Computers In The Home: 1990

Simulator: A Modeling Planner For Apple, Atari, VIC

Hidden Maze: A Game Program For Apple, PET/CBM, VIC And Atari

Sprite Editor For The Commodore 64

Sorts In BASIC For The TI-99/4A, Radio Shack Color Computer, VIC And Apple

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NOTE: Consult Listing Conventions before typing in programs.
More On The IBM Personal/Home Computer
It appears, according to our sources, that IBM is preparing a $500 level entry into the home market. With the rumored introduction still at least six months away, the “Home Computer” is expected to have full color and graphics capability, as well as the ability to be upgraded to run IBM PC (Personal Computer) programs. Our impression is that now that IBM has had a successful taste of this market with their PC, they’re anxious to move quickly into broadening their market share. The main thrust of the new computer, suggested one source, is to compete with both VIC-20 type graphics and the power of an Apple.

How COMPUTE! Readers Use Their Computers
"Those things aren’t good for anything but playing games...", "What can you do with them if you’re not a programmer?", "Etc....." We thought it appropriate, in this home applications issue, to find out how our readers use their computers. We randomly selected subscriber names from all over North America, and Tom Halfhill, our Features Editor, spent several days, nights, and a few weekends tracking down COMPUTE! readers. Many, not surprisingly, interrupted their computing to talk with Tom. The article makes interesting reading, and we welcome your thoughts on the use of your computer at home.

David Thornburg, our monthly author of “Friends of the Turtle” and “Computers and Society” columns, has been addressing philosophical problems in C&S in COMPUTE! since early 1980. Several points are raised in Tom’s article that will be of increasing interest to parents and children using computers in the home. Let us know your feelings on the parent/child/computer interaction, and we’ll pull in the comments of David, Tom, and Fred D’Ignazio and present a forum article in a few months. Another relevant topic is Fred’s column in this issue, “The World Inside The Computer.” We predict some thoughtful reader feedback on sex role stereotyping and children with computers.

A Bang And A (Small) Whimper
The Commodore 64, shipping 10,000 to 12,000 units in its first two weeks of production, was recently slowed down for some apparent ROM upgrades and other cosmetic fixes. We hear that several hundred of the very first ones were involved in a recall to fix a firmware bug. Sources indicate the 64 is now backlogged to the tune of tens of thousands of units, and that production won’t be close to demand until capacity is drastically increased early in ’83. The Commodore MAX Machine, originally scheduled for a fall introduction, will be released in early spring. The price for the game machine/computer will be revised from the original $180 or so to the low $100’s. This change obviously reflects the fact that, since announcement of the MAX, the price of the VIC-20 has plunged from $299.95 to the level originally intended for the MAX.

Tooting Our Horn
You’ll recall that our October issue, a scant two months ago, broke the magic 100,000 press run barrier. Not only did we break it, we literally crashed through it! For purposes of dealer reorders, we had to declare the October issues sold out on October 4. November press run bumped to 118,000, and this issue hits the 130,000 mark. 500,000, here we come. A recent survey of our new subscribers indicated that 87% of you have one or more friends you expect will purchase their first personal computers within six months. Introduce them to COMPUTE! while they’re at it.

In the November Micro World Electronix advertisement, the price of the “System 310” appeared incorrectly. The actual price of the “System 310” is $1195. We apologize for any inconvenience this may have caused our readers or Micro World Electronix.
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**Fig-FORTH** — For specialized programming needs, such as educational or game applications, ATARI Fig-FORTH is uniquely effective. Fig-FORTH combines power and simplicity in an efficient 10K size, with characteristics of an interpreter and the speed of machine language code.

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For more information, write to ATARI, Inc., Dept. C4Z, P.O. Box 16525, Denver, CO 80216.

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POWER produces a dramatic improvement in the ease of editing BASIC on Commodore's computers. POWER is a programmer's utility package (in a 4K ROM) that contains a series of new commands and utilities which are added to the Screen Editor and the BASIC Interpreter. Designed for the CBM BASIC user, POWER contains special editing, programming, and software debugging tools not found in any other microcomputer BASIC. POWER is easy to use and is sold complete with a full operator's manual written by Jim Butterfield.

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Ask The Readers
The Editors And Readers of COMPUTE!

Screen Memory On The Atari
Before I upgraded my Atari 400 (I went from 16K to 48K of memory), I was able to use a whole set of POKEs I accidentally found one time: POKE 15424 to POKE 16383. These are X,Y positions in Graphics 0. When accompanied by the character number from the Internal Character Set, User's Manual, they would produce the chosen character at the X,Y location on screen. For example, POKE 15424,64 would put a heart at position 0,0.

I wrote several programs which used this, but since I've expanded to 48K memory, I can't get these POKEs any more. Did I sacrifice them to the new memory somehow?

Richard Fleagle

You accidentally came upon screen memory. This section of your memory holds all the data necessary to display text on the TV. If you change the contents of this memory with POKEs, you automatically change the display.

Screen memory is always found at the “top” of memory, at the highest addresses. When you upgraded and added more memory, the screen memory zone relocated itself to remain on the top. Fortunately, you can always determine just where screen memory is on an Atari with:

SCREEN = PEEK(88) + 256 * PEEK(89)

On a 40 or 48K Atari, you should get back 40960 as the value for the variable SCREEN. Using that formula will insure that your programs will run correctly on any Atari.

John Cresswell

Color Computer Maps
Possibly some of your readers can help me out. I purchased a TRS-80 Color Computer with Extended BASIC and an assembler, thinking I could come up with some simple game for myself and family. Then I found out that the addresses of even the most simple ROM subroutines are not available. A letter to TRS-80 customer service was not very fruitful either. They said they were not allowed to give that information out.

Such information is available to Atari owners, PET owners and others. Can someone help me out or tell me where to get the information?

John Gee

VIC Soft Memory Recovery
Your “Ask The Readers” article on the Super Expander Cartridge for the VIC, in the August COMPUTE! issue, was great information for me. Now I have some information for William D. Collins. He said in his only way to get “your” memory back after typing RUN/STOP and RESTORE is to type SYS 64802; this is fine if you don’t want your program. But if you want to keep your program, all you have to do is PRESS the “F1” key then 4 and RETURN. Doing this you disable the S.E.C., which has 3K of RAM for use in BASIC programs if the graphics are not called too.

I hope this information will help him as much as it helped me.

John Cresswell

Reader Walter Dudek sent in an alternative way to recover memory non-destructively. He points out that Graphics mode 4 can be put at the end of a program, or in a short routine to use while writing or debugging a program:

2000 END
2001 GRAPHIC 2
2002 GRAPHIC 4

Then just RUN 2001 to return lost memory.

Autorun Atari
How can you put Autorun on a disk to run BASIC programs? Can a BASIC program be saved as an AUTORUN.SYS that will boot up into RAM when the power is turned on? Could you help with an explanation? Or cover this subject in an article?

Jim Givens

For a tutorial article and demonstration, see “Automate Your Atari” in next month's COMPUTE!.
Challenge the masters in Renaissance, a thousand-year-old game played in twenty-first century style. The strategy is the same as Othello™ or Reversi™, but the similarity ends there. Renaissance will test your intellect against that of your opponent — the computer. You can recall moves, change sides, switch skill levels, or save games to continue later. You can even ask your opponent for help!

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Preschooler Programs
We have purchased unexpanded VIC’s for two Headstart centers and are having a difficult time finding software aimed at preschool children. I’d be interested in hearing from people who might know of such sources.

Joan Haverson
Schuykill County Child Development Program
P.O. Box 183
Ringtovm, PA 17967

COMPUTE! regularly publishes programs and games for young computerists. See “Mathman” in October 1982, “An Atari for Christmas” last month, and “Name Play” in this issue. Also, the Computer Friend being built as a series of programs in Fred D’Ignazio’s “The World Inside The Computer” is of great appeal to youngsters.

Machine Language Printing
I have started to convert my BASIC programs to machine language (ML). The problem I am having is that I don’t know how to print a character in ML. The other question is where can you load ML programs into memory which can be called from a BASIC program? I already know about the cassette buffers.

Aris Zakinthinos

There are several ways to print characters in ML. Perhaps the easiest is to load the accumulator with the character’s code number and then JSR to the “output a byte” routine: LDA #$41 JSR $FFD2. This is BASIC’s way of printing to the screen. The next time you JSR to $FFD2, the character will be printed in the space following the previous character. Alternatively, you could LDA +$41 and then STA$8000 or wherever your screen RAM is located. This is the equivalent of a BASIC POKE.

You don’t mention which computer you use, but we are assuming that it’s a Commodore model since you speak of the traditional cassette buffer location for hiding ML from BASIC. Because BASIC puts variables in RAM, it could overwrite an ML program which was unprotected. Before putting ML and BASIC together, you need to reset the “limit-of-memory” pointer ($34, 35 in 4.0 and Upgrade BASIC; consult a map of your computer’s memory for other BASICS). This makes BASIC think that there is no more RAM beyond whatever address is indicated by these two bytes. It will perform its operations below the protected ML.

However, because ML is the machine’s language, it is highly specific to each model. You need to work with a map of your version of BASIC and of your computer’s memory usage. While $FFD2 means something in Commodore BASIC, it would be entirely different on an Atari or a TI.

Commodore 64 Peripherals
I plan on buying my first computer by Christmas of this year. The Commodore 64 seems to have the capability and memory I need. I have been looking forward to seeing the 64, but the more I read about it the more concerned I become about the peripheral connections.

I read that the VIC’s RS-232 uses non-standard voltage (0 to 5 volts) rather than the standard (-12 to 12 volts) and that the signal levels are inverted from the standard. Since the 64 is compatible with the peripherals of the VIC, it would seem to me that the 64 also has non-standard voltage on its RS-232 port.

All this leads to my major concern. Will I be able to use other manufacturers’ equipment on the Commodore 64’s RS-232 port, or will I be limited to Commodore products? I also have two friends who have TRS-80 computers who want to upgrade to the 64, and now they are becoming concerned that their peripherals will not work on the 64.

Earl T. Jones

There is a cartridge from Commodore, currently available for $49.95, which converts the VIC and 64 ports to standard. With this, you can attach printers and other peripherals not specifically designed to be compatible with the VIC/64 RS-232C signal levels and voltages.

Versions Of Atari
I’m curious about some things that were written in COMPUTE!’s First Book of Atari. On pages 17 and 18, you listed some flaws in Atari BASIC. Do you know if Atari has made any changes to their models that would correct any of these flaws? If they have, how would I know if I were buying an older computer with the flaws or a newer one without them? Could I tell by its serial number?

I intend to purchase an Atari 800 and would hate to buy anything but the most recent model.

Scott Lapham

Most of the bugs in the 10K OS ROM (operating system) have been corrected in what is called the “Revision B Operating System.” All Ataris shipped after January 1982 contain the new Revision B ROM chips. To check if a particular machine has the new ROMs, type:

PRINT PEEK (58383)

from BASIC. If you get a zero, that computer has Revision B.

COMPUTE! welcomes questions, comments, or solutions to issues raised in this column. Write to: Ask The Readers, COMPUTE! Magazine, P.O. Box 5406, Greensboro, NC 27403. COMPUTE! reserves the right to edit or abridge published letters.
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Microchips are turning up in all kinds of “smart” consumer products, not only in home computers. Here’s a look at how microchips might be useful in the home of the near—and not-so-near—future.

Computers In The Home: 1990

Tom R. Haifhill, Features Editor

Remember the Jetsons? That Saturday morning cartoon family of the 21st century, the ones with the high tech house filled with fancy gadgets. They were the alter-egos of the Flintstones. Mr. Jetson commuted to work in his flying car. Mrs. Jetson kept a carefully coiffed wig handy in case someone called her early in the morning on the picturephone. Robots did all the housework.

Well, don’t hold your breath. Flying Fords and home picturephones seem to be around the same corner as prosperity.

But equally exciting high-tech products are on the way, thanks to an invention the Jetsons never heard of: microprocessor chips. These tiny computers, etched on specks of silicon, are the heart of today’s home and personal microcomputers. You could stack hundreds of them on a cornflake.

But although home computers are the glamour children of the microchip revolution, chips are turning up in a wide range of consumer electronic products as well: microwave ovens, tape decks, stereo receivers, turntables, video tape recorders, clock radios, cameras. Usually the “intelligence” added to these “smart appliances” comes in the form of relatively simple timers, sensors, or counters. However, research and development planners, engineers, and futurists foresee much greater possibilities.

Living In Xanadu

Architect Roy Mason is building his vision of the future out of plastic foam in Orlando, Florida.

Dubbed “Xanadu,” it’s a model home for the 1990s and beyond. Xanadu consists of domed pods built by spraying polyurethane foam onto removable molds. The quick-setting polyurethane hardens in a couple of days, forming perfect seals around the doors and windows which are set directly into the foam. The resulting structure is said to be so well insulated that it requires only a quarter of the energy for heating and cooling as a similar-sized conventional house. It also reduces construction time for the basic shell to only three days, and is claimed to be suitable for any type of climate.

But Xanadu’s really revolutionary features will be tucked away inside the foam shell. It is being crammed with every electronic and computerized gadget imaginable. The point is not necessarily to show what will happen to homes in the near future, but what could happen. Xanadu will cost about $300,000, even though much of the equipment is being donated for promotional purposes. When completed late this year, Xanadu will open as a tourist attraction for people visiting nearby Disneyworld and Epcot Center.

Architect Mason believes Xanadu will alter the way we now tend to think of houses—as little more than inanimate, passive shelters against the elements. “No one’s really looked at the house as a total organic system,” says Mason, who is also the architecture editor of The Futurist magazine. “The house can have intelligence and each room can have intelligence.”

Take Xanadu’s kitchen, for example. It’s equipped with a “family dietitian” consisting of four microcomputers. It plans well-balanced meals for family members depending on their height, weight, sex, age, and levels of activity. If you come home from a busy day and inform the computer-dietitian that you skipped lunch and nibbled on a candy bar instead, it calculates supper based on the nutrients you missed. An “auto-chef” can move food from the refrigerator to the microwave oven to the dining table, and the computers keep track of the grocery inventory so you know what to replace. The auto-chef can even regulate the ambience of the dining room to match your meals, adjusting the lighting and background music to
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complement your Mexican dinner, for instance. Some of that food is grown by the house itself. Xanadu has a built-in greenhouse. Naturally, a microcomputer monitors the watering of plants, artificial sunlight, ventilation, humidity, soil content, and the shutters and awnings.

The groceries you can't grow can be bought by tele-shopping at the household work station. The catalog is on a videodisc system hooked into the microcomputer, and the transaction is handled with the help of tele-banking. The work station computer also maintains a household calendar, records, and home bookkeeping.

Architect Roy Mason and a clay model of his concept house for the 1990s, "Xanadu." (Credit: Barry Fitzgerald)

Xanadu incorporates the latest "electronic cottage" concepts to reduce or eliminate daily commuting to and from work. A study/office shows how business could be conducted from the home, with electronic mail, access to stock and commodities trading, and news services.

Xanadu’s other features include “AutoOasis,” a computer-controlled party room; a health spa, where a computer suggests exercises based on your physical characteristics and diet; a family learning center with four talking microcomputers that run educational software and even an interactive psychoanalysis program; illusionary "windows" that display computer-generated images, just in case you get tired of staring at the laundry on the Joneses’ clothesline; a “Sensorium” with hologram projection and a computer-controlled bio-feedback device which regulates background music and abstract patterns on the walls in tune with your moods; and an electronic art gallery with ever-changing, laser-projected images.

With all this advanced electronics, you’re probably wondering at this point about Xanadu’s horrendous electric bills. Mason has an answer for that, too. A central microcomputer monitors all energy consumption and eventually will be programmable as a watchdog. “You could program the house, ‘I’m only going to spend $300 this month for utilities and that’s that.’ So you’d program that on the keyboard and the house would only use $300 worth of utilities. Of course, you might not get your laundry done for a few days, but that’s your decision.”

The central computer is part of the family media room, which also includes video games (of course), two-way cable TV, and a large-screen video projection system. But the central computer is the heart of the house, and comprises what Mason refers to as the “electronic hearth.”

The Electronic Hearth

“The home of the future will be more like the home of the past than the home of the present,” says Mason. “It used to be that the whole family gathered around the hearth for entertainment activities, meals, and so on. The home of the future will feature what I call an ‘electronic hearth,’ a home computer that is the center of the family’s activities — entertainment, bookkeeping, meal-planning.”

Although families today gather around TV sets, that form of entertainment is passive, with little or no interaction between the family members and the TV set or with each other. A home computer, on the other hand, allows interactive entertainment. Mason says the difference has yet to be fully appreciated.

“My feeling is that the home computer has never really been a home computer, it’s been a personal computer. We haven’t really seen home computers being used as home computers, as a house computer. [At Xanadu] we’re using the home computer as a true house computer.”

Tomorrow House Via Apple

Surprisingly, most of the microchip devices in the Xanadu house are already available off-the-shelf.
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items. Xanadu simply brings them all together in one place with little regard for expense. To demonstrate that the concepts are practical, Mason is planning a spin-off model of Xanadu, a less elaborate version that is relatively affordable. It, too, will be made of polyurethane foam, but will have less hardware.

“I don’t want people walking through this house [Xanadu] and saying, ‘Well, this is great, but who could afford it?’ I want a version that is affordable,” says Mason.

This version would have about 2,000 square feet – Xanadu has 5,000 – and would cost around $80,000, Mason hopes. “We’ll probably have extras like you have when you buy a car – you can make the house as smart as you want. It’s already a pretty smart house.”

All the energy and security alarm monitoring at Xanadu will be handled by a commercially available program called TomorrowHouse, marketed since mid-summer by Compu-Home Systems, Inc. of Denver, Colorado. TomorrowHouse is a dramatic demonstration of the future possibilities for microcomputer-controlled homes. Running on an Apple II, it supervises the central heating and air-conditioning, monitors temperatures outdoors and in every room, and performs dozens of other tasks.

“For example, if you go off skiing for a weekend, which we do all the time here in Colorado, you can program your hot tub to heat up to 102 degrees at 7 o’clock on Sunday night to be ready when you get home,” says designer Russ Coffman, president of Compu-Home.

TomorrowHouse also enables the computer to talk. This adds some interesting features. “If anyone breaks into your house, the security system detects it and the computer turns on all the lights and starts talking,” explains Coffman. The idea is to frighten the burglar into thinking the house is occupied. To that end, you might imagine that the computer says something like, “Whoever’s out there, watch out for the cobra!” or “Honey, pass me the hand grenades!”, but Coffman kept it simple: “It just says, ‘Intruder alert at 7:03’ or whatever time it is, just enough talking to make the intruder think that somebody is home.”

For the future, Coffman wants to make it possible to monitor and reprogram the house from any touch-tone telephone. When you’re on vacation, you could phone the computer and check if any break-ins have been detected, or if the freezer is still working. As microchip technology advances, other features will be added, too.

“Voice recognition we haven’t started working on yet, but we’re keeping our eyes on it,” he says. “We eventually want to fix it so you can just holler at the computer and get it to do things.”

**Are We Ready?**

Actually, some planners believe the biggest hurdle won’t be microchip technology itself, but market resistance from people unaccustomed to delegating tasks to computers.

“Companies are waiting to see what people really want,” says Dick Lane, project manager for Honeywell, Inc. “We could do almost anything in the home right now that you could imagine in the next 20 years, but it’s just a matter of getting people to accept it.”

As long as the housing market remains depressed, Lane explains, microprocessor controls won’t be built into new homes, because builders already are trying to save every penny. Also, people would rather spend extra money elsewhere: “People want to start with a three-car garage, but they’re a lot more cautious about the gee-whiz features.... There’s a lot of competition right now for the consumer’s discretionary income in the way of electronics products. Right now the pleasure products, such as video tape recorders and video games, are getting the bulk of that income.”

When microchip-controlled homes do become common, Lane also doubts that the systems will be built around home computers, as TomorrowHouse is. “Our perception is that people don’t really want to touch a keyboard to change the temperature of their home, or to activate security devices, and so on. We have to find another type of I/O device [input/output] before people will be more accepting of it. Voice recognition, of course, would be the ultimate.”

Another problem with controlling houses with home computers is that the machines cannot be used for anything else while they’re occupied. Today’s home computers cannot handle multitasking – running more than one program simultaneously and independently. As microchip technology advances, tomorrow’s home computers may have the capability to play video games or balance the checkbook while monitoring the furnace, but Lane predicts the functions will be handled by separate systems. He thinks this would also be more reliable,
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since consumer computers aren’t necessarily designed to run 24 hours a day, 365 days a year.

With the increasingly powerful microchips becoming available, the computer-controlled functions might be “invisible” to the consumer, since the devices could “program” themselves. “The chip could have some intelligence,” describes Lane. “It could have a learning algorithm in it so it could know what’s normal. If it’s cold outside, the furnace would learn those conditions, such as how much it should be running. If you left your door open, the furnace would know it was running more than normal and would alert you to that fact. Or if the filter were clogged and the airflow were reduced, the furnace would notice that it was getting less air than usual and would tell you.”

This would be a better approach than programming a single home computer to handle everything, Lane believes. A more important contribution of today’s home computers, he says, might be simply acclimating consumers to the idea of computers in the home. “I certainly think the personal computer has made the most dramatic impact at this time.... As this set of people gets more familiar with computers and buys more personal computers, maybe we’ll see a desire to involve computing devices in more broad applications.”

**Synthesizing The Beatles**

If all this talk about computer-controlled homes and intelligent furnaces sounds rather mundane, be assured that microchips will be turning up more often in the fun products as well. Already, microchips are becoming common in video cassette recorders, cameras, TVs, and stereo components.

Last year, Sony showed prototypes of its filmless electronic camera. Instead of using film, the camera receives the image on a densely packed array of charge-coupled devices (CCDs), electronic circuits sensitive to light. This image, in turn, is stored on a tiny interchangeable magnetic disk, a lot like the mini-floppies used with home computers. Since the image is stored magnetically, no processing is required. The pictures are viewed on an ordinary TV set with a special disk player. A full-color printer might be available for hard copies. The disk can be duplicated, erased for re-use, or edited. A single cookie-sized disk might hold 50 pictures.

The Sony camera is a couple of years from production, and Sony engineers are working to overcome a few remaining problems. They’ve done a fantastic job of shrinking it to hand-holdable size; even with its built-in disk drive, the prototype is about the size of a 35-mm single lens reflex camera. The CCD arrays are expensive, however, and right now the camera would cost around $800, according to some estimates. Since the resolution of a TV picture is nowhere close to what professionals and advanced amateurs have come to expect from conventional photography, the Sony camera would have to be aimed at the mass consumer market—for which $800 is a steep price. But remember, it was only a few years ago that the least expensive home computers cost that much.

The computerization of sound holds even greater promise. For although it will be some time before video images surpass the quality of photographic images, digital sound is already clearly superior to today’s analog recordings.

Sound is recorded digitally by a computer which “samples” the sound thousands of times per second, and then converts the tones into digital bits of information. The advantage is that the sound can be manipulated like any other digital information. Extraneous noise can be dropped out, weak sounds can be amplified, and overly loud sounds can be tempered. The results are amazingly distortion-free.

Some “digital” record albums are available today, but this means only that the music was recorded digitally in the studio. The sound is reconverted to analog when pressed onto the vinyl record, since the needle-and-groove system is an analog process. Even this hybrid digital analog method is a noticeable improvement. But the audio industry is on the verge of a technological leap into a pure digital system.

A digital audio disc was introduced in Japan this fall by Pioneer Electronics, and may be introduced in the U.S. as early as next year. Music is recorded digitally on the four-inch disc in tiny pits which are read by a laser “stylus” on a special player. This is somewhat similar to the videodiscs already on the market, except that images on videodiscs are still analog reproductions. The digital audio disc will dramatically reduce record wear, and up to an hour’s music can be recorded on a single side.

As with computer-controlled homes, though, the biggest roadblock for digital audio discs is not technology, but marketing considerations. The record industry doesn’t seem as enthusiastic as the electronics industry. Still, few people doubt that digital audio discs will supplant analog discs eventually, and researchers are excited by the possibilities of computerized, digital sound systems.

For example, Verle Rader, product planner for Pioneer Electronics, thinks tomorrow’s computerized stereos may allow listeners to modify recorded music far beyond the capabilities of today’s tone controls and graphic equalizers.

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you could change it to a samba. Or you can analyze by computer all the music written by Beethoven. You could sit down and compose a short melody line, feed that into the computer, and the computer could then generate a Beethoven symphony based on your melody line. Or you could feed all the vocals of all the Beatles' songs into the computer and let it analyze them. Then you could write your own song, feed that into the computer, and it would come back with your song performed by the synthesized voices of John, Paul, George, and Ringo, just as if they had recorded it originally.

Of course, these kinds of developments are further in the future. Closer to home, Rader says stereo manufacturers will use microchips to make their products easier to use. Up to now, it seems, manufacturers have been seizing every opportunity to transform their audio components into something out of a space shuttle cockpit. That's about to change.

"We're encountering a lot of consumer resistance to all these buttons on the front panel," says Rader. "The reason is that our market is changing somewhat. Up until now, we've been selling primarily to the 18 to 34, male, technically oriented, middle-class, affluent buyers. They like to push all the buttons. But we've pretty much saturated that market. Now we're finding more buyers who are not 18 to 34, male, technically oriented, middle-class, and affluent. They don't want to push a dozen buttons just to play a tape. So we have to make our products simpler to operate."

That's why some top-model stereo cassette decks now sense the type of tape inserted in them and automatically adjust the bias and equalization to fit the tape's makeup. Another new stereo system allows you to switch from playing a tape to the FM radio by pressing only one button. Look for more such features as microchips become more widely adopted for consumer products.

The Computerized Chariot
It seems strange that space-age devices such as microprocessors would be wedded to that huff-and-puff holdover from 19th century technology, the internal combustion engine, but the fact is that auto manufacturers are rapidly becoming the world's largest customers for microchips.

All the manufacturers are increasingly using microchips for such tasks as regulating fuel flow and ignition systems, computerizing instruments, diagnosing problems, and jazzing up accessories. The 1983 Thunderbird will use computerized voice synthesis to speak with a three-sentence vocabulary: "Your key is in the ignition," "Your headlights are on," and "Door is ajar."

Again, however, technology is taking a back seat to marketing considerations. Especially when it comes to innovations such as talking dashboards, the auto manufacturers are stepping softly and measuring consumer acceptance at every turn. Remember, even after two decades, most American drivers still refuse to accept seatbelts, and airbags are often regarded as an outrage.

Still, designers foresee tremendous possibilities for intelligent autos. "By 1985-1990, virtually every car in the world will have at least one microprocessor," predicts Robert F. Haase, technical planning manager for Ford Motor Company's Electrical/Electronics Division. "Our Continental today already has four or five microprocessors."

Haase says microchips will make possible the "personalized car": "You'll have a way to tell the car just what person is driving the car, so it can

Jerome G. Rivard, chief engineer for Ford's Electrical/Electronics Division, compares the size of the company's original Electronic Engine Control (right) with the latest version. The new controller can process a million commands per second.
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A major advantage of this system would be
that you wouldn’t have to worry any more about
folding up the map when you are done. But you’d
still have to worry about the kids spilling jelly
on the disks.

It might even be possible to pre-define your
route by moving a cursor over the screen map.
Then, like any good backseat driver, the car could alert you to wrong turns: “Hey, dummy, you
shouldahungleftonElmStreet...”

“Another thing you might see in the next few
years is sonar devices to detect if you’re backing up
over your kid’s tricycle or whatever,” says Haase.

"Ten or 15 years down the road,
the sky’s the limit. You can
envision radar systems, sonar,
infrared, heads-up displays.”

Heads-up displays are projections of instruments or other
information on the inside of
windshields, much like the
cockpit displays on the latest
jet fighters.

The next big leap would
be the logical extension of voice
synthesis-voice recognition.
Instead of pushing buttons, you
just tell the car what you want.

"If you attach the possibilities of
speech recognition to the per-
sonalized car, you can envision
walking up to your auto and
saying, ‘Good morning, car,’
and it responds by unlocking its
door for you and adjusting its
mirrors and seats and turning
on your favorite radio station,”
explainshaase.

Advanced systems might be
able to distinguish between
voices so you could program the
car to respond only to your
own voice and your spouse’s (or maybe not your
spouse’s).

The Limits of Automation

Although some sort of computer-controlled, radar-
or sonar-triggered collision-avoidance
device seems a likely development, Haase expects stiff consumer
resistance to any type of automatic collision-avoid-
ance system. People would accept a warning light
or buzzer, but would resist a device that slammed
on the brakes for them, just as they are wary of
airbags.

There seems to be a psychological limit to
what humans are willing to delegate to machines.
We perceive a fine line between contrivances which
grant us more freedom by relieving us of certain
tasks, and those which threaten to rob us of freedom
by automating some things we want to control
ourselves. Computers are bumping against this
boundary more than other machines because they
are capable of so much, and because they are the
first machines with the power to automate not just
muscle movements, but also brain functions.

This psychological boundary is becoming a bit
more flexible as automation and computerization
become more widely accepted, but in the end it
may prove to be a limit more stubborn than the
reach of our technology.
Atari Innovators...

New Excitement for your Atari 400/800 from Synergistic Software

Crisis Mountain, by Ron Aldrich and David Schroeder. Can you stop the explosion that could trigger a dreaded volcanocúmer eruption spewing tons of radioactive ash into the atmosphere? In this fast-paced real-time game you leap tumbling boulders, crawl through claustrophobic tunnels, and bound over columns of bubbling lava to defuse the bombs. Be sure to avoid Bertram — the radioactive bat, and hurry, the bombs are ticking away! Multi levels of play. Requires 48K, one disk drive, and game paddles or joystick to play. $34.95

Warlock's Revenge, by Butch Greathouse. Rid your kingdom of the evil warlock, Oldorf, who has terrorized its inhabitants. Lead a party of adventurers, including a gladiator, a strongman, a wizard, a cleric, an elf and a thief in this fearful mission. Overcome the dangerous obstacles in Oldorf's realm. A role-playing adventure game with high-res graphics. Requires 48K and one disk drive to play. $34.95

Probe One: The Transmitter, by Lloyd Ollmann, Jr. In a research center on the remote planet, Eldriss V., you must deduce how to use the scientific devices found in the lab to unlock its sealed areas. You must capture the Transmitter, a secret device needed to save your race. Use keyboard commands and paddles to fight off the building's guard droids. A strategic, arcade-action game in high-res graphics. Requires 48K, disk drive, Atari BASIC, and joystick or paddles. $34.95

Free Yourself from Programming Drudgery with Synergistic Software's New Utilities.

Programmer's Workshop, by Dennis M. Keathley. A collection of seven different utility programs including: disk to cassette transfer, BASIC program compare (lists differences between 2 different programs), cassette baud rate increase, analysis of program code, etc. One utility, the ANALYZER, will unlock the mysteries of a cassette file, the computer ROM and RAM, or any portion of a diskette, by displaying data in both Hex and ASCII. Requires Atari 400/800 with 16K, disk drive, and cassette player (optional) ... $34.95

Disk Workshop, by Dennis M. Keathley. A collection of seven different utility programs including fast copying of disks, sending a formatted disk directory to a printer, using machine language character strings in BASIC, a screen dump for the MX-80 Epson Printer with Graftrax or Graftrax Plus, etc. One utility, DISK EDIT, allows you to easily modify individual bytes or entire sectors on the diskette. Requires Atari 400/800 with 16K, one disk drive, and printer. $34.95

Graphics Workshop, by Lloyd Ollmann. A collection of utility programs to improve the graphics capabilities of Atari programmers. The PLAYER-MISSILE device handler allows easy set-up and use of player missiles using the Atari BASIC OPEN, PRINT, and PUT commands. GRAPHICS ENHANCEMENTS includes a new graphics mode and bit-map capabilities. Package also includes a character editor, a bit-map editor, and a player missile editor. Requires Atari 400/800 with 48K and one disk drive. $39.95

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Hundreds of thousands of people are buying home computers these days, but you still hear the remark, "A home computer? What can you do with one of those things?" COMPUTE! sampled its subscribers to find out why people buy home computers and what they do with them.

How COMPUTE! Readers Use Their Computers

Tom R. Halfhill
Features Editor

Bob Federer of Toronto, Ontario has used his to add sound effects to new wave records. William Wilbur of Kittery, Maine uses his to catalog more than 1700 model airplane kits. The Millers of Martinez, Georgia use theirs to educate their children and keep them out of the arcades. The McLain family of Reading, Pennsylvania plays games and writes programs. Clint Williams of Portage, Michigan produces an amateur radio newsletter. Roberto Huyke of Mayaguez, Puerto Rico prepares engineering programs for his college students. Malcolm F. Smith II of Beckley, West Virginia forecasts the costs of doing business. Linda Timmons of Leavenworth, Kansas keeps track of her high school students' grades. And 13-year-old Jason H. Rogers of La Mesa, California is teaching himself how to program.

All of these people — and thousands more like them — have found everyday uses for the newest everyday marvel, the home microcomputer. Uses that are practical, educational, fun. No longer merely accoutrements of electronics hobbyists, microcomputers are finally coming home to join the TV sets and stereos in family rooms everywhere.

But among the uninformed, the question still persists: What is a home computer for? Readers of this magazine probably already know the simple answer: Why, it's for the home, of course. But some people still wonder if home computers have a "practical" use. When you query them further, often they define a "practical" use as one that pays for the computer. Not many home computers are paying for themselves in a purely monetary sense, but then neither are many TV sets or stereos. COMPUTE! decided the best answer might be to pose the question to some of our readers. What do you use your home computer for? Why did you buy it? How did you get involved in personal computing?

Pulling names at random from our subscribers list, we contacted readers living all over this hemisphere, from British Columbia to Puerto Rico, and from Maine to Southern California. We talked to parents, single adults, youngsters, retirees. All of them were happy with their computers, and in many households the computer was rivaling the TV set as the most heavily used home appliance. Few of the uses we turned up were particularly unusual — although come to think of it, just a few years ago any use of a computer in the average home would have been considered unusual.

But generally, the typical uses we ran across fell into three main classes: education, entertainment, and efficiency. "Education" included everything from teaching toddlers the primary colors to exploring the intricacies of machine language programming. "Entertainment" mainly involved playing video games, of course, but also included the intellectual challenge of programming home-grown games in BASIC. And "efficiency" included everything from computing personal finances to using the computer as a tool at work.

In fact, almost all owners of home computers seem to use their machines for all three categories to some extent. Even the most "serious" user admitted to enjoying a crack at Pac-Man or Space Invaders now and then. Overall, entertainment and education surfaced again and again as the predominant applications, especially where children were involved. Whether or not everyone agrees the Computer Age has arrived, one thing is never doubted: if it's not already here, it's coming, and
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our children had better be prepared for it. That alone was reason enough for many parents to acquire a home computer.

**All In The Family**
The Crum family of Auburn, Washington is a representative home computer household. John Crum, 32, says he has always been interested in electronics and works with highly specialized controller computers in his job at Western Electric. He started off with a Sinclair ZX-81 for himself, but when he returned home from a business trip one day last March, his wife had a surprise for him — she had sold the Sinclair and bought an Atari 400.

"And it was a surprise," he says.

Now the whole family is involved with the computer. "I've got a little boy who's two and a half years old, and I've got some educational programs for him," says Crum. "I think when he grows up that computers will be much more necessary in his society than in ours."

"I like to play games, even though they're frustrating and addictive — which I guess they're designed to be. Of course, my wife gets in there and plays the games, too. I'd rather play the games than watch TV, really, especially since most TV programs are pretty boring, usually. Like, I have another hobby which is just for me that my son might take over someday. I don't know. But the computer is something the whole family can sit down and enjoy together — me, my son, and my wife. It sounds sort of odd, but we can all get into it together."

"I was surprised," he says, "but even the grandparents get involved with it. We get a lot of rain here in Washington, of course, so on those rainy afternoons when they come over for a visit, often we'll play some Sunday golf, or one of those other games that are slower and don't require so much joystick action. It's better than playing cards, and everyone can get involved."

When he finds the time, Crum plans to work up a telephone dialer program and an inventory of household possessions for insurance purposes.

The Johnsons of Brandon, South Dakota also have made computing a family activity. "We bought it last winter," says Jan Johnson, referring to her family's Atari 400. "We had a really cold winter here last year, so it gave us something to do to keep warm."

But Johnson says she was a little reluctant at the outset when her programmer/analyst husband, Ken, decided to buy a home computer. "I wasn't all that gung-ho on it at first. It was my husband's idea and he uses it more than anyone else.... He tries out some things at home that he wants to do at work.

"But since then, I enjoy it myself, too," she says. "The games get kind of addictive. Our kids [ages four and six] use the computer for educational uses, with some programs that my husband and his friends wrote. They teach about shapes and colors and things like that. It was a toy at first, but it's working out better than I thought. My daughter has started working with some math problems on the computer, even though she's only six, and I think it's helping her a lot."

The Johnsons also use the computer to balance the household budget. And since a family friend also bought an Atari 400 at the same time, there are running battles to see who can get the highest scores on Pac-Man and Missile Command.

**Education Versus Entertainment**
The educational aspect of home computing was important to the Millers of Martinez, Georgia, too.

"The children like the games and I like the educational part," says Diane Miller. "The kids are in there right now playing either Canyon Climber or Gold Mine. I don't know which. I wanted something to keep the kids out of the arcades. That can get pretty expensive..."

Miller says she first looked at home computers during a stopover in San Francisco when her husband, a U.S. Army captain, was assigned to Korea. She was interested, but thought the prices were too high. When they recently returned from Korea after a two-year tour, she was happy to see that prices had markedly dropped. Mindful of the educational possibilities for their children, ages nine and twelve, they bought an Atari 400 and programs such as States And Capitals and European Capitals.

"It was 50/50 educational and entertainment," says Miller. "That was my stipulation, that it not be used strictly as a game machine, that it be used for educational purposes, too."

The computer has more than lived up to their expectations, she says. In fact, the Millers got so hooked on computing that they've become a two-computer family. Diane and her husband, Gary, bought an Atari 800 and a disk drive for themselves because the children monopolize the Atari 400. The Millers are amateur radio operators and plan to use the 800 to control their ham station.

Now they are trying to convince other people of the educational uses of home computers. Gary Miller recently demonstrated one of their Ataris to a third-grade class at their children's public school, and another presentation to sixth-graders was
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Diane Miller says their own children’s contact with the machines has fired an interest in computing that may evolve beyond mere game-playing. Since they save money by typing in game listings from magazines instead of routinely buying commercial software, the children are learning something about BASIC programming. “The kids like typing in the programs and getting them to work almost as much as they like playing the games when they’re done,” she observes.

Joseph D. McLain of Reading, Pennsylvania has a Commodore PET which does double duty, too. The McLains have five children – ages three, seven, and eleven-year-old triplets. In 1979, McLain saw a good deal on a used original 8K PET and bought it with a small windfall (“When you’ve got five kids there usually isn’t any extra money”). A programmer/analyst with experience in languages such as RPG and COBOL, McLain taught himself BASIC well enough to teach it at a local college. Meanwhile, his children play games and use educational programs.

“It helped me teach hand-eye coordination to my younger kids,” says McLain. “My older ones use a math type of game that runs through a series of ten programs and then spits out the results.

“When we first get a new game, of course, the whole family gathers around and plays it, usually until my son Todd gets the best score, and then the rest of us get frustrated and quit.”

Roger W. Leezier of Orangevale, California, who is the dean of arts and sciences at California State University-Sacramento, has three children between the ages of six and twelve. After shopping around and delving into hardware manuals, he bought an Atari 800 with a disk drive and printer. “Basically I bought it so the family would have it to use. I have more access to computer equipment at work than I know what to do with.”

It, too, is used for both educational and entertainment purposes. Leezier’s wife, who works at a medical laboratory which may soon computerize, wants to learn more about computers “so she can do more than just sit down and type on the keys.”

The Computer Kids
While some parents might be a little slow to accept the computer age, young people are not. Unlike practically anyone over 22, today’s young people are increasingly coming into contact with computers by the time they reach high school. For example, Peter Lobl, a tenth grader in Lindenhurst, New York, was turned on to microcomputers by the Commodore PETs at his public school. He almost got a video game machine at home, but then decided to get a computer instead.

“I started with the Sinclair ZX-80, and then moved up to the Interact, a really rare computer sold by Protecto Enterprises. Then I got the VIC. If the price of the Sinclair kit comes down, I’d like to get one of those. I like to know what makes a computer work, not just type in something and sit
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back and say, ‘Hey, this works.’"

Peter is trying to learn machine language and hopes to get a part-time job at a local computer store run by a teacher. "I might go to school for computers when I finish up high school, I don't know yet," he says. "It would be kinda nice to write a Caverns Of Mars, make a few grand, sit back and relax, maybe buy a yacht...."

Craig Murray of Vancouver, British Columbia was introduced to computers at his private school. "It started back in grade six," explains Craig, 14. "Our class had a PET computer. Our teacher was very interested. We spent a lot of time after school talking about computers."

Attracted by the color graphics and sound, and already familiar with Commodores, Craig soon got a VIC-20. Then his brother David, 15, got hooked.

"My brother got me involved in computing, I guess," says David. "He taught me the PRINT statement."

Now both of them are busy playing games, writing programs, and pushing the VIC to its limits. "I wrote a program that imitates the high-resolution screen of the Apple almost exactly," David says. "However, it also uses practically all of the memory in the machine. I think I used everything right up to the very last byte."

Mark Rees first got his hands on an Apple II when he was a high school junior in Washington, Illinois. Now a freshman engineering major at Illinois Central College, he pitched in with his brother Steve - a high school senior who also plans to major in engineering - to buy an Apple III.

Why? Because the college uses Apple IIs and the brothers can do their computer work at home instead of crowding into the school's lab.

"There's no doubt about it, that it's helped us out," says Mark. "If we couldn't do our schoolwork at home, we'd have to use the school's computers during their hours, and when you're working [part-time], it's not easy to get the same hours."

In La Mesa, California, 13-year-old Jason H. Rogers has been tinkering with his VIC-20 since March. Jason's school also uses PETs and has a computer club which he is joining this year. For Jason, computing was a logical extension of his interests. "Grandpa had wires and lightbulbs and stuff laying around, so I've always been fooling around with electronics. Then when computers came out, I started buying computer magazines and reading about them, and pretty soon I was wanting one. Then I got a letter from my uncle saying that he had got a VIC-20 for me, and I was really surprised."

Now Jason is burying himself in computer magazines and library books, teaching himself how to program. "I like to program music into it, to play tunes and stuff, because it's simple and it's fun."

Computing For Fun And Profit

But young people aren't the only ones curious about computers. Adults too old to have encountered computers in school are also discovering what all the fuss is about. Some of the adults surveyed bought computers for educational purposes - not for children, but for themselves.

"The main reason I bought it was because my education had nothing to do with computers," says John Swisher, 42, an Atari 400 owner in Bay Village, Ohio. "They didn't even have electronic calculators when I was in school, so I knew zero about computers. I tried taking some of those adult education classes at night, but they're always filled up. So mainly I got it just to learn what they're all about."

A runner, Swisher uses his machine to keep track of his times, distances, and averages, and to catalog his record collection. His two elementary-age children mostly play games. "It's mostly just for education and entertainment," he says. "But although I haven't found a way to make it pay for itself yet, I've still been very happy with it."

Some adults are exposed to computers at work - usually to large machines or highly specialized microprocessor controllers - and develop a curiosity about home computing. Charles Magruder of Jackson, Mississippi is a system technologist on IBM mainframes who bought a 32K Atari 800 with his income tax refund last winter. He was playing Shoot, an arcade-style game published in last October's issue, when contacted by COMPUTE! one Saturday.

"Mainly I am playing a lot of games, I'd say 60 percent of the time, which compares to about 95 percent of the time when I first got my computer," says Magruder. "But now I'm trying to do more programming."

Magruder, 27, is writing a program to catalog his foreign coin collection, and has already written...
FROM THE ARCADES OF TOMORROW . . .

STRATOS

Arcaders who’ve seen and played the ATARI and TRS-80 versions of STRATOS came to the same conclusions — these state-of-the-art games were ahead of their time. After all, any program that boasts crisp graphics, punchy sounds, joystick compatibility and a full complement of extras, like high score saving and multi-player option has a definite touch of tomorrow.

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P R I C E S S U B J E C T T O C H A N G E
a program indexing all the Atari articles in **COMPUTE!** since February 1981. He wants to write a program to keep track of expenditures for his church, and he'd also like to learn player/missile graphics well enough to program a game. "It's a great deal. The computer has more capabilities than I knew it had when I bought it. It's worth more than I paid for it."

Clint Williams, 28, an electronics technician for Eaton Corporation in Portage, Michigan, uses TRS-80 Model IIIIs at work. Williams started off three years ago with an Ohio Scientific C1P, moved up to an OSI C4P, and recently bought a TRS-80 Model III with two disk drives so his home programming would be compatible with his programs at work. He plays games, programs for self-education, compiled loan tables when he recently shopped around for a new car, and uses the Scripsit word processor to produce a monthly local newsletter for the National Amateur Radio Club.

"I don't know what I'd do without the microcomputer now that I've had one for a couple of years," says Williams. "I'm so used to having a word processor for writing letters and so forth. It's a funny thing, once you find out everything that computers can do, you quickly become dependent on them."

In Beaumont, Texas, 40-year-old Everett Davis also got into home computing because of his exposure to computers at work. He's a communications planner for a utility company, and he bought a 48K Atari 800 last February. "Of course, in my work everything is going microprocessors -- our phone systems, everything. So it was a natural for me to get involved in computers."

He's written a few short home budget programs, and his wife and 18-year-old daughter also use the machine. "My daughter just graduated high school and has started college, majoring in business, so I'm sure she'll be using computers, too," says Davis.

"I'm planning on using it for word processing eventually, and also for some applications at work involving graphics," he adds. "Many of our friends are very interested in buying a computer, too. The only question is which one: that's the big debate."

Warren E. Walker of Peoria, Illinois bought his Ohio Scientific C8 two and a half years ago. "I've been in the computer business a long time, almost since it started, as a programmer and analyst. So when they finally became affordable, I bought one."

Writing almost all of his own software, Walker uses his C8 mainly to keep track of personal finances and to analyze the stock market.

**Beyond Fun And Games**

Walker was among several home computerists contacted who found profitable uses for their machines, or who use the computer for work as well as play. For example, Bob Federer of Toronto, Ontario, who owns an Atari 400 with 48K and a disk drive, occasionally brings his machine into the recording studio where he works. "There was a tune that I was working on when I needed a rhythm beat, and I actually worked out the rhythm part on the Atari," he explains. "I also used the Atari to create some sound effects for a new wave recording I was working on."

Federer is also an avid adventure game player, and has been struggling for months to program his own cribbage game. "I've got it to the point where it does just about everything but play the game."

William Wilbur of Kittery, Maine, retired from the U.S. Navy, is director for the New England region of the International Miniature Aircraft Association. He has a small mail-order business which involves printing out directories of kits for eight- to ten-foot radio-controlled model aircraft. Wilbur uses an original Commodore PET. It's been expanded to 32K, but what he really wants someday is a disk drive. "I'm running -- and this sounds like a nightmare -- a 1700-pius data base on cassette tape. It's a list of kits, plans, specifications, prices, and stuff like that for model aircraft. Would you believe 47 tape files? From where I sit I can see 16 boxes of cassette tapes."

Roberto Huyke of Mayaguez, Puerto Rico is a professor of civil engineering at the University of Puerto Rico. He put a VIC-20 in his home that would be compatible with the Commodore PET his students use at school. "I use it more as a professional computer than as a home computer. I use it for games, too, and so does my son, but he doesn't use it for anything else since he's only ten years old. Mainly I use my VIC for preparing programs for the Commodore PET here at school...we use programs for structural engineering and also some data management."

Another teacher who discovered the value of a computer in the home is Linda Timmons of Leavenworth, Kansas, who teaches high school computer science. She uses her PET to keep track of her
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students' attendance, grades, scores, and tests. Both Timmons and her husband have degrees in computer science and write all their own software. "The price came down so much, and they're so convenient, and they're so easy to use — anybody can program the things — that we just decided we couldn't do without one. It just makes so much sense to use a computer to keep track of grades and scores and so forth, because it saves so much time.

"Some people I know don't seem to be getting their money's worth out of their computers when it comes to personal use," says Timmons. "But I bought mine primarily for how it could help me on my job."

In Forest Hills, New York, Carol Klitzner's whole livelihood now revolves around personal computers. Back in 1977 she bought an original PET and a TRS-80 Model I. "I was working in educational publishing at the time, and this seemed like a natural to me, better than the workbooks and other materials I had been working with."

In 1980, Klitzner formed Computer Software Solutions, which develops educational software, and she has written a book on VisiCalc due in the Spring. She has added an Apple II, an Atari 800, a TRS-80 Color Computer, and a Monroe computer to her arsenal.

Malcolm F. Smith II of Beckley, West Virginia recently graduated with a master's degree in business administration from the University of West Virginia and is looking for a job. Meanwhile, he's using his VIC-20 to experiment with business forecasting. He recently used a program of his own design to forecast administrative costs for a friend's company. Previous forecasts had been about $1 million off. Smith's forecast was only about $150,000 off.

"Even though I bought my computer for rather unsophisticated reasons — I saw William Shatner advertising the VIC on TV and figured that if it was good enough for Captain Kirk it was good enough for me — I've become a more sophisticated user, and a very dedicated Commodore owner," he says.

"I look at a computer as a tool that will help me make a living," adds Smith. "I'm firmly committed to the computer age and Alvin Toffler's Third Wave and all of that. I think they are a definite part of our future."

If COMPUTE!'s informal survey is any indication, Smith is no exception.
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Perhaps the question we’re most often asked is “which computer should I buy?” This article, excerpted from The Beginner’s Guide to Buying a Personal Computer (COMPUTE! Books, 1982), should be of help in answering that question.

How To Select Your First Home Computer

As the microcomputer industry becomes more competitive, prices are dropping. It’s likely that you or someone you know will want to buy a personal computer soon.

Buying a computer is something like buying a television station or a supersonic jet—assuming that these items suddenly became affordable. You are about to buy a very sophisticated machine. It is still essentially mysterious. That is, we do not easily understand computers on the same level that we understand automobiles or washing machines. We do have highly sophisticated items in our homes already (microwave ovens, televisions), but the main difference between the TV and the computer is level of knowledge required to purchase them.

It is quite a task to deal with the facts and figures you’ll encounter in shopping for a microcomputer. You have to face a deluge of words: bits and bytes; RAM and ROM; characters and interfaces. This article, excerpted from The Beginner’s Guide to Buying a Personal Computer (COMPUTE! Books, ISBN 0-942386-03-5), is designed to guide you towards making an intelligent decision. It is not just a consumer’s guide to specific brands. It goes beyond that to help you match your expectations about personal computing to products that are currently available. And the specification charts at the end of this article should prove invaluable when you’re ready to narrow the choices down to the computer that best suits your needs.

Choices And Options

Let’s look at some of the considerations for choosing a machine. Keep in mind that some of the things we will look at will be highly subjective.

Memory

How much memory do you need? There are two basic rules regarding memory: 1. Larger memories can make complex programming more efficient, and allow you to do more sophisticated things with your computer. 2. Larger memories are generally more expensive. It’s the familiar story: capability costs money.

First, let’s take a quick look at memory and try to find out what memory is. Memory is a warehouse for the storage of instructions and data within the computer. The warehouse is divided into electronic bins or slots called “locations” or “addresses.” Each location has a numerical identifier, unique to that location, called its address, a marvelous and surprisingly simple term in light of the industry’s love for jargon. Each location can store one byte (1 byte = 8 bits, binary digits) of information.

What can you find in one byte? A single alphanumeric or graphic character, part of a number, part of an address for another memory location, or a single instruction for the processor. As you can see, a byte is a very small parcel of information. Thus, we will need many memory locations. Due to the electronics involved, microcomputers are generally limited to 65,536 locations, thus we can potentially store 65,536 bytes of data in the memory. Although some microcomputers can access more memory, we’ll treat 65,536 as our “ceiling” for the following discussion.

In order to be programmable and yet also automatically perform housekeeping chores (scanning the keyboard, loading or saving programs, displaying information on the screen, and other internal functions), the computer must have two types of memory, ROM and RAM. Both types reside in the 65,536 locations mentioned above. ROM, Read Only Memory, is for permanent storage. RAM, Random Access Memory, is temporary storage. Both ROM and RAM are random access memories. (Random Access – refers to the ability to access any specific location within the memory directly.) The contents of a ROM are written by the manufacturer and can never change. The computer can read the contents of a ROM, but cannot change these contents. ROMs are like a slab of granite with the information chiseled deep into the surface. RAMs are like a chalk board: the contents can be written, then read, then rewritten. This entire operation may occur in a few millionths of a second.
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ROM contains your computer’s basic “personality”; when you type something on your computer keyboard, and it appears on the screen, you don’t have to “tell” your computer to write to the screen. The computer’s operating system programs, embedded in ROM, automatically handle this for you.

RAM (Random Access Memory)

This is memory that’s available in your computer for “working” storage. You use this memory each time you work with your computer. When you type a program, or set of instructions, into your computer, this is where your computer saves them. You don’t have to worry about how it saves them (your ROM based programs take care of this). What you do need to remember is that, unlike ROM, RAM is not permanent memory. Thus, when you turn your computer off, RAM is erased. That’s the reason your computer has external storage devices available.

**Buying Memory**

Let’s explore what to look for in memory when you are shopping for a computer. First ROM. You may notice that the amount of ROM is sometimes advertised. Which is better, 12K of ROM or 14K? That is a fairly meaningless question. The actual amount of ROM is not, in itself, important. You can’t use ROM, only the machine can.

What is important are the functions that are packed into the ROM. The ideal is a great number of powerful functions packed into the smallest total number of memory locations. So you can’t shop for numbers; you have to shop for performance. ROM is something like a book: you purchase a book for its information, not how many pages it contains.

Size of ROM is somewhat meaningless, but the numbers game is important in RAM. RAM stores your programs and data. The more RAM, the longer your programs can be. Greater RAM also allows larger blocks of data to be entered in a machine. This can speed up data file manipulations. The machine can process data much faster when it can process (manipulate) data directly (while it’s in RAM) as opposed to loading small pieces, processing, then saving them back to tape or disk. Cassette tape drives move at a snail’s pace compared to the speed of the computer working within its RAM. By loading an entire file into the RAM memory, you can proceed at machine speeds once the load is completed.

With a small RAM memory, you may be forced to load, process, load, process ... this can be tiresome. Larger RAM memories allow you to do more with your computer: write longer programs, and process faster. Another argument in favor of larger memories is the RAM requirements of commercially available software. Some programs require large memories. Most home applications programs will run on 8 or 16K, but there are some programs that require 32K or more depending on the model of the computer. If you have more RAM than a program requires, it is no problem. However, if you attempt to run a program that exceeds the available RAM, the program will not run. The machine will crash (cease functioning) and display an error message indicating that you have run out of memory. You can use special techniques, however, like “chaining” to run a program in several sections.

What are the disadvantages? There is only one: cost. Extra RAM costs more. This does not mean that you order any amount of RAM that comes to mind. Models offer a certain amount of RAM and you choose which model you want.

**RAM Sizes**

How do you buy RAM? The available memories are almost as numerous as the machines. Some manufacturers offer the same basic machine with several choices of memory sizes (e.g., 8K, 16K, or 32K). Other manufacturers offer one model with a given amount which can be expanded, and offer a better model with more. Each manufacturer has his own way of doing this. You have to buy some definite amount; that is, you can’t order a “Data Cruncher Mark IV” with 19 1/4K of RAM. You would have to buy either a 4K or a 16K or whatever “Data Crunchers” have available.

1, 2, 3, 5, 8, 16, 32, and 48K are the common amounts sold with computers. That represents a variety of machines, not one model. On some machines, with higher price tags, you may find 64K, 96K, 128K, 256K.

Another point about RAM. You can add additional RAM up to some maximum amount. That is, you can buy a computer with less than the ceiling on RAM, and add more RAM later up to that ceiling. The ceiling is defined by how many of the original 64K of memory locations are consumed by the operating system, the BASIC interpreter, and expansion ROM. If all of this added up to 16K, then the ceiling for RAM would be 48K.

What are the memory considerations? For RAM there are only two: 1. How much RAM do you need and can you afford on your initial purchase? 2. What is the maximum amount of RAM that the machine can handle, the ceiling mentioned above? A minimum of 8K is probably sufficient for most home applications. 16K should be more than sufficient, and possibly the best choice for a cost versus use consideration. Unless you have something quite specific in mind, perhaps you need not worry about getting more than 16K to begin with;
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**Screen Considerations**

**Displays.** Your display is your window into your computer. If you had no TV screen or monitor, using your computer would be like typing on a typewriter with no paper. The type of display you have is equally important. If your computer has color graphics capabilities, then you'll need to be considering a color television or monitor for it. Otherwise a less expensive black and white TV will do. We strongly recommend that you take a look at various displays with your computer. Buying an expensive personal computer system and then hooking it up to the cheapest TV you can find may be somewhat like buying $19 speakers for your $2000 stereo. After all, it is the display that you'll spend all of your working time looking at.

Some computers come with a built-in display monitor. This standard feature should be another consideration in your decision.

**Screen Format.** Screen format describes the physical presentation of information on the screen of the video monitor or TV. The format is decided by the computer, not the video monitor. The monitor only displays what the computer tells it to. There are two terms which must be defined in order to understand screen formats: lines and columns.

The various computers on the market offer a variety of screen formats. Common column formats are 22, 24, 32, 40, 64, and 80 columns. Common line formats are 1 (hand-held computers), 16, 24, and 25. The more exotic machines may exceed these figures.

Why are screen formats important? The larger the format (the more lines and columns you have), the greater the amount of information you can display at one time. Let's consider four different formats: a hand-held with 26 columns by 1 line, a desk-top with 32 columns by 16 lines, a second desk-top with 40 columns by 25 lines, a third desk-top with 80 columns by 25 lines. These are all common formats. How many total characters can each format display?

Simply multiply the columns by the lines. Thus we have 26 (1 X 26) for the hand-held, 512 (32 X 16) for the first desk-top, 1000 (40 X 25) for the second desk-top, and 2000 (80 X 25) for the third desk-top.

The more information that you can display at one time, the more useful and, unfortunately, the more expensive the computer is. The impact of screen format is determined by your main use for the computer. Again, you must balance cost against need.

Related to screen format is the **character matrix.** The character matrix is a block of Picture Elements, pixels, which is used to form the individual characters on the screen. Each pixel is like a light bulb: it may be on or off independently of the rest of the matrix. The matrix resembles a bank of light bulbs used on a scoreboard, or a time/temperature sign. By illuminating the proper pixels, any character (alphanumeric, graphics, punctuation, or symbols) can be displayed. For a period (.), only one pixel would need to be illuminated. For a flashing square, all of the pixels in the matrix would be illuminated, then off, then illuminated ....

The number of pixels in the character matrix is always given in terms of a horizontal dimension and a vertical dimension. Common dimensions for a character matrix are: 5 X 7, 7 X 9, and 8 X 8. In 5 X 7, the character matrix has a dimension of 5 pixels horizontally and 7 pixels vertically. The total number of pixels in the matrix is the product of the horizontal and vertical dimensions (e.g., 35 for the 5 X 7). The larger matrices provide a finer **font.** (Font - style and size of any form of printing.) The lowercase letters can have true "descenders" for the letters g, j, p, q, and y. Descenders are the portions of these letters that descend below the bottom line established by the remaining letters.

A 5 X 7 matrix cannot produce descendents due to the short vertical dimension of the matrix. Letters without descendents have an elevated appearance, and the font is coarse and harder to read. The larger the character matrix dimensions (i.e. the more pixels in the matrix), the more detailed the font can be. The display will have a better appearance.

**Keyboards.** The keyboard is not really part of the computer. It is an input peripheral. Due to the fact that most models of computers have a keyboard included, we will take a look at some of the aspects of a keyboard. Don't underestimate the importance of a keyboard. You will be spending hours pounding away on it, so it is a critical consideration. You will often see the term **human engineering** used in relation to keyboards. Human engineering is the concept of designing something that is practical and comfortable for human beings to use. You can have the most wonderfully designed keyboard in terms of electronics and, if it is uncomfortable to use, it's not worth buying. Shop for human engineering in keyboards.

Some manufacturers place all of the numbers and, in some units, the arithmetic operators (+, -, *, /) in a calculator-like keypad to the right of the main keyboard. (BASIC uses the * to denote multiplication, and the / to denote division.) This layout has two advantages: 1. The numerical keypad is very convenient for math operations. 2. Additional
From "The Editor's Feedback" Card, a monthly part of our continuing dialogue with readers of COMPUTE! These are responses to the question, "What do you like best about COMPUTE!?"

1. "It is written so a beginner can read and understand it... it's layman oriented..."
2. "Clear, clean layout, good presentation..."
3. "The Atari game programs..."
4. "Best and most information on PET..."
5. "Cover to cover, and all in between..."
6. "Reviews of software and hardware..."
7. "Good balance of application and technical articles..."
8. "It is the best source of info about various levels of VIC/PET/CBM machines and applications..."
9. "The BASIC and machine language programs..."
10. "I like programs that can be typed into a computer, run, and then used right away (a program without bugs)..."
11. "That it is organized well, and covers a broad range of information concerning Atari. Keep it up! please, I'm learning..."
12. "Table of contents listings and computer guide to articles is a great idea. Best magazine for personal home computer users..."
13. "Best I have found for VIC info..."
14. "Informative articles: 'Secrets of Atari', Game programs, especially programs that teach the reader about the Atari..."
15. "I like all the articles and programs for my computer, the PET. I've learned and found out things about it that I never even thought existed. Other magazines don't have too much material for the PET and, for that reason, I find COMPUTE! invaluable..."
16. "The up-to-date hardware reviews..."
17. "Machine language utilities for Atari..."
18. "Articles are terse but understandable and accurate. Utility and applications program listings very helpful..."
19. "The April, '82 issue is my first. I am impressed that you not only acknowledge the VIC-20, you even have applications for it..."
20. "I really enjoy (since I am one) the Beginner's Page..."
21. "The attention it gives to Atari and the easy-to-understand language it's written in..."
22. "It is concerned with explaining programs, not just listing them. It is the best VIC magazine I could buy..."
23. "The new table of contents 'Guide to Articles and Programs' is excellent, particularly the indication of 'multiple computer' items..."
24. "Broad range (sophistication) of programs..."
25. "You don't speak over the average user's head..."

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characters can be added to the empty keys normally used for the numbers and the shifted position of the extra numerical keys. The only disadvantage is that the keyboard has to be somewhat larger.

Also notice the location of special function keys, especially those that may have a devastating result if inadvertently struck (RESET key). Any command keys should be located so that it is difficult to accidentally strike them during normal use.

There are several types of keyboard construction. The two major categories are the flat panel, touch sensitive (membrane), and the mechanical switch (or contact) types. The flat panel can use the same layout, and can perform the same functions as any other keyboard. The keyboard is flat; there are no bumpy individual keys sticking up. Key placement is indicated by labeled blocks printed on a plastic sheet, which is glued or laminated to the surface of the board. The flat panel has the appearance of a diagram of a keyboard that one might find in an instruction manual. It is wafer thin, very light, cheap to manufacture, and, with no moving parts, it is very rugged. Flat panel keyboards are being used extensively by industry in hostile environments. Since it is flat, it is very easy to clean. The flat panel keyboard is less sensitive to peanut butter, jam, candy, soft drinks, and abusive pounding. It can be a wise choice for children.

With all of these advantages, you may wonder why the computer industry has relegated the flat panel to the low cost models only. The reason: there is no tactile feedback with a flat panel keyboard. You cannot feel the locations of the keys, nor can you feel a response to a keystroke. There is no keystroke. Typing on a flat panel keyboard is like typing on the top of a desk. Touch typists have nothing to touch; there is no feeling that the key has been actuated. So, for all of its advantages, which are considerable, the flat panel’s failure to involve our sense of touch is its great weakness.

Everything that is advantageous about the flat panel is a disadvantage with the mechanical switch type. They are expensive, delicate, and difficult to clean. They use contacts which oxidize and get dirty. They cannot be used in hostile environments or by hostile people. Liquids and humidity are murderous to them. Because they have moving parts, they can wear out.

Watch Out For Bounce

With all of these disadvantages, the mechanical switch keyboard has its one very big advantage: you can feel the keys. You don’t have to keep one eye on the keyboard (if you touch type). You can feel the key’s response and know that the character has been entered.

Within the mechanical switch category, there are a variety of stroke depths, key sizes, and stroke pressures. Sizes range from tiny, on the hand-holds, to what is known as the full-size keyboard. The full-size is similar to a standard typewriter keyboard. Stroke depth (the distance the key travels during the stroke) and stroke pressure (the force required to strike a key) vary on the different models. Generally, an expensive keyboard will have a very positive response: a light, but even pressure and, perhaps, a slight snapping action at the bottom of the stroke called a detent. Cheap keyboards will usually have a very shallow stroke depth and a “mushy” feel. The feel of a keyboard, of course, is a very subjective matter. Your best test of a keyboard is to try it out.

A feature that you want on any keyboard is two or three key rollover. This is the ability of the keyboard to distinguish small nuances in time passing between two keys being struck almost simultaneously, and to keep the order correct. Without rollover, touch typos would have a terrible time with characters getting out of order or lost altogether. You want rollover.

You don’t want bounce. Keyboard or switch bounce is the multiple entry of a character when only one character was desired (sswitiittchhh bbbooouunnccee). Keyboard bounce is caused by microscopic bouncing of the contacts during a keystroke. All mechanical switches have switch bounce, but special circuitry is implemented to eliminate the effect. However, a bad keyboard can overcome the circuitry and, on occasion, a character may be entered more than once. Keyboard bounce can be lived with, if it is not excessive, but it is always aggravating. Naturally, manufacturers are not going to advertise that their computers have bounce, so you have to ask experienced users or dealers about the problem. Get a number of opinions; people have been known to hint about bounce on a particular model they don’t like. It’s like saying a particular car has transmission trouble; it may or may not be true.

If you can touch type, or you intend to do a lot of programming, or you intend to use the computer for word processing, you need a good quality, mechanical switch type of keyboard. If the computer will be used mainly by young children, a flat panel, touch sensitive keyboard might be best. If you will be doing a lot of numerical work, look into a model with a separate numerical keypad.

Unfortunately, you don’t get much of a choice on keyboards either. Don’t underestimate the importance of a keyboard. It is your primary method of communicating with the computer.

Graphics And Character Sets

Graphics are computer-generated illustrations
Very, very, difficult!

The definitive, super-fast, multiple skill, shoot-out game for Atari® 400/800™
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and graphs. In essence, any nonverbal and non-numerical information is considered graphics. There are two general categories: low resolution and high resolution. Most home computers feature graphics, but some models are limited to low resolution.

With low resolution graphics, the machine will have a given number of standard graphic characters. These characters are internally generated in the same manner as the alphanumeric characters. Each character is assigned a key on the keyboard, usually in the shifted mode, and they are typed or programmed on the screen in the same fashion as alphanumeric characters.

High resolution graphics illuminate the individual pixels of the character matrix anywhere on the screen. You can make very detailed drawings as the screen becomes a giant matrix of thousands of individual dots which can be illuminated independently of one another. You can draw curves, irregular angles, three dimensional figures, and those fascinating geometrical constructions which are graphic representations of mathematical functions. As a comparison, imagine two artists painting a picture. One uses a fine set of art brushes (high resolution), the other uses a two inch house brush (low resolution).

If your interest is in low resolution graphics, look for the greatest number of different characters and the largest screen format. This will give you a greater versatility and allow a more detailed image. If high resolution interests you, you want to look for the largest maximum screen resolution. You want many pixels: the more, the better. The number of pixels will determine the detail of your image. High resolution graphics are somewhat more expensive. Some machines have high resolution graphics as a standard feature. Others offer it as an option, and some models rely on add-on boards offered by separate, specialty manufacturers. If you are especially interested in computer graphics, you will want high resolution graphics. If you cannot afford them initially, make sure that the machine of your choice can be expanded to include them.

The character set is the total package of characters that can be displayed on the screen. The character set includes alphanumeric, symbols and punctuation, graphics, and special notation (e.g., mathematical notation, Greek letters for engineering, special punctuation used in foreign languages). Character sets differ from machine to machine, and, to some degree, are an indicator of price. The very low cost units may offer only uppercase letters, the minimum of punctuation and symbols, numbers, and perhaps a smattering of graphic characters. However, in many cases, additional specialized symbols can be added to the machine.

Related to the character set are special video effects. The most common is reverse video. In normal video, the character is illuminated on a black background. The only portion of the character matrix that is illuminated is that portion which is required to form the character. In reverse video, the character is black and the remainder of the character matrix is illuminated. If you had one word printed in reverse video on an otherwise blank screen, you would see a black screen with an illuminated stripe (one line high and the same length as the word), with the word printed in black letters on the stripe. Other special effects include flashing and underlining.

Color. Do you need color? The answer can only be determined by you. It is debatable that you need color, but it does add to games, graphs, etc. Can you afford color? Don’t forget that, with color, you must pay more for your display. Some monochrome (one color, generally black and white or green and white display) models have their display already built in. So don’t forget the price of the display when making your pricing comparisons. A color TV or monitor can be as expensive as the computer itself.

Where is color most useful? For games and educational programs. Educational programs, especially for younger children, are enhanced with color. Creative programming with color can be very conducive to maintaining attention. Another primary use of color is in graphics (using the computer to form images). Imagery in color is much more interesting to the eye. If one of your principal interests is computer graphics, the color machine becomes even more necessary. Color is less important in financial, word and information processing, unless you’re interested in the more expensive systems that can generate color graphs and charts.

Assuming that you do want color, what should you look for? First, realize that you don’t get every color in the rainbow. Most models offer 8 or 16 basic colors. Some will allow you to perform various intensity and shading tricks, bringing your number of available shades up as high as 128 different “colors.” Check the number of available hues. Another issue is the versatility of the color functions. How many colors can be displayed simultaneously on the screen? How easy is the color to work with? How accessible are color “commands” in the computer’s programming language? If color is an important factor in your choice, then it should be versatile and easy to program. We have a tendency to think of computers as either color or monochrome, as we think of a TV. Remember that each computer is capable of a great number of different tasks, and each model has a distinct set of features.
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Inside Atari DOS

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Please charge my □ VISA □ MasterCard □ American Express
Account No. Expires /

Please send me:
Quan. Price Shipping/Handling
Beginner’s Guide $3.95 ea. + $1.00 ea.
First Book Of Atari 12.95 ea. + 2.00 ea.
Inside Atari DOS 19.95 ea. + 2.00 ea.
First Book of PET/CBM 12.95 ea. + 2.00 ea.

Total

Name
Address
City State Zip
Country
Allow 4-6 weeks for delivery. Foreign surface delivery allow 2-3 months.
and limitations. Color should only be one factor. You shouldn't make a pass/fail screening test to eliminate 50% of the machines right away. You want the best total package to fit your requirements. It all goes back to knowing what you're doing. Take your time, and personally evaluate your options.

**Software.** If you have a specific job in mind, software availability may make the difference between a useful machine and a dust collector. For the general home user, there is a myriad of programs to choose from. The software ranges from backgammon to recipe costs, arithmetic for children to energy conservation calculations, etc. Think of any subject, and chances are that someone is selling a program related to it.

Some models of computers have a great amount of commercially available software. Others, for some reason, do not. Also, some software is available only for certain machines. If you will be dependent on commercially available software, (doing no programming yourself), choose a model with a large selection. Bear in mind however, that a recently introduced model will be lacking in software. Over time, software will be written for it.

You can find a lot of information about software availability in magazine advertisements. One thing to realize is that, in most cases, independent software houses will offer more software for a particular machine than does the manufacturer of the machine. Look beyond what the manufacturer offers. Dealers are also a good source of information on software availability. There are some software directories available, and many dealers have these on hand.

A word of caution: after you get your computer, choose your software carefully. Due to abuses of copyrighted software, dealers are becoming reluctant to refund or exchange purchased software.

**Peripherals.** Do you need peripherals? Yes, unless you only intend to use the computer as a space heater. Peripherals communicate with the computer.

We think of a computer as being a box with a keyboard and TV sitting on it. Actually, we have a computing system: the computer, an input peripheral (the keyboard), and an output peripheral (the TV or video monitor). If any one of the three items fails, the whole system becomes useless. If all three items are installed on a common chassis, you should still visualize them as a computer with two peripherals. You will be buying some peripherals whether you realize it or not.

What other peripherals do you need? It depends. Specialized uses require specialized peripherals (a printer for word processing). As a general statement, the more useful the system will be.

Buy peripherals as you need (and can afford) them. 1. If you decide that computing is not really for you, there is less equipment to sell off at a depreciated price. 2. You, as a beginner, have enough to learn for a while with the purchase of a minimal system. 3. After you have used your system and have become familiar with computing, you may redefine your needs. When you have some experience, you will be better able to make decisions on peripherals.

On the other hand, you might be offered a significant price cut in a package deal. Otherwise, you should buy a good minimum system. But don't cut corners on your basic system in order to throw in that flashy extra item. A good minimum system has far more potential than an ill-planned extensive system.

You may also want to consider joysticks, game paddles, or a light pen since these items are rather inexpensive ($20 to $50 per item). They can add to the pleasure of playing games.

**Storage Devices.** In our discussion of RAM, we concluded with the need to have something available for storing the contents of RAM when you turn the computer off. This isn't, of course, the only reason for storage. This is where you'll end up saving the hundreds of programs you'll acquire and develop for your computer. There are two major types of storage available. One is cassette tape, the other diskettes. The cassette tape type of storage is a medium we're all familiar with. You simply plug a tape into your recorder and tell your computer to save or loads something.

Operation of a disk drive is equally simple. The major difference between these two technologies is cost. Your simple disk storage system will add at least $300-$400 to the cost of your system; your tape based storage will add less than $100. You'll have to weigh this cost disparity against your needs. Tape is much, much slower than disk, in its loading and saving operations. In some personal computer systems it is less reliable. Disks have the advantage of much greater storage capacity, a factor essential to some educational applications, and such business ones as data management, word processing, and so on. Again, as with the computer display you select, you'll be living with the storage medium you select. Evaluate carefully! Your initial choice isn't a one way street, of course. Many home users start off with tape storage, and "move-up" in several months to disk storage. This is an ideal way to spread out the costs of your initial personal computer system.

**Documentation.** Documentation refers to the instruction manuals, programming manuals, theory
Explore the Frontiers of Intelligence

- Variations of blind-fold play—camouflaged or invisible pieces
- Invert board to play black on bottom
- Change pieces on board during game, or set up position
- Change between 15 levels of play; plus postal and mate-finder modes
- Show move that Chess is thinking about
- List played moves for each side
- Lines of force in: attacks and defenses on a square
- Lines of force out: squares attacked and defended
- Chess suggests a move
- Show moves Chess thinks you will make, and its responses
- Evaluation of a position
- Return to board or switch to command menu
- Take back a move (repeatable)
- Play move suggested by look-ahead search
- Chess plays neither side
- Switch sides
- Chess plays against itself—one level against another
- Replay through most advanced position
- Skip to most advanced position
- Start new game
- Leave program
- Save, get, and delete games to and from disk

All features self-documented; all choices cursor-controlled

Screen shows "outward" and "look" features being used

THE PEOPLE BEHIND THE PROGRAMS:

Larry Atkin & David Slate: Authors of the Northwestern University Chess 4.7 program—World Computer Chess Champion, 1977-1980

Peter Frey: Northwestern University professor

Editor: Chess Skill in Man and Machine

One of U.S. Othello Assoc.'s top-ranked players

Checkers features

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(From Checkers documentation)

"Scores" feature in Odin

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(U.S.A.)

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Checkers: $49.95
Odin: $49.95

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systems, and Atari 48K disk systems,
Odin is also available for TRS-80 Model
1 & 3 32K disk systems.)

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### MEMORY

<table>
<thead>
<tr>
<th></th>
<th>RAM Standard:</th>
<th>Expansion to:</th>
<th>ROM Expansion</th>
<th>Tape Drive</th>
<th>Disk Drive</th>
<th>Lines x Characters</th>
<th>Character Matrix</th>
<th>Upper-And Lowercase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple II &amp; Apple II Plus</td>
<td>16K</td>
<td>48K</td>
<td>&quot;Cards&quot; inside unit</td>
<td>X</td>
<td>Up to six 143K per drive</td>
<td>24x40</td>
<td>5x7</td>
<td>No</td>
</tr>
<tr>
<td>Atari 400</td>
<td>16K</td>
<td>48K</td>
<td>ROM cartridges</td>
<td>X</td>
<td>Up to four 92K per drive</td>
<td>24x40</td>
<td>8x8</td>
<td>Yes</td>
</tr>
<tr>
<td>Atari 800</td>
<td>16K</td>
<td>48K</td>
<td>ROM cartridges</td>
<td>X</td>
<td>Same as Atari 400</td>
<td>24x40</td>
<td>8x8</td>
<td>Yes</td>
</tr>
<tr>
<td>Commodore 64</td>
<td>64K</td>
<td>N/A</td>
<td>&quot;Cards&quot; and cartridges</td>
<td>X</td>
<td>Up to five 170K per drive</td>
<td>25x40</td>
<td>8x8</td>
<td>Yes</td>
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<tr>
<td>Commodore PET/CBM</td>
<td>16 or 32K</td>
<td>32K</td>
<td>Internal sockets</td>
<td>X</td>
<td>Dual drive (up to four) 340K or one megabyte double density</td>
<td>25x40*</td>
<td>6x8</td>
<td>Yes</td>
</tr>
<tr>
<td>Commodore SuperPET</td>
<td>96K</td>
<td>N/A</td>
<td>Internal sockets</td>
<td>X</td>
<td>Same as PET</td>
<td>25x80</td>
<td>6x8</td>
<td>Yes</td>
</tr>
<tr>
<td>Commodore Max Machine</td>
<td>9K</td>
<td>N/A</td>
<td>Cartridges</td>
<td>X</td>
<td>Single 170K disk drive</td>
<td>25x80</td>
<td>6x8</td>
<td>Yes</td>
</tr>
<tr>
<td>Commodore VIC-20</td>
<td>5K</td>
<td>32K</td>
<td>Cartridges</td>
<td>X</td>
<td>Single 308K disk drive</td>
<td>30x64</td>
<td>8x8</td>
<td>—</td>
</tr>
<tr>
<td>Exidy Sorcerer</td>
<td>16K</td>
<td>48K</td>
<td>ROM &quot;Paks&quot;</td>
<td>X</td>
<td>Built-in</td>
<td>10x32</td>
<td>5x7</td>
<td>Yes</td>
</tr>
<tr>
<td>Hewlett-Packard HP-85A</td>
<td>16K</td>
<td>32K</td>
<td>ROM &quot;Drawer&quot;</td>
<td>X</td>
<td>Double density disk drives 286K</td>
<td>25x80</td>
<td>9x14</td>
<td>Yes</td>
</tr>
<tr>
<td>IBM Personal Computer</td>
<td>16K</td>
<td>512K</td>
<td>&quot;Cards&quot;</td>
<td>X</td>
<td>Up to two 320K disk drives</td>
<td>25x80</td>
<td>9x14</td>
<td>Yes</td>
</tr>
<tr>
<td>Mattel Intellivision</td>
<td>16K</td>
<td>N/A</td>
<td>—</td>
<td>X</td>
<td>—</td>
<td>24x40</td>
<td>4x8</td>
<td>Yes</td>
</tr>
<tr>
<td>NEC PC-8001A</td>
<td>32K</td>
<td>160K</td>
<td>One internal socket</td>
<td>X</td>
<td>Up to four 186K drives</td>
<td>25x80**</td>
<td>7x9</td>
<td>Yes</td>
</tr>
<tr>
<td>Osborne 1</td>
<td>64K</td>
<td>N/A</td>
<td>—</td>
<td>X</td>
<td>Built-in dual disk drives 160K each</td>
<td>24x52</td>
<td>9x10</td>
<td>Yes</td>
</tr>
<tr>
<td>Panasonic Hand Held Computer</td>
<td>2K</td>
<td>8K</td>
<td>ROM capsules</td>
<td>X</td>
<td>(Up to 8K non-volatile RAM capsules)</td>
<td>—</td>
<td>8x6</td>
<td>No</td>
</tr>
<tr>
<td>Radio Shack Color Computer</td>
<td>4K</td>
<td>32K</td>
<td>Program &quot;Paks&quot;</td>
<td>X</td>
<td>Up to four 150K drives</td>
<td>16x32</td>
<td>6x16</td>
<td>No</td>
</tr>
<tr>
<td>Radio Shack Pocket Computer</td>
<td>16K</td>
<td>16K</td>
<td>—</td>
<td>X</td>
<td>—</td>
<td>Single line, 24 character LCD display</td>
<td>7x5</td>
<td>No</td>
</tr>
<tr>
<td>Radio Shack TRS 80 III</td>
<td>16K</td>
<td>48K</td>
<td>—</td>
<td>X</td>
<td>Up to four 175K disk drives</td>
<td>16x64</td>
<td>7x9</td>
<td>Yes</td>
</tr>
<tr>
<td>Sinclair ZX-81/ Timex TS-1000</td>
<td>16K</td>
<td>16K</td>
<td>—</td>
<td>X</td>
<td>—</td>
<td>24x32</td>
<td>8x8</td>
<td>No</td>
</tr>
<tr>
<td>Texas Instruments TI-99/4A</td>
<td>16K</td>
<td>48K</td>
<td>Plug-in &quot;Modules&quot;</td>
<td>X</td>
<td>Up to three 90K disk drives</td>
<td>24x32</td>
<td>8x8</td>
<td>Yes</td>
</tr>
<tr>
<td>Xerox 820</td>
<td>64K</td>
<td>N/A</td>
<td>—</td>
<td>X</td>
<td>Up to two 308K disk drives</td>
<td>24x80</td>
<td>7x9</td>
<td>Yes</td>
</tr>
<tr>
<td>Zenith Z89</td>
<td>48K</td>
<td>N/A</td>
<td>—</td>
<td>X</td>
<td>One built-in 100K disk drive Up to three total disk drives allowed</td>
<td>25x80</td>
<td>5x7</td>
<td>Yes</td>
</tr>
</tbody>
</table>

*The CBM 8032 has 25 x 80.
**Can be varied.
SUNDAY DRIVER gives you four scenarios to choose from. You must beat the clock as you drive along while avoiding pedestrians, other cars, and obstacles. In other versions it's winter and you're on ice-slicked roads. In game three it's nighttime (don't hit the ghosts). If this sounds too easy try the 007 option — it's you against them on twisty roads.

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16K cassette or disk $29.95.

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## Typical Starter System

<table>
<thead>
<tr>
<th>Computer</th>
<th>List Price</th>
<th>Comments</th>
<th>Number Of Colors</th>
<th>Maximum Resolution</th>
<th>Sound</th>
<th>Special Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apple II &amp; Apple II Plus</td>
<td>$3130</td>
<td>16K RAM</td>
<td>16</td>
<td>280x192</td>
<td>Speaker generates clicks</td>
<td>High resolution 8 colors, low resolution 16 colors. Some color inaccuracies.</td>
</tr>
<tr>
<td>Apple II Plus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apple 400</td>
<td>$299-95</td>
<td>16K</td>
<td>256</td>
<td>320x192</td>
<td>4-voice, 4-octave special effects</td>
<td>16 graphics modes from all text to high-resolution. Four animated “sprites,” or player/missile graphics, keyboard graphics, custom character set.</td>
</tr>
<tr>
<td>Atari 800</td>
<td>$299-95</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commodore 64</td>
<td>$595</td>
<td>64K</td>
<td>16</td>
<td>320x200</td>
<td>3-voice programmable synthesizer</td>
<td>Graphics characters, custom characters, mixed text and graphics, 8 animated “sprites.”</td>
</tr>
<tr>
<td>Commodore PET/CBM (4032-8032)</td>
<td>$995/1495</td>
<td>32K</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commodore SuperPET</td>
<td>CBM 8050, 1 megabyte dual disk drive ($7995)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commodore Max Machine</td>
<td>Same as Commodore 64</td>
<td>$1995</td>
<td>96K</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commodore VIC-20</td>
<td>$260</td>
<td></td>
<td>16</td>
<td>176x184</td>
<td>3 voices plus white noise</td>
<td>Graphics characters, custom characters, custom characters, mixed text and graphics, 8 animated “sprites.”</td>
</tr>
<tr>
<td>Exidy Sorcerer</td>
<td>Cassette player, BW/TV</td>
<td>$1295</td>
<td>16K</td>
<td></td>
<td></td>
<td>Graphics characters, custom characters.</td>
</tr>
<tr>
<td>Hewlett-Packard HP-85A</td>
<td>[This computer is sold with a built-in tape player and thermal printer.]</td>
<td>$2750</td>
<td>16K</td>
<td></td>
<td></td>
<td>Graphics commands from BASIC.</td>
</tr>
<tr>
<td>IBM Personal Computer</td>
<td>Tape recorder BW/color TV</td>
<td>$1265</td>
<td>16K</td>
<td>640x200</td>
<td>1 voice</td>
<td>Graphics characters, high-resolution color and BW graphics.</td>
</tr>
<tr>
<td>Mattel Intellivision</td>
<td>[Cassette player built in] BW or color TV</td>
<td>$599</td>
<td>16K</td>
<td></td>
<td></td>
<td>Video-game processor.</td>
</tr>
<tr>
<td>NEC PC-801A</td>
<td>Audio cassette player BW or color TV</td>
<td>$995</td>
<td>32K</td>
<td></td>
<td></td>
<td>Green characters, high-resolution graphics.</td>
</tr>
<tr>
<td>Osborne 1</td>
<td>[No additional devices required. Built-in disk drives and CRT.]</td>
<td>$1795</td>
<td>60K</td>
<td></td>
<td></td>
<td>32 graphics characters.</td>
</tr>
<tr>
<td>Panasonic Hand Held Computer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radio Shack Color Computer</td>
<td>Color TV Tape recorder ($599-95)</td>
<td>$399-95</td>
<td>16K</td>
<td></td>
<td></td>
<td>Optional enhancement allows high-resolution graphics.</td>
</tr>
<tr>
<td>Radio Shack Pocket Computer</td>
<td>Cassette player ($79-95)</td>
<td>$150-95</td>
<td>2.6K</td>
<td></td>
<td></td>
<td>22 graphics characters.</td>
</tr>
<tr>
<td>Sinclair ZX-8/1 Timex TS-1000</td>
<td>Cassette player BW or color TV</td>
<td>$99.95</td>
<td>4K</td>
<td></td>
<td></td>
<td>22 graphics characters.</td>
</tr>
<tr>
<td>Texas Instruments TI-99/4A</td>
<td>Cassette player BW or color TV</td>
<td>$299</td>
<td>16K</td>
<td>256x192</td>
<td>3 voices plus white noise</td>
<td>High-resolution Custom characters, 256 animated “sprites.”</td>
</tr>
<tr>
<td>Xerox 820</td>
<td>2 disk drives</td>
<td>$3295</td>
<td>64K</td>
<td></td>
<td></td>
<td>33 graphics characters.</td>
</tr>
<tr>
<td>Zenith Z89</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* To effectively use this system, these additional devices are necessary.  
** This price does not include the cost of any required additional devices (such as 'TVs') listed above.  
*** Tape recorder is distinguished in this chart from audio cassette recorder. The latter can be an ordinary portable cassette player, the former is optimized for data storage.
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of operation, and trouble-shooting information provided with the computer. Good documentation is essential. Your understanding and the ultimate usefulness of the computer depend on the quality of the documentation. Some documentation is excellent; most is adequate. Fortunately, when a manufacturer provides poor documentation someone will usually write a book on the machine. Sometimes, you can purchase the instruction manuals separately.

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Cupertino, CA 95014
(408) 996-1010

Atari Inc.
1296 Boregas Ave.
Sunnyvale, CA 94086
(408) 745-2000

Commodore Business Machines
950 Rittenhouse Rd.
Norristown, PA 19403
(215) 687-9750

Eddy Inc.
Data Products Division
390 Java Dr.
Sunnyvale, CA 94086
(408) 734-9431

Hewlett Packard
Personal Computer Division
1010 N.E. Circle Blvd.
Corvallis, OR 97330
Contact local sales office

IBM Corporation
National Marketing Center
Dept. 86-R
1133 Westchester Ave.
White Plains, NY 10604
Contact local sales office

Mattel Electronics
Division of Mattel, Inc.
5450 Rosecrans Ave.
Hawthorne, CA 90250
(213) 978-5150
(213) 978-6847

Nippon Electric Co., Ltd. (NEC)
1401 Eakes
Elk Grove, IL 60007
(312) 228-5900

Osborne Computer Corp.
2233 Corporate Ave.
Hayward, CA 94545
(415) 867-8080

The Panasonic Company
One Panasonic Way
Secaucus, NJ 07094
(201) 348-7000

Radio Shack
Division of Tandy Corp.
1800 One Tandy Center
Fort Worth, TX 76102
Contact local sales offices

Sinclair Research LTD
One Sinclair Plaza
Nashua, NH 03061

Texas Instruments Inc.
Consumer Relations
P.O. Box 53 (Attn: TI-99-4A)
Lubbock, TX 79408
(806) 741-4800

Xerox Corporation
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Dallas, TX 75247
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SIMULATOR:

“Tiny Plan,” A Modeling Planner For Home Applications

Christopher J. Flynn
Herndon, VA

There seems to be a revolution occurring in corporate America. Microcomputers are increasingly appearing on desk tops. One of the reasons for this is the development of sophisticated business software. A prime example is the computerized spreadsheet. With this kind of software, managers can rapidly evaluate various business situations. The ability to react quickly may mean the difference between profit and loss (or worse).

What about the average household, however? Hasn’t home financial planning become more necessary? Hasn’t it also become more difficult? Consider, for example, the variety of investment opportunities that are now available. There are money market plans, CDs, IRA accounts, and so on. How can you tell which is best for your family’s needs? Are you able to state what your assets and liabilities will be in, say, two years?

A Personal Computerized Spreadsheet

“Tiny Plan” is a computerized spreadsheet program for home computers. It is a tool that makes difficult calculations and projections much easier. Combine Tiny Plan with your good judgment, and you are well on the way to preparing sound financial plans.

Keep in mind, however, that Tiny Plan is only a tool. Tiny Plan does not make recommendations. It is not, nor is any other program, an electronic crystal ball.

Tiny Plan will work on most home computers. Your computer should have a minimum amount of RAM memory—8K will do just fine. Tiny Plan will work without a disk or printer.

Tiny Plan was developed on a Commodore VIC-20. Since the VIC allows only 22 characters per line, you will notice that Tiny Plan’s messages and instructions tend to be brief.

Tiny Plan can be adapted to your computer quite easily. VIC’s color and sound capabilities were not used at all, to make the program more general. In fact, only one program line needed to be changed when Tiny Plan was tried on an expanded Rockwell AIM 65. That was line 50010, where the clear screen control character is defined.

Tiny Plan Models

The concept behind Tiny Plan is that of building a model. A model is a representation of reality. The representation may be a physical replica (like a model airplane) or a mathematical abstraction. Tiny Plan uses the language of mathematics.

In practice, the mathematics used by Tiny Plan are very simple. There are the familiar operations of addition, subtraction, multiplication, division, and a variety of percentage calculations. The power of Tiny Plan comes from its ability to perform these calculations on lots of numbers quickly and accurately.

Projection

We will use an example to illustrate Tiny Plan that will project the value of different financial assets for the next three years.

The first step is to develop a model. You don’t need an algebra book or your neighborhood economist—neither will do much good. At this point all you need is a pencil and paper. We’ve mentioned that Tiny Plan can work on lots of numbers. However, we don’t start with a jumbled list of numbers. Using a little thought and pencil and paper, we can start by developing a scheme for organizing the numbers. Let’s agree to arrange the information in the form of a chart.

Suppose we have three savings plans—a CD, an All Savers certificate, and a passbook account. We know the amount of money in each account and the annual yield of each account. We want to project each account for three years. Our chart might look something like this:

<table>
<thead>
<tr>
<th>Principal</th>
<th>Yield 1983</th>
<th>Yield 1984</th>
<th>Yield 1985</th>
</tr>
</thead>
<tbody>
<tr>
<td>CD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Savers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Passbook</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The chart has three horizontal rows to represent the three savings plans. Five vertical columns represent various characteristics—some we already
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know; some we wish to calculate.

We have just developed a model. The chart represents our understanding of what will happen to these accounts over the next few years. For the purposes of our example, let's assume that there will be no deposits or withdrawals and that the yield will stay the same for the next three years.

Not surprisingly, the first step in using Tiny Plan is specifying the model, which is then described to Tiny Plan in the form of a chart. We tell Tiny Plan how many rows and columns there are, and then we give the name of each row and column. (The more RAM memory you have in your computer, the bigger the model that Tiny Plan is able to manipulate.)

If we were carrying out the analysis by hand, we would next write down the principal and yield information.

<table>
<thead>
<tr>
<th>Principal</th>
<th>Yield</th>
<th>1983</th>
<th>1984</th>
<th>1985</th>
</tr>
</thead>
<tbody>
<tr>
<td>CD</td>
<td>10,000</td>
<td>16%</td>
<td>11,600</td>
<td>13,456</td>
</tr>
<tr>
<td>All Savers</td>
<td>8,000</td>
<td>12%</td>
<td>9,696</td>
<td>10,635</td>
</tr>
<tr>
<td>Passbook</td>
<td>2,000</td>
<td>6%</td>
<td>2,120</td>
<td>2,247</td>
</tr>
</tbody>
</table>

Then we perform the following calculations for each of the savings plans for each of the three years:

1. Compute the interest by applying the yield to the principal.
2. Compute the total dollars by adding the interest to the principal.

After a little work, our chart looks like this:

<table>
<thead>
<tr>
<th>Principal</th>
<th>Yield</th>
<th>1983</th>
<th>1984</th>
<th>1985</th>
</tr>
</thead>
<tbody>
<tr>
<td>CD</td>
<td>10,000</td>
<td>16%</td>
<td>11,600</td>
<td>13,456</td>
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<tr>
<td>All Savers</td>
<td>8,000</td>
<td>12%</td>
<td>9,696</td>
<td>10,635</td>
</tr>
<tr>
<td>Passbook</td>
<td>2,000</td>
<td>6%</td>
<td>2,120</td>
<td>2,247</td>
</tr>
</tbody>
</table>

The figures have been rounded to the nearest dollar.

Suppose we want to see what happens if we change our investment mix. Out comes the pencil and paper again. We repeat the calculations on a different set of numbers.

In this example, we had to perform the calculations step by step for each of the three savings plans. What if we had enough money for ten savings plans? The calculations would be quite tedious indeed. Needless to say, we would probably not want to repeat the exercise, so we would be giving up our chance to evaluate different situations.

**Rapid Analysis**

Tiny Plan allows us to perform analyses very rapidly. Once the initial data is entered, Tiny Plan calculates whole rows or columns of numbers at once. Using our example, we could tell Tiny Plan to multiply the yield times the principal. Tiny Plan would work out this calculation for each savings plan, whether we had three, ten, or thirty. If we wanted to see the effects of different yields, we could go back and change only the yield data. Then we could repeat the calculations. All of this can be done in a very short time. You can see how it would be useful for household planning.

A good tool must help its user solve the intended problem. Also, the tool must be easy to use. Tiny Plan satisfies both of these requirements.

Tiny Plan has four simple steps to follow:

1. Specify the model.
2. Enter the data for the model.
3. Perform the calculations.
4. Examine the results.

You may repeat steps 2, 3, and 4 as many times as you like for a given model. By doing this, you can evaluate the impact of changing conditions.

For each step, Tiny Plan will ask you for the information it needs. Most of Tiny Plan's messages are self-explanatory. Don't worry about making mistakes. Tiny Plan will let you know if it can't figure out what you're trying to tell it.

**Step 1: Specify The Model**

Before you even try to use Tiny Plan, sketch a picture of your model on a piece of paper. Recall how we worked our example. Give each row and column a name. Since you will use these row and column names in other steps, try to choose names that relate to the problem you're working on. Also, jot down the numbers that you wish to enter initially. Finally, have a pretty good idea of the calculations that need to be done.

Specifying a model consists of entering the number of rows and columns and then the names of the rows and columns. Bear in mind that Tiny Plan keeps the model in your computer's RAM memory. After you enter the size of your model, Tiny Plan will check to see if there is enough memory to hold your model. If not, you may want to point out the benefits of more memory to your home budget director.

People like myself often confuse simple concepts such as rows and columns. Tiny Plan will show you what your chart looks like. Tiny Plan displays a rectangle consisting of rows and columns of X's. So, if you've mistaken rows for columns and vice versa, the rectangle will look different from your chart. Tiny Plan gives you a chance to verify the size and shape of the model.

If everything is OK, you can put in the names for each row and column. Tiny Plan asks for the names one by one. You can enter a name that is from one to ten characters long. If a name is longer than ten characters, only the first ten will be kept. Do not use the same name twice; this would confuse you and your computer.

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row and column names. To do this, hit RETURN whenever Tiny Plan asks for a name. (This might not work on all computers. Try it on yours.) Tiny Plan names the rows R1, R2, R3, and so on. Similarly, it names the columns C1, C2, C3, etc. Notice that there is no space between the letter and number.

**Step 2: Enter The Data For The Model**

After you have specified the model, Tiny Plan sets all the rows and columns to zero. The data entry step is the way for you to put data in the model. You can also use the data entry step to change the data that may already be in the model.

You may enter data by rows or by columns or by a combination of the two. You do not need to enter all of the rows or columns, just the ones you want. Suppose we want to enter the column PRINCIPAL in our example. First, we would tell Tiny Plan the name of the column we want. Then Tiny Plan would ask us for the values of CD, ALL SAVERS, and PASSBOOK. On the other hand, suppose we wanted to enter the row PASSBOOK. Tiny Plan would ask for the values for PRINCIPAL, YIELD, 1983, 1984, and 1985. Since we are calculating 1983, 1984, and 1985, we could enter zero or just hit RETURN. The choice of row or column entry depends on your particular model. In our example, entering the columns turns out to be a little easier.

When Tiny Plan asks for a new value, it shows you the current value of the item in the model. To retain that value, just hit RETURN. (On some computers, though, you may have to retype the same number again even if you don’t want to change it.) If you want to change the value, type in the new number.

**Step 3: Perform The Calculations**

Once you’ve entered your data, you’ll probably want to do some calculations. Tiny Plan will perform calculations on entire rows or columns of numbers. Every number in the row or column will be included. The only time that Tiny Plan skips a calculation is when a division by zero is attempted.

Depending on your model, you will choose to do row or column calculations. Your model may even involve doing some row calculations and then some column calculations. The only restriction is that you cannot perform an operation involving a row and column. For example, you cannot add a row to a column. You can, of course, add one row to another row or multiply one column by another column.

Each time you do a calculation, Tiny Plan will ask you for four items of information:

1. A row or column name,
2. The type of calculation (such as addition),
3. A second row or column name, and
4. A third row or column name indicating where the answer will be kept.

The first and second row or column names indicate to Tiny Plan which numbers will be used in the calculation.

**Trying Out The Example**

An example will make this clearer. Our savings plan analysis uses column calculations. When Tiny Plan asks for names, we respond with column names. To compute 1983’s results, we would respond to the four prompts with:

1. PRINCIPAL as the first column name,
2. % + as the type of calculation,
3. YIELD as the second column name, and
4. 1983 as the column which will hold the results.

This means that we want to increase all the numbers in the PRINCIPAL column by the percentages contained in the YIELD column. We want the results saved in the 1983 column. Tiny Plan does the calculation for each and every number in the indicated columns. In our example, there were just three numbers in each column. There could just as easily have been 30 numbers. Notice that “% +” is one of Tiny Plan’s special percentage calculations.

Now, to obtain 1984’s results we would use:

1. 1983
2. % +
3. YIELD
4. 1984

The same yield figures are used again. This time, however, 1983’s calculated results are used as the base. As an exercise, how would you obtain 1985’s results?

As we mentioned, “% +” is one of Tiny Plan’s percentage calculations. Tiny Plan can perform a variety of calculations:

- + add the first row/column to the second row/column
- - subtract the second row/column from the first row/column
- * multiply the first row/column by the second row/column
- / divide the first row/column by the second row/column
- % compute the given percentage (second row/column) of the first row/column
- % + increase the first row/column by the percentage specified in the second row/column
- % - decrease the first row/column by the percentage specified in the second row/column
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%D compute the percent difference between the first row/column and the second row/column, using the first row/column as the base.

With the exception of the "+" and "=" operations, the order of the rows and columns is very important. For example, if we tried to do:

1. YIELD
2. % +
3. PRINCIPAL
4. 1984

we would get strange and unpleasant results. This is because Tiny Plan assumed that the second column name entered (i.e., PRINCIPAL) will contain the percentage figures. In the case of the CD, Tiny Plan thinks that the intent was to increase 16 by 10,000 percent. The moral here is to be careful. When Tiny Plan asks for row or column names, be sure that you enter them in the proper order for the particular calculation that you are doing.

Important Note: when you use the percentage operations, make sure that your numbers are entered as percentages. In other words, enter 12.5% as 12.5, not as .125. When Tiny Plan computes a result that is a percentage (%D), it will do the same thing.

You may perform as many calculations as you like. Each calculation will require four items of information.

**Step 4: Examine The Results**

This is probably the most important step. Only after examining and analyzing the results can you start to carry out your plan.

As in the previous steps, Tiny Plan now gives you the choice of looking at rows or columns. You may examine one row or column at a time. Tell Tiny Plan the name of the particular row or column that you want to examine. It will respond by showing you all the numbers in that row or column. Furthermore, Tiny Plan will compute and display the row or column sum automatically.

If we wanted to examine the column for 1985, Tiny Plan would prepare the following display:

<table>
<thead>
<tr>
<th>CD</th>
<th>ALL SAVERS</th>
<th>PASSBOOK</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>15,609</td>
<td>11,239</td>
<td>2,282</td>
<td>29,230</td>
</tr>
</tbody>
</table>

We get the column total without ever having to direct Tiny Plan to compute it. Be careful. Sometimes a column total is not really meaningful. If we displayed the YIELD column, we would see the three yield figures and a total figure. In this case, the total has no meaning – it is just the sum of numbers.

Rows are displayed in a similar manner. The numbers in the row are listed vertically. The appropriate column names are shown to the left of the numbers. A row total is also provided. The same caution concerning the total should be observed here.

Assume that your budget director has seen the benefits of additional memory. Now you are working on very large models. Let's say you have a model with 40 columns and 40 rows. What would happen if you wanted to examine a particular column? Can your computer display 40 lines of data? Ours can't.

Regardless of how many numbers are in a particular row or column, Tiny Plan will display at most ten numbers at a time. Tiny Plan will then pause. When you press the space bar, the next group of numbers will be displayed. This process continues until the entire row or column has been displayed. Note that the row or column total is always visible at the bottom of the screen. Just keep in mind that the total is the sum of the entire row or column and not the sum of the group of numbers that happens to be on the screen.

When you have finished examining the results, Tiny Plan will ask you if you want to model again. If you do, Tiny Plan will resume at the data entry step. Step 2. You can take the opportunity to change some or all of the numbers and then proceed with additional calculations. Finally, you can review the results again.

**Tiny Plan On Your Computer**

Although Tiny Plan was developed on a VIC-20, every effort was made to use standard BASIC commands. If your computer uses a version of Microsoft BASIC, you should have no trouble getting Tiny Plan to work. Other versions of BASIC may require some conversion.

There are very few comments in the program listing itself. Also, spaces have been omitted wherever possible. While the program may be hard to read, this does conserve memory space. The result is that Tiny Plan can handle bigger models.

There are a few areas in Tiny Plan that would need adjusting depending on the computer brand being used. Make the changes appropriate to your particular computer. Then save two copies (just in case) of the customized version of Tiny Plan.

1. **Clear screen code**

   Line 2420 defines a variable CS$. CS$ is given a value of 147. This is the VIC control code for homing the cursor and clearing the screen. You should use the proper code for your computer. (The code is 12 for an AIM 65 equipped with an MTU Visible Memory.) Use HOME on the Apple in place of PRINTCS$.
Exterminator

by Ken Grant

First the bad news...this game is literally full of bugs. The good news? We guarantee hours of exciting entertainment trying to remove them. Some bugs you are likely to come up against are spiders, snails, fleas and centipedes in this rapidfire, 100% machine language, exceptional quality game. Exterminator runs in standard 5K VIC. **$24.95**

Antimatter Splatter!  A more dastardly alien could scarcely be found than one who would wipe out an entire civilization by dropping antimatter anti-canisters, right? If your opinion of this alien troublemaker is the same as ours, probably your first thought was, get some matter! We say calm down! All is not lost. A mobile rapid splatter cannon capable of both breaking through his standard alien moving force fields and laying waste to the ever-increasing number of anti-canisters is even now hovering above us. If only our cannonner hadn’t called in sick...say, what are you doing today? Anti-Matter Splatter is 100% machine language and runs in standard 5K VIC. **$24.95**

3-D Man  The exact maze from probably the most popular arcade game ever with perspective altered from overhead to eye level. The dots...the monsters...the power dots...the side exits. New on-screen radar. This game is amazing. 3-D Man requires at least 3K memory expander but will run with any memory add-ons (8K, 16K, 24K, etc.) that we have come across. **$19.95**

Defender on TRI  As pilot of the experimental Defender-style ship “Skyes Limited,” you are the only hope for an advance party of scientists trapped in ancient alien sphere which suddenly (heat from collision course with sun presumably—G.E.) came to life. Four screens worth of unique defenses, on-off shields, fuel deposits, alien treasures, running timer, energy, score and very nice graphics display make this one that does not quickly wax old. Defender on TRI requires at least 3K memory expander, but will run with any memory add-on (8K, 16K, 24K, etc.) we have come across. **$19.95**

Rescue From Nufon  This graphic adventure has five floors with 20 rooms apiece. Use the elevator to change levels and the N, S, E, W keys to move your characters around as you search for 30 hostages randomly scattered (differently every run) throughout. As there are three different monsters occupying Nufon, you are armed with a blaster, but unfortunately it uses energy pretty fast, forcing you to do some fancy dodging in order to make the supply last. Average game is twenty minutes. Standard 5K VIC 20—Keyboard **$19.95**

Krazy Kong  The crazy gorilla has taken three fair maidens up to the top of the giant stairway. And you (the valiant hero) will attempt to rescue them at the risk of your own life. Your timing must be totally accurate as you jump the barrels that Kong is rolling down at you. **$12.95**

And there’s more...

Collide ................................. **$12.95**
Alien Panic ............................ **$12.95**
Vikman ................................. **$12.95**
Search ................................. **$12.95**

SPECIAL OFFER! With any order of Exterminator and Anti-Matter Splatter we’ll send you a FREE 17” X 22” poster like the one shown above. Also available separately for $3.50.
2. **Row and column display size**

The VIC can display 23 lines of information. When Tiny Plan displays a row or column, there is room to show ten numbers and several messages. Some computers can display a maximum of 16 lines. Line 2430 defines a variable NL. Set NL to however many numbers from a row or column you want to display at one time. Don't forget to leave room on the display for the message lines as well.

3. **Memory size check**

Most computers have some way of letting you know when there is not enough memory to run a program or store additional data. The typical computer responds by stopping the program and returning to the command mode.

Right after you enter the number of rows and columns in your model, Tiny Plan does its own check to see if there is enough memory. Lines 290, 300, and 2530 are used in this check. Line 290 estimates memory requirements based on:

- a. 5 bytes for each numeric array element
- b. 13 bytes for each row and column name (3 bytes for the string length and pointer plus 10 bytes for the name itself).

Consult your computer's technical manuals for the way to estimate memory requirements. Alternatively, you may leave out these three lines entirely.

4. **INPUT statement**

On the VIC, you can hit RETURN by itself in response to an INPUT statement. If you do this, the contents of the variables in the INPUT statement will remain unchanged. The VIC acts in this case as if the INPUT statement had never been executed. Tiny Plan makes use of this VIC feature when it asks you to enter data values.

Some computers, however, respond a little differently. The TRS-80, for example, will set the variables in the INPUT statement to zero (or to a null string) if only the RETURN key is hit. If your computer works this way, make these two changes to Tiny Plan:

```
14070 RS$ = "": INPUT RS$: IF RS$<>"" THEN DA(R,I) = VAL(R$)
18070 RS$ = "": INPUT RS$: IF RS$<>"" THEN DA(L,C) = VAL(R$)
```

There is a slight price to be paid. The VAL function does not let you know if it encounters non-numeric data. So, if you typed U123 instead of 123, VAL would convert the input to zero. This is not what you intended, but there would be no error message. These two modifications should work well for most applications. Just be advised that extra attention is required when typing in numbers.

There is yet another variation in computer behavior. The AIM 65 and Commodore PET/CBM simply stop if just a RETURN is keyed after an INPUT statement. The program can be resumed by typing CONT. For this type of computer, you have to use slightly different operating procedures. Never hit RETURN without first entering something.

5. **Decimal Places**

Tiny Plan normally rounds all calculated results to two decimal places. This is quite appropriate if you work most often in units of dollars and cents. A variable DP (for decimal places) is defined in line 2490. You may set DP to zero if you want all calculated results to be integers (no decimal fractions shown). Also, DP may be set to round calculated results to a different number of decimal places.

Experiment with Tiny Plan. Start by setting up very simple models. Expand on the simple models. Compare your projections with reality. Try to account for any differences. Then go back and add additional terms to your models. And let us know of your results. What modifications did you make to Tiny Plan to get it to work on your computer? What models have you developed? What have the results been?

---

**Program 1: Microsoft Version: VIC, PET, Apple, OSI, Color Computer (Extended BASIC)**

```
100 REM TINY PLAN
110 GOSUB160
120 GOSUB510
130 IF RS$="Y" THEN 120
140 PRINT CS$; PRINT "THANK YOU. ": PRINT
150 END
160 REM BEGIN
170 GOSUB2418
180 GOSUB240
190 IF RS$="N" THEN 180
200 DIM DA(NR, NC)
210 DIM CS$ (NC), RN$( NR)
220 GOSUB350
230 RETURN
240 REM CONFIGURE
250 PRINT CS$; PRINT "HOW MANY ROWS AND"
260 PRINT "COLUMNS IN THE MODEL ?": PRINT
270 INPUT NR$: PRINT "** ROWS (ACROSS) **" ": INPUT RN$:
280 NC$= '"" PRINT "** COLS (UP & DOWN) **" ": INPUT NC$:
290 IF NR$ = 0 THEN PRINT " NOT ENOUGH MEMORY " : GOTO 270
300 IF NC$ = 0 THEN PRINT " NOT ENOUGH MEMORY " : GOTO 270
310 PRINT FOR I = 1 TO NR$: FOR J = 1 TO NC$: PRINT "X ": NEXT I
320 PRINT " SHAPE OK (Y OR N) ? "
```
NOW. The only real limitation for your VIC 20 is imagination.

The ARFON MICRO VIC 20 EXPANSION CHASSIS allows you to fully expand the VIC 20 memory, plug in interfaces, other computer peripherals, cartridges for expanded Basic language functions, programming utilities and even ROM cartridges of your own design to turn the VIC 20 into a sophisticated computer control system. In fact, with your VIC installed in the ARFON MICRO VIC 20 EXPANSION CHASSIS the only real limitation to the uses you can find for the VIC 20 is imagination.

VIC 20 SOFTWARE FROM ARFON MICRO, U.S.

TOTL TIME MANAGER is a set of two programs which allow you to create personal or business schedules, calendars of events, and checklists of activities. Organize reports by: person, project, or activity. Sort reports by: beginning or ending dates, or activity number. Print 56 different bar chart formulas. $25.

RESEARCH ASSISTANT 2.0 is a set of programs which allow you to keep track of reference data and create keyword cross reference lists. Keep data on reference sources: author, title, bibliography. Keep reference notes: pages, text, up to 12 keyword cross reference, print data and or cross reference lists. $25.

TOTL LABEL 2.0 is a very useful mailing list and label program. TOTL LABEL 2.0 features easy editing, add or delete labels, define your own labels (width, length, number of printed lines), sort alphabetically or numerically and more. $20.

TOTL TEXT 2.0 is a complete word processing program which allows you to create and format professional looking documents. There is no limit to the length of a document. TOTL TEXT features: page numbering, paragraph control, right and left margin control, VIC printer expanded characters, skip to top of page, single, double, or triple spacing, centered title lines, tab position control, character and line spacing, upper and/or lower case, use of graphic characters, full screen editing, full cursor control while editing, scroll up and down through text, add, change and delete characters, insert and delete blocks of text. $25.

TOTL TEXT 2.5 has all the features of TOTL TEXT 2.0, plus up to 4 heading lines per page, footing line every page, footnotes, keyboard input for form letters (up to 6 80-column lines), special characters for printer, right justify, and 3K additional working memory for editing. $35.

ALL TOTL 2.0 series programs work with tape and/or disk and require VIC 20, 8K expansion, cassette deck and or disk drive, VIC printer or RS-232 printer.

BALDOR'S CASTLE is a fast-moving real time adventure—can you fight off 11 different types of monsters with just your bare hands, or will you need bow and arrow, magic sword, potions, and more to steal Baldor's gold? Game cartridge by Martin Kennedy. (More fun with joystick.)

ARFON VIC EXPANSION CHASSIS comes complete with aluminum cover monitor shelf.

Vic 20 & COMMODORE are registered trademarks of Commodore Business Machines.

Ask your VIC Dealer, or Contact
ARFON MICROELECTRONICS, U.S.
111 Rena Drive, Lafayette, La. 70503
(318) 988-2478
A Sample RUN

Here is a sample RUN of the Modeling Planner using Mr. Flynn's example. Try it on your computer, and you will get a feel for how to use the Modeling Planner. Most helpful is the "worksheet" that you develop before you run the program. You'll need to refer to it often. Here is Mr. Flynn's worksheet:

Principal Yield 1983 1984 1985

<table>
<thead>
<tr>
<th></th>
<th>CD</th>
<th>All Savers</th>
<th>Passbook</th>
</tr>
</thead>
<tbody>
<tr>
<td>CD</td>
<td>10,000</td>
<td>8,000</td>
<td>2,000</td>
</tr>
<tr>
<td>All Savers</td>
<td>16%</td>
<td>12%</td>
<td>6%</td>
</tr>
<tr>
<td>Passbook</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

First, we'll set up this worksheet on the computer. User input is shown in boldface. Comments are enclosed in brackets.

RUN

TINY PLAN
VERSION 1.0 JULY 1982
ELECTRONIC
SPREADSHEET

HOW MANY ROWS AND
COLUMNS IN THE MODEL?

#ROWS (ACROSS)? 3
[Three rows: CD, All Savers, and Passbook]
= # COLS (UP & DOWN)? 5

XXXXX
XXXXX
XXXXX

SHAPE OK (Y OR N)? Y
[This resembles the worksheet]

WHAT IS THE NAME OF
EACH ROW AND COLUMN?
NAMES CAN BE UP TO
10 CHARACTERS LONG
[We'll probably have to abbreviate]

ROWS (ACROSS) FIRST.

1 OF 3? CD
2 OF 3? ALL SAVERS
3 OF 3? PASSBOOK

COLUMNS (UP AND DOWN).

1 OF 5? PRINCIPAL
2 OF 5? YIELD
3 OF 5? 1983
4 OF 5? 1984
5 OF 5? 1985

* DATA ENTRY STEP *
[This is the second step, where we can enter as much data as we please, in either rows or columns. We'll enter the principal and the yield, which are columns. Using Mr. Flynn's table, it would look like:]

Principal Yield 1983 1984 1985

<table>
<thead>
<tr>
<th></th>
<th>CD</th>
<th>All Savers</th>
<th>Passbook</th>
</tr>
</thead>
<tbody>
<tr>
<td>CD</td>
<td>10,000</td>
<td>8,000</td>
<td>2,000</td>
</tr>
<tr>
<td>All Savers</td>
<td>16%</td>
<td>12%</td>
<td>6%</td>
</tr>
<tr>
<td>Passbook</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Now we'll enter the first two columns into the computer.

ENTER DATA (Y/N)? Y

ENTER ROWS (Y/N)? N
[We entered "N" because we'll enter data by columns:]

ENTER COLS: (Y/N)? Y

COL NAME OR 'END'?
PRINCIPAL
[First, we'll enter the principal]

ENTER 3 VALUES -
1 FOR EACH ROW

** COL PRINCIPAL **

[Note that the column names are abbreviated to five characters here:]

ROW VALUE
PRINC 0 ? 10000
ALLS 0 ? 8000
PASSB 0 ? 2000

COL NAME OR 'END'?
YIELD

ENTER 3 VALUES -
1 FOR EACH ROW

*** COL YIELD ***

[Note the "0". It is the previous value of the row element.]

ROW VALUE
PRINC 0 ? 16
ALLS 0 ? 12
PASSB 0 ? 6

COL NAME OR 'END'?
END
[Because we're through entering data]

* CALCULATE STEP *

CALCULATE (Y/N)? Y

WORK ON ROWS (Y/N)? N
[We'll be calculating columns (1983-1985) from the first two columns. We won't be working on rows.]

WORK ON COLS. (Y/N)? Y
[Each calculation will be a percentage calculation on a column against the yield.]

1ST COL NAME OR 'END'?
PRINCIPAL

+,-,*,/,%,+,,-%,%,D
?

2ND COL NAME OR 'END'?
YIELD

ANS COL NAME OR 'END'?
1983
[The answer will be put in column 1983]

WORKING...

[Now let's calculate 1984 from 1983]

IST COL NAME OR 'END'?
1983

+,-,*,/,%,+,,-%,%,D
?

2ND COL NAME OR 'END'?
YIELD

(continued)
MAstertypEm™ and Atari™ make typing a blast.

Now anyone can learn to type and have hours of fun at the same time. With MasterType. We’ve combined the fast-action of blow ’em up video games with the best instructional program available. You either learn to type or the aliens ZAP your spaceship into oblivion. The results? Highly motivated and enjoyable learning.

MasterType earns a ten-gun salute.

MasterType is fast becoming the best selling educational software product designed for use with the Atari 800 home computer.

It’s no wonder, when you consider what InfoWorld magazine had to say:

“MasterType is an excellent instructional typing game. We had fun reviewing it, and we highly recommend it to those who want to learn typing in an unconventional but motivating way.”

InfoWorld also went on to rate MasterType as “excellent” in all four of its categories.

MasterType teaches your fingers to fly.

Face it. If you’re like most people, the most inefficient components on your computer are probably your fingers. But you can change all that with MasterType. In just a few easy lessons your fingers will be doing things you thought them incapable of.

MasterType. With 18 explosive learning levels. You’ll either learn to type or get blown to pieces.

$39.95. Requires disk drive 32k and basic.
(continued from page 72)

ANS COL NAME OR 'END'
\> 1984

WORKING...
[We now have values for 1983 and 1984. Try to continue here and calculate 1985. We'll just stop calculating and look at some data now.]

1ST COL NAME OR 'END'
\> END

* DATA DISPLAY STEP *
DISPLAY DATA (Y/N)? Y
DISPLAY ROWS (Y/N)? Y
ROW NAME OR 'END'
\> ALL SAVERS

COLUMN ALL SAVERS
0 PRINCIPAL 8000
1 YIELD 12
2 1983 8960
3 1984 10035.2
4 1985 0

ROW TOTAL 27007.2

SPACE TO CONTINUE

ROW NAME OR 'END'
\> END

DISPLAY COLS (Y/N)? Y
[Let's display 1984]

COL NAME OR 'END'
\> 1984

ROW 1984
0
CD 13456
ALL SAVERS 10035.2
PASSBOOK 2247.2

COL TOTAL 25738.4

SPACE TO CONTINUE

COL NAME OR 'END'
\> END

[We're finished displaying data]

MODEL AGAIN (Y/N)? N
[At this point, you could enter 'Y'. You could enter or edit the data, re-do the calculations, and display. This is the "what-if" power of a microcomputer. You can just change a few values and re-calculate dozens of others.]

THANK YOU.

READY.

330 GOSUB2260
340 RETURN
350 REM SYMBOL TABLE
360 PRINTCSS;"WHAT IS THE NAME OF":PRINT:PRINT"EACH ROW AND COLUMN?"
370 PRINT:PRINT"NAMES CAN BE UP TO":PRINT:PRINT"16 CHARACTERS LONG."
380 PRINT:PRINT:PRINT"ROWS (ACROSS) FIRST.":PRINT:PRINT"COLUMNS (UP AND DOWN).":PRINT
390 FORI=1TONC
400 RS="":PRINT;"OF":;NR;
410 RNS(I)=LEFTS("R"+MIDS(STR$(I),2)+BL$,10)
At last! The ultimate baseball game for your Atari 400/800

- Scrolling outfield
- Individual player control
- Fully detailed animation
- Complete range of pitches

Tape $34.95
Disk $39.95 (U.S. Funds)

- Hysterical crowd scenes
- Two player game
- Joystick control
- Requires minimum 16K

INHOME SOFTWARE INCORPORATED,
2485 Dunwin Drive, Unit 1, Mississauga, Ontario L5L 1T1 (416) 828-0775 (416) 828-0778
1150 PRINTCSS;"* CALCULATE STEP *":PRINT  
1160 PRINT"CALCULATE (Y/N)?";  
1170 GOSUB2260  
1180 IFRS="N"THEN1310  
1190 REM  
1200 PRINTCSS;"WORK ON ROWS (Y/N)?";  
1210 GOSUB2260  
1220 IFRS="N"THEN1250  
1230 PRINTCSS;PRINT"1ST ";:GOSUB860:IFETHEN1250  
1240 GOSUB1320:GOTO1230  
1250 REM  
1260 PRINTCSS;"WORK ON COLS. (Y/N)?";  
1270 GOSUB2260  
1280 IFRS="N"THEN1310  
1290 PRINTCSS$:PRINT"1ST ";:GOSUB1050:IFETHEN1310  
1300 GOSUB1490:GOTO1290  
1310 RETURN  
1320 REM WORKONROWS  
1330 R1=R  
1340 GOSUB2180  
1350 PRINT:PRINT"2ND ";:GOSUB860:IFETHEN1350  
1360 R2=R  
1370 PRINT:PRINT"ANS ";:GOSUB860:IFETHEN1370  
1380 R3=R  
1390 GOSUB1580:GOTO1310  
1400 RETURN  
1410 REM WORKONCOLS  
1420 C1=C  
1430 FORI=1TONP:READOPS(D:NEXT  
1440 DATA+,-,*,/,%,%+,%-%,%,D  
1450 DP=2:D1=10:DP=D1+1  
1460 PRINTCSS;"TINYPLAN":PRINT:PRINT"VERSION1.0JULY1982"  
1470 FORI=1TO8000:NEXT  
1480 SZ=FRE(0)-150  
1490 RETURN  
1500 RETURN  
1510 RETURN  
1520 RETURN  
1530 RETURN  
1540 RETURN  
1550 RETURN  
1560 RETURN  
1570 RETURN  
1580 RETURN  
1590 RETURN  
1600 FORI=1TONP:READOPS(D:NEXT  
1610 R3=1:R2=1:R1=I  
1620 GOSUB2300  
1630 NEXT  
1640 PRINTCSS;"COMPLETED"  
1650 RETURN  
1660 REM DISPLAY  
1670 PRINTCSS;"** DATA DISPLAY STEP **":PRINT  
1680 PRINT"DISPLAY DATA (Y/N)?";  
1690 GOSUB2260  
1700 IFRS="N"THEN1890  
1710 PRINTCSS:PRINT"DISPLAY ROWS (Y/N)?";  
1720 GOSUB3200  
1730 REM ROW PANEL  
1740 FORI=1TONR  
1750 PRINTCSS:PRINT"COLUMN ";:RNS$(R):PRINT  
1760 FORJ=1TOC:PRINTClJ):PRINT  
1770 NEXT  
1780 IFC<NLTHENPRINT  
1790 IFCN0THENPRINT"KEY 'Y' OR 'N'":GOTO2270  
1800 PRINT"ROWTOTAL":RT  
1810 IFKNTHENPRINT:PRINT"MORE..."  
1820 PRINT:PRINT"SPACETO CONTINUE"  
1830 GETR$:IFR$<>""THEN2010  
1840 NEXT  
1850 RETURN  
1860 REM COL PANEL  
1870 FORI=1TONR  
1880 PRINTCSS:PRINT"ROW ";:CN$(C):PRINT  
1890 FORJ=1TOC:PRINTClJ):PRINT  
1900 NEXT  
1910 IFKNTHENPRINT:PRINT"MORE..."  
1920 PRINT:PRINT"SPACETOCONTINUE"  
1930 GETR$:IFR$<>""THEN2150  
1940 NEXT  
1950 RETURN  
1960 REM GETOPERATOR  
1970 PRINT^PS  
1980 FORI=1TONP:PRINTOP$(I);",";:NEXT:PRINT  
1990 INPUTOPS  
2000 FORI=1TONP:IFOP$(I)=OP$THENI=1E6  
2010 NEXT  
2020 IFI=NP+1THENPRINT"TRY AGAIN":GOTO2010  
2030 RETURN  
2040 REM GETFN  
2050 GETR$:IFR$=""THEN2270  
2060 IFR$O"Y"ANDR$O"N"THENPRINT:PRINT"KEY 'Y' OR 'N'":GOTO2270  
2070 IFOP$="+%"THENDA(R3,C3)=DA(R1,C1)+DA(R2,C2)  
2080 IFOP$=%"THENDA(R3,C3)=DA(R1,C1)+DA(R2,C2)/100  
2090 IFOP$="+-"THENDA(R3,C3)=DA(R1,C1)-DA(R2,C2)  
2100 IFOP$=%"THENDA(R3,C3)=DA(R1,C1)-DA(R2,C2)/100  
2110 IFOP$="+%D"ANDDA(R1,C1)O0THENDA(R3,C3)=DA(R1,C1)/DA(R1,C1)*100  
2120 DA(R3,C3)=INT(DA(R3,C3)*D2+5)/100+1  
2130 RETURN  
2140 REM INITIALIZE  
2150 REM CLEAR SCREEN  
2160 NL=10  
2170 NR=0:NC=0  
2180 BL$="  
2190 NP=8:DIM OP$(NP)  
2200 FORI=1TONP:READOPS(I):NEXT  
2210 DATA+,%,+-,\%,%+,%,D  
2220 DP=2:D1=10:DP=D1+1  
2230 PRINTCSS;"TINY PLAN":PRINT"VERSION 1.0 JULY 1982"  
2240 PRINTCSS;"SMALLPLAN":PRINT"PRINT"  
2250 PRINTCSS;"PRINT"  
2260 FORI=1TO8000:NEXT  
2270 SZ=PRE(0)-150  
2280 RETURN
You are Sentinel I, the latest in highly maneuverable strike aircraft, and you have a mission, to protect the metropolis, but the alien attack will stop at nothing to destroy your very last lines of defense. Your senses are tuned for battle and the attack begins.

Aliens will block your path, destroy your ship, deplete your fuel and sacrifice their lives to stop your mission. You must destroy the aliens with your rapid fire lasers before they home in and destroy you. There is no escape — you must destroy them all for they will stop at nothing.

- 100% machine language
- 1 or 2 player option
- joy stick controls
- lateral scrolling screen
- superb graphics
- extensive color
- finest sound utilization
- available in 16K tape $29.95 U.S. funds
- 24K disc $34.95 U.S. funds
- call your local dealer for more information
Program 2: Atari Version

100 REM TINY PLAN
110 GOSUB 160
120 GOSUB 510
130 IF RS$="Y" THEN 120
140 PRINT CS$;"THANK YOU.";PR
150 END
160 REM BEGIN
170 GOSUB 2410
180 GOSUB 240
190 IF RS$="N" THEN 130
200 DIM DA(NR,NC), RN*(NR*10), N*(10)
210 DIM CN*(NC*10), RN*(NR*10), N*(10)
220 GOSUB 350
230 RETURN
240 REM CONFIGURE
250 PRINT CS$;"HOW MANY ROWS AND COLUMNS IN THE MODEL?": PRINT:
260 NR=0: PRINT "#ROWS(ACROSS) ": INPUT NR: IF NR<=0 THEN PRINT "WHAT?": GO TO 270
270 NC=0: PRINT "#COLS(UP&DOWN) ": INPUT NC: IF NC<=0 THEN PRINT "WHAT?": GO TO 280
280 MS=(NC+1) *(NR+1)*6+(NC+1)*10+(NR+1)*10
290 IF MS>SIZ THEN PRINT "NOT ENOUGH MEMORY": PRINT; GOTO 270
300 PRINT; FOR I=1 TO NR: FOR J=1 TO NC: PRINT "X": NEXT J: PRINT: NEXT I
310 PRINT; PRINT "SHAPE OK(Y/N)?": PRINT: GOSUB 2260
320 RETURN
330 GOSUB 2260
340 RETURN
350 REM SYMBOL TABLE
360 PRINT CS$;"WHAT IS THE NAME OF": PRINT; PRINT "EACH ROW AND COLUMN?": PRINT:
370 PRINT; PRINT "10 CHARACTERS LONG ".
380 PRINT; PRINT; PRINT; PRINT "ROWS (ACROSS) FIRST.": PRINT
390 FOR I=1 TO NR
400 PRINT I; OF ";NR;
410 T$="R": T$(2)=STR$(I); T$(LEN(T$)+1)=BL$;
420 INPUT R$: IF R$="" THEN T$=R$: IF LEN(T$)<10 THEN T$(LEN(T$)+1)=BL$
425 RN$(I10I-9,10I)=T$
430 NEXT I
440 PRINT CS$;"COLUMNS (UP AND DOWN) ": PRINT
450 FOR I=1 TO NC
460 PRINT I; OF ";NC;
470 T$="C": T$(2)=STR$(I); T$(LEN(T$)+1)=BL$
480 INPUT R$: IF R$="" THEN T$=R$: IF LEN(T$)<10 THEN T$(LEN(T$)+1)=BL$
485 CN$(10I-9,10I)=T$
490 NEXT I
500 RETURN
510 REM BUILD MODELS
520 GOSUB 580
530 GOSUB 1660
540 GOSUB 560
550 PRINT CS$;"MODEL AGAIN (Y/N)?";
560 GOSUB 2260
570 RETURN
580 REM ENTER DATA
590 PRINT CS$;"DATA ENTRY STEP 1": PRINT
600 PRINT "ENTER DATA (Y/N)?": PRINT
610 GOSUB 2260
620 IF RS$="N" THEN 750
630 REM
640 PRINT CS$;"ENTER ROWS (Y/N)?": PRINT
650 GOSUB 2260
660 IF RS$="N" THEN 690
670 PRINT CS$:GOSUB 860: IF E THEN 690
680 GOSUB 760: GOTO 670
690 REM
700 PRINT CS$:"ENTER COLS. (Y/N)?": PRINT
710 GOSUB 2260
720 IF RS$="N" THEN 750
730 PRINT CS$:GOSUB 1050: IF E THEN 750
740 GOSUB 950: GOTO 730
750 RETURN
760 REM ENTER ROW
770 PRINT CS$:"ENTER ";NC;" VALUES -": PRINT
780 PRINT "1 FOR EACH COLUMN."; PRINT
790 PRINT "* ROW "; RN$(NR+10,R+10); " ** PRINT
800 PRINT CS$; "COLUMNS(5 SPACES) VALUES ": PRINT
810 FOR I=1 TO NR
820 PRINT CN$(I*10-9,I*10); ": DA(R, I)
830 TRAP 840: INPUT TT: DA(R, I)=TT
840 GOSUB 40000: NEXT I
850 RETURN
860 REM GET ROW 
870 E=0: N$="": PRINT "ROW NAME OR 'END' ": PRINT
880 INPUT N$: IF N$="END" THEN E=1: RETURN
890 IF LEN(N$)<10 THEN N$(LEN(N$)+1)=BL$
900 FOR I=1 TO NR
910 IF RN$(I10I-9,10I)=N$ THEN R=I: I=1000000
920 NEXT I
930 IF I=NR+1 THEN PRINT ";": GOTO 870
940 RETURN
950 REM ENTER COL
960 PRINT CS$;"ENTER ";NC;" VALUES -": PRINT
970 PRINT "1 FOR EACH ROW": PRINT
980 PRINT; PRINT; PRINT "* COL "; CN$(I*10-9,C*10); " ** PRINT
990 PRINT CS$; "COLS(7 SPACES) VALUE ": PRINT
1000 FOR I=1 TO NR
1010 PRINT RN$(I10I-9,10I); ": DA(I, C)
1020 TRAP 1030: INPUT TT: DA(I, C)=TT
1030 TRAP 40000: NEXT I
1040 RETURN
1050 REM GET COL 
1060 E=0: N$="": PRINT "COL NAME OR 'END' ": PRINT
1070 INPUT N$: IF N$="END" THEN E=1: RETURN
1080 IF LEN(N$)<10 THEN N$(LEN(N$)+1)=BL$
1090 FOR I=1 TO NC
1100 IF CN$(I10I-9,I10)=N$ THEN C=I: I=1000000
1110 NEXT I
1120 IF I=NC+1 THEN PRINT ";": GOTO 1060
1130 RETURN
1140 REM CALCULATE
1150 PRINT CS$:"CALCULATE STEP ": PRINT
1160 PRINT "CALCULATE (Y/N)?";
For the Atari 400/800 Home Computer

As their only hope for survival, you must rescue allied space ships and aliens from the grasp of the deadly Gorn and his Guardians.

The Guardians of The Gorn are hideous spiders waiting to catch and feed you to the master of the web, the Gorn. But even worse, the Gorn will suddenly appear without warning to do his own dirty work.

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1170 SET SUB 2260
1180 IF R$="N" THEN 1310
1190 REM
1200 PRINT CS$;"WORK ON ROWS (Y/N)?";
1210 GOSUB 2260
1220 IF R$="N" THEN 1250
1230 PRINT CS$;"IST ";:GOSUB 86050:IF E THEN 1250
1240 GOSUB 1320:GOTO 1230
1250 REM
1260 PRINT CS$;"WORK ON COLS. (Y/N)?";
1270 GOSUB 2260
1280 IF R$="N" THEN 1310
1290 PRINT "1ST ":GOSUB 1320:GOTO 1230
1300 RETURN
1310 REM WORK ON ROWS
1320 FOR I=1 TO NC
1330 C3=I:C2=I:C1=I
1340 GOSUB 2300
1350 NEXT I
1360 PRINT:PRINT "COMPLETED"
1370 RETURN
1380 REM WORK ON COLS
1390 C1=C
1400 GOSUB 2160
1410 PRINT:PRINT "2ND ":GOSUB 860:IF E THEN 1400
1420 R2=R
1430 PRINT:PRINT "ANS ":GOSUB 1320:IF E THEN 1400
1440 FOR I=1 TO NR
1450 R3=I:R2=I:R1=I
1460 GOSUB 2300
1470 NEXT I
1480 PRINT:PRINT "COMPLETED"
1490 RETURN
1500 REM DO ROW
1510 GOSUB 2160
1520 PRINT:PRINT "WORKING..."
1530 FOR I=1 TO NC
1540 C3=I:C2=I:C1=I
1550 GOSUB 2300
1560 NEXT I
1570 RETURN
1580 REM DO COL
1590 PRINT:PRINT "WORKING..."
1600 FOR I=1 TO NR
1610 R3=I:R2=I:R1=I
1620 GOSUB 2300
1630 NEXT I
1640 PRINT:PRINT "COMPLETED"
1650 RETURN
1660 REM DISPLAY
1670 PRINT CS$;"* DATA DISPLAY STEP * ";
1680 PRINT:PRINT "DISPLAY DATA (Y/N)?";
1690 GOSUB 2260
1700 IF R$="N" THEN 1890
1710 PRINT:PRINT "REM ROWS"
1720 PRINT:PRINT "DISPLAY ROWS (Y/N)?";
1730 GOSUB 2260
1740 IF R$="N" THEN 1800
1750 PRINT:PRINT "B60:IF E THEN 1800
1760 RT=0:FOR I=0 TO NC:RT=RT+DA(R,I)
1770 NEXT I
1780 N=INT((NC+1)/NL):IF (NC+1)NL$>0 THEN N=N+1
1790 C=1:GOSUB 1900
1800 GOTO 1750
1810 PRINT:PRINT "DISPLAY COLS (Y/N)?";
1820 GOSUB 2260
1830 IF R$="N" THEN 1890
1840 PRINT:PRINT "B1050:IF E THEN 1890
1850 CT=0:FOR I=0 TO NR:CT=CT+DA(I,C)
1860 NEXT I
1870 N=INT((NR+1)/NL):IF (NR+1)NL$>0 THEN N=N+1
1880 R=1:GOSUB 2040
1890 GOTO 1840
1900 RETURN
1910 REM ROW PANEL
1920 PRINT CS$;"WORKING..."
1930 FOR I=1 TO N
1940 R3=I:R2=I:R1=I
1950 GOSUB 2300
1960 NEXT I
1970 RETURN
1980 REM COLUMN PANEL
1990 FOR I=1 TO N
2000 R3=I:R2=I:R1=I
2010 GOSUB 2300
2020 NEXT I
2030 RETURN
2040 REM GET OPERATOR
2050 PRINT:PRINT "SPACETO CONTINUE"
2060 GET #1,A:IF A>32 THEN 2010
2070 NEXT I
2080 RETURN
2090 REM GET YORN
2100 GET #1,A:A=CHR$(A)
2110 IF A<="N" AND A>="Y" THEN PRINT T="KEY "Y" OR "N""
2120 RETURN
2130 REM CALCULATIONS
2140 IF T="+" THEN DA(R3,C3)=DA(R1,C1)+DA(R2,C2)
2150 IF T="-" THEN DA(R3,C3)=DA(R1,C1)-DA(R2,C2)
2160 IF T="*" THEN DA(R3,C3)=DA(R1,C1)*DA(R2,C2)
2170 IF T="/" AND DA(R2,C2)<>0 THEN DA(R3,C3)=DA(R1,C1)/DA(R2,C2)
2180 IF T="%" THEN DA(R3,C3)=DA(R1,C1)*DA(R2,C2)/100
2190 PRINT:PRINT "SPACETO CONTINUE"
2200 GET #1,A:IF A<="N" AND A>="Y" THEN PRIN T="TRAP 2210:INPUT T$:T$(LEN(T$)+1)
2210 IF T="Y" THEN TRAP 2210:INPUT T$:T$(LEN(T$)+1)
2220 FOR I=1 TO NP$2 STEP 2:PRINT OP$(I,(I+1));", ";:NEXT I:PRINT
2230 IF T=OP$(I,(I+1))=T$ THEN I=1000000
2240 NEXT I
2250 PRINT:PRINT "TRAP 2210:INPUT T$:T$(LEN(T$)+1)
2260 FOR I=1 TO N:IF A<>N THEN PRINT T="TRAP 2210:INPUT T$:T$(LEN(T$)+1)
2270 IF T="Y" THEN PRIN T="SPACETO CONTINUE"
2280 FOR I=1 TO NP$2 STEP 2:PRINT OP$(I,(I+1))=T$ THEN I=1000000
2290 NEXT I
2300 PRINT:PRINT "SPACETO CONTINUE"
2310 IF T="+" THEN DA(R3,C3)=DA(R1,C1)+DA(R2,C2)
2320 IF T="-" THEN DA(R3,C3)=DA(R1,C1)-DA(R2,C2)
2330 IF T="*" THEN DA(R3,C3)=DA(R1,C1)*DA(R2,C2)
2340 IF T="/" AND DA(R2,C2)<>0 THEN DA(R3,C3)=DA(R1,C1)/DA(R2,C2)
2350 IF T="%" THEN DA(R3,C3)=DA(R1,C1)*DA(R2,C2)/100

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

In the beginning there was the membrane keyboard.

So it was to be done that Inhome Software would create a full-stroke keyboard for the Atari 400 Home Computer and it would be called the B Key 400, and would sell for $119.95 U.S. funds.

The new B Key 400 was made so easy to install that the owner could do it himself in a miraculous two minutes.

With the B Key 400 keyboard from Inhome Software, you will follow into the land of professional home computers that are powerful, easy to program and have a great capacity that can be made even greater with Inhome Software 48K and 32K memory boards. It was done and it was good.
SUPER PARATROOPER is a High Resolution game that doesn't let you make any mistakes. You are in charge of a big gun that sweeps back and forth by your command. Helicopters fill the sky, (and we mean fill the sky!), dropping paratroopers. Your mission is to keep 3 paratroopers from hitting the ground on either side of your gun. But that's just the beginning. You score by hitting the helicopters or the paratroopers, but if you miss a shot it subtracts from your score. Therefore, you must make every shot count to make a high score! IT HAS FOUR FAST ACTION LEVELS TO CHALLENGE THE BEST PLAYER.

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RUNS ON STANDARD VIC-20

The High Resolution graphics helicopters are fantastic. They look exactly like helicopters! The paratroopers are super realistic. Their chutes open and then they drift down to earth. If this weren't enough the sounds are fantastic. There are helicopter blades whirring and you can hear the howitzer pumping shells. When you hit a parachute you hear this ripping sound and the paratrooper falls struggling to the ground! NOW HEAR THIS! — If you let three paratroopers land, they bring in a tank from either side and blast you!!! This game really shows off the sound and graphic capabilities of your VIC. SUPER PARATROOPER IS OUR NO. 1 SELLING ARCADE GAME — you've got to get this game to believe it — we are so sure you'll like it we'll give you "10 DAY FREE TRIAL."

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2360 IF T$="%+" THEN DA(R3,C3)=DA(R1, 
C1)+(DA(R1,C1)*DA(R2,C2)/100)
2370 IF T$="%−" THEN DA(R3,C3)=DA(R1, 
C1)-(DA(R1,C1)*DA(R2,C2)/100)
2380 IF T$="%D" AND DA(R1,C1)<0 THEN 
DA(R3,C3)=((DA(R2,C2)-DA(R1,C1) 
)/DA(R1,C1))*100
2390 DA(R3,C3)=INT((DA(R3,C3)*D2+5)/I 
)/D1
2400 RETURN
2410 REM INITIALIZE
2415 OPEN #1,4,0,"K"
2420 DIM CS$(10):CS$=CHR$(125):REM CLE 
AR SCREEN
2430 NL=10
2440 NR=0;NC=0
2450 DIM BL$(10):BL$="(11 SPACES)"
2460 NP=8:DIM OP$(NP*2),T$(10),R$(10) 
:OP$=""":OP$(NP*2)=""":OP$(2)=OP 
$)
2470 FOR I=1 TO NP+2 STEP 2:READ T$:O 
P$(I)=T$:NEXT I
2480 DATA +,-,*,/,%,%,%,%,%
2490 DP=2:D1=INT(10^DP+0.1):D2=INT(10 
^((DP+1)+0.1)
2500 PRINT CS$:"TINY PLAN":PRINT :PRI 
NT "VERSION 1.0 JULY 1982"
2510 PRINT ;PRINT "SPREADSHEET"
2520 \:?:?:"PRESS \:NEXT I"
2521 IF PEEK(53279)<6 THEN 2521
2530 Sz=FRE(0)-150
2540 RETURN

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<td>1</td>
<td>Super Paratrooper</td>
<td>$24.95</td>
<td>$19.95</td>
</tr>
<tr>
<td>2</td>
<td>Exterminator-Plus</td>
<td>$24.95</td>
<td>$19.95</td>
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<tr>
<td>3</td>
<td>Cricket</td>
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<td>4</td>
<td>3-D Hackman</td>
<td>$24.95</td>
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<td>5</td>
<td>Snackman</td>
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<td>6</td>
<td>Bug Blast</td>
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<td>7</td>
<td>Anti Matter Splatter</td>
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<td>8</td>
<td>Bombs Away</td>
<td>$18.95</td>
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<td>9</td>
<td>3-D Maze-Escape</td>
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This program, with both Microsoft and Atari versions, can help you lose weight by cutting calories. Be sure to consult with your doctor before using this program or any other weight-loss technique.

CalCalc: Computerize Your Diet

Charles Brannon
Editorial Assistant

Calorie counting is important in most diet plans. Unfortunately, the process of looking up every item of food you eat is discouragingly tedious. And even if you conscientiously keep track of calories, how do you know how much progress you’re making?

Your body burns a certain number of calories per day. This depends on your sex, build, and activities. In order to lose weight, you must eat fewer calories than your body needs, forcing it to convert fat tissue into carbohydrates. On the other hand, if you eat more calories than your body “burns” in one day, the excess is converted into fat.

3500 Calories = 1 Pound

In order to lose one pound of fat, you have to miss 3500 calories. In order to gain a pound, you have to have an excess of 3500 calories. This is not on a daily basis; calories accumulate. So, if you ate 1000 more calories each day than your body used, you would gain one pound in about three and a half days.

Since any calculation is spread over many days, it can be hard to see progress, or to predict how long it will take to shed that “excess baggage.” The computer is of great aid here.

CalCalc asks you a number of questions, such as your sex and age, to determine how many calories you need each day. You then enter everything you’ve eaten at the end of the day, selecting foods and quantities from a list (a menu, appropriately enough!). Just press the letter corresponding to the food you ate. If you don’t see a certain food, press RETURN to see more items.

Adding To The Menu

What if you ate a food not on the list? This is not too hard, since we’ve included only a sample selection of foods, found in the DATA statements from lines 1140 and up. To customize this list to your preferences and habits, just purchase a pocket-sized calorie-counter (available at most grocery-store checkout counters). Then add to or change the DATA statements.

There is one DATA statement for each food. The first item on the line (after the word DATA) is the name of the food. Make the name less than 20 letters long. The next item, preceded with a comma, is the number of calories in an average serving, followed by a comma, and the description of the average serving, such as a “1 CUP” or “1 8″ F.A.R.” The last DATA statement (line 1500 here) should be END,0,0 which marks the end of the list.

After you’ve pressed the letter corresponding to the food you’ve eaten, the computer will display the quantity (such as one cup) and calories of an average serving. You enter the multiple or fraction in decimal of the quantity given. For example, if you drank two glasses of milk for breakfast, enter a 2, for two one-cup portions. If you had half of a medium orange, enter 0.5. CalCalc then displays the calories for the food consumed, and the cumulative total of calories. You continue to enter foods for everything you’ve eaten.

Guessulating

You can also approximate calories. For example, if you ate a chicken-filet sandwich, you could select “T”, chicken (one four oz. serving), and “K”, two one-slice portions of white bread. Or, if you can look on the wrapper of the product, you can enter the calories directly. Just press the number sign, “#”, instead of a letter, and enter the calories literally.

The Moment Of Truth

After you’ve finished entering all the foods, the computer is ready to predict weight loss. It bases this prediction on the assumption that you will eat about the same number of calories each day. Just enter the number of days you want to “look ahead,” and CalCalc will tell you how much weight you will have lost. If you’re eating too much, it will, with equal placidity, show you how much you’ll gain.

CalCalc makes dieting much easier. It goes beyond mere automation of a calorie counter by letting you see the effect of changes. By only cutting down on meals and checking your total calories with CalCalc, you can see if you’ll lose weight.

Program 1: Microsoft Version

100 POKE 59468, 12: PRINT CHR$(142): GOSUB 1020
110 PRINT”{DOWN}{REV}WARNING{OFF}: CONSULT YOUR
120 PRINT”R DOCTOR BEFORE USING THIS PROGRAM OR ANY
130 PRINT”OTHER WEIGHT-LOSS TECHNIQUE.
140 PRINT”ARE YOU (REV)M(OFF)ALE OR (REV
150 GETA$: IF A$ <> "M" AND A$ < > "F" THEN 150
160 SX=8: IF A$ = "F" THEN SX=1
170 IF SX=0 THEN 200
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Conversion Notes For Apple, OSI, VIC, Color Computer, etc.

Program 1 is designed to run on all computers with Microsoft BASIC (called Extended BASIC on some computers). Because it was programmed on a PET/CBM, some changes in screen display and format are necessary.

Most obvious are lines 1030-1100, which display the CalcCalc logo. You can use your system's graphics capabilities to do this, or just delete lines 1040-1100, and change line 1030 to:

1030 REM (since it's a target line of a GOSUB).

All statements preceded with [REV] should be entered in inverse video, or preceded with INVERSE, and end with NORMAL. All statements using the [DOWN] cursor control can be changed from:

610 PRINT“DOWN”ENTER...

to

610 PRINT:PRINT“ENTER...

The [BELL] character should be entered as CTRL-G. [CLEAR], or clear screen, should be changed to HOME on the Apple (outside quotes).

The statements that provide a "default" answer, such as line 520, which positions the cursor on the "0", can be changed to delete the "0" and the three cursor-lefts, or altered to provide a default answer on your computer.

Since the PET lacks absolute X,Y cursor positioning (using relative cursor controls instead), Apple owners need to use HTAB and VTAB statements instead:

260 PX=0:PY=1:GOSUB 1020
300 HTAB PX:VTAB PY:INVERSE:PRINT CHR$(1+64):NORMAL:PRINT “”;LEFT$(FOOD$,19)
330 CP$=HOME[24 DOWN]
340 IF TI-T<60 AND TI-T<120 THEN PRINTCP$;“ENTER[REV]OF[OFF]OF FOOD”
350 IF TI-T>120 AND TI-T<180 THEN PRINTCP$;PR ESS[REV]RETURN[OFF]TO GO ON
360 IF TI-T>180 THEN PRINTCP$;PRESS [REV]*[OFF] WHEN DONE
370 GETA$:IF(A$<"A"ORAS>"Z")ANDA$<>CHR$(13)AND A$<>“**ANDAS<“THEN340
380 IFAS<CHR$(13)THEN410
390 NX=NX+1:IF FOOD$="END" THEN RESTORE:NX=0
400 GOTO 260
410 RESTORE
420 IFAS=“*”THEN600
430 IFAS=“**”THEN660
440 FOR I=1 TO NX*26+ASC(A$)-64
450 READ FOOD$,CL,AMOUNT$  
470 GOSUB 1020
480 PRINT“FOOD:”;FOOD$;
490 PRINT“CALORIES PER”;AMOUNT$;”:”;CL
500 PRINT“ENTER QUANTITY OF ABOVE FOOD CONSUMED, USING A MULTIPLE OR A DECIMAL FRACTION?0{LEFT}”;INPUT QU
510 IF QU=0 THEN 590
520 IF QU<0 THEN PRINT“[REV][DOWN][BELL]IMPOSIBLE:FORM=170500:GOTO470
530 PRINT“[DOWN]CALORIES OF [REV][FOOD]:”;
540 PRINT“CALORIES CONSUMED SO FAR [:CA L]="CAL+CL*QU:PRINCALCAL
550 PRINT“[YOU]DOWN][PRESS [REV]RETURN[OFF] TC C ONINUE... “
560 GETA$:IFAS<CHR$(13)THEN580
570 RESTORE:NX=0:GOTO 260
580 PRINT“TOTALCALORIES FOR FOOD NOT ON LIST:”
590 PRINT“[YOU]DOWN]OF CALORIES FOR FOOD NOT ON LIST: “
600 PRINT“[YOU]DOWN]ENTER ABSOLUTE QUANTITY “
610 PRINT“[YOU]DOWN]OF CALORIES FOR FOOD NOT ON LIST:”
620 PRINT“[YOU]DOWN]OF CALORIES FOR FOOD NOT ON LIST:”
630 IF CL<0 THEN NX=0:GOTO 260
640 IF CL<0 THEN PRINT“[DOWN][REV][BELL]IMPOSSIBLE:FORM=170500:NEXTW:GOTO600
650 QU=1:GOTO560
660 GOSUB 120
670 PRINT“TOTALCALORIESCONSUMED:”;CAL
680 PRINT“[YOU]DOWN]DOES THAT SOUND REASONABLE “
690 IF YES THEN 730
700 PRINT“[YOU]DOWN]DO YOU WANT TO:”PRINT“RE-ENTER THE CALORIES:”;GOSUB980
710 IF YES THEN CAL=0:GOTO360
720 PRINT“CLEAR “END

(continued on p. 90)
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With new and exciting games created by NEXA that offer you hi-res, color, and 3D-graphics, superb human engineering, super sound effects, exciting scrolling displays, multiple game levels, and more, you can give your customers a full line of entertainment software.

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MAZE MASTER will make the maze fanatic happy with three different challenging levels of play. We dare you to try our maze game. (Atari 400/300 w/32K)

CAPTAIN COSMOS will make the young at heart happy. It gives you the satisfaction of destroying The Munchies with Somanizer rays (arcade fashion) before your very eyes. (Atari 400/800 w/32K)
730 GOSUB1020
740 INPUT "WHAT IS YOUR AGE? 20{04 LEFT}"; AGE
750 IF AGE<20 ORAGE>70 THEN PRINT "YOU MUST BE BETWEEN 20 AND 70" AND GOTO 730
760 IF AGE<20 ORAGE>70 THEN GOTO 870
770 IFAGE=20 AND AGE<30 THEN CPD=3200: IF SX THEN CPD=2300
780 IF AGE=30 AND AGE<40 THEN CPD=3100: IF SX THEN CPD=2231
790 IF AGE=40 AND AGE<50 THEN CPD=2768: IF SX THEN CPD=1587
800 IF AGE=50 AND AGE<60 THEN CPD=2528: IF SX THEN CPD=1088
810 CPD=CPD*1000*NU+450*PREG
820 PRINT "NUMBER OF DAYS TO PROJECT"
830 INPUT "WEIGHT LOSS/GAIN? 1{03 LEFT}"; ND
840 IF ND<1 THEN PRINT "AT THE CURRENT CONSUMPTION YOU SHOULD" AND GOTO 810
850 IF DF<0 THEN PRINT "LOSE"; GOTO 960
860 PRINT "GAIN";
870 PRINT INT(ABS(DF*ND)/3500); "POUNDS.";
880 END
890 PRINT "(Y/N):";
900 GET A$: IF A$="Y" AND A$<"N" THEN GOTO 990
910 YES=0: IF A$="N" THEN PRINT "NO" AND RETURN
920 YES=1: PRINT "YES" AND RETURN
930 PRINT "0NASCALEOF 1{OFF}-(REV) 5{OFF}"
940 PRINT "HOW ACTIVE ARE YOU?"
950 GET A$: IF A$<"1" OR A$>"5" THEN GOTO 850
960 CPD=CPD+VAL(A$)*200
970 GOSUB 1020: PRINT "ESTIMATED ENERGY EXPENDITURE": PRINT "IN CALORIES IN ONE DAY:"; CPD
980 PRINT "TOTAL CALORIC INTAKE IN ONE DAY:"; CAL
990 DF=CAL-CPD
1000 IF DF<0 THEN PRINT "YOU ARE NOT SURE";
1010 IF DF>4500 THEN PRINT "YOU ARE YOUNG"
1020 PRINT "BELL": TRAP 220: PRINT "CALORIES? ARE YOU SURE";
1030 IF CAL<0 THEN PRINT "(DOWN)" AND "BELL"
1040 PRINT "CALORIES CONSUMED?": TRAP 40000
1050 IF CAL>4500 THEN PRINT "YOU ARE YOUNG"
1060 PRINT "BELL": TRAP 220: PRINT "CALORIES? ARE YOU SURE";
1070 IF CAL<0 THEN PRINT "(DOWN)" AND "BELL"
1080 IF CAL>4500 THEN PRINT "YOU ARE YOUNG"
1090 PRINT "BELL": TRAP 220: PRINT "CALORIES? ARE YOU SURE";
1100 PRINT "BELL": TRAP 220: PRINT "CALORIES? ARE YOU SURE";
1110 PRINT "BELL": TRAP 220: PRINT "CALORIES? ARE YOU SURE";
1120 PRINT "BELL": TRAP 220: PRINT "CALORIES? ARE YOU SURE";
1130 RETURN
1140 DATA APPLES,87,1 MED.
1150 DATA ORANGE JUICE,108,1 CUP
1160 DATA CORN FLAKES,96,1 CUP
1170 DATA WHITE BREAD,63,1 SLICE
1180 DATA WHOLE WHEAT BREAD,55,1 SLICE
1190 DATA HAMBURGER MEAT,316,3 OZ
1200 DATA STEAK,293,3 OZ
1210 DATA LAMB CHOP,480,4 OZ
1220 DATA BACON,48,1 SLICE
1230 DATA HAM,340,3 OZ
1240 DATA LEMON,78,4 OZ
1250 DATA TUNA FISH,170,3 OZ
1260 DATA CHICKEN,163,3 OZ
1270 DATA EGGS,648,1 CUP
1280 DATA SUGAR,48,1 TBS
1290 DATA GRAPEFRUIT,77,1 CUP
1300 DATA ORANGES,70,1 MED.
1310 DATA CANTALOUPES,37,1/2 MELON
1320 DATA CARROTS,68,1 CUP
1330 DATA POTATOES,128,1 MED.
1340 DATA BEET GREENS,39,1 CUP
1350 DATA LETTUCE,7,4 SM. LEAVES
1360 DATA SPINACH,46,1 CUP
1370 DATA LIMAS,152,1 CUP
1380 DATA CORN,92,8'' EAR
1390 DATA PEAS,74,5 CUP
1400 DATA TOMATOES,30,1 MED.
1410 DATA BLACK BEANS,295,1 CUP
1420 DATA END,0,0

Program 2: Atari Version
100 GRAPHICS 0: POKE 752, 1: GOSUB 1020:
105 DIM A$(1), FOOD$(19), AMOUNT$(10)
110 OPEN #1, 4, 0, "K": POKE 82, 0
115 PRINT "(DOWN) WARNING: CONSULT YOUR DOCTOR BEFORE"
120 PRINT "USING THIS PROGRAM OR ANY"
125 PRINT "OTHER WEIGHT-LOS
130 PRINT "TECHNIQUE."
135 PRINT "ARE YOU CALE OR \n140 PRINT "MALE?"
145 GET #1, A$: IF A$="M" AND A$<"F" THEN 150
150 SX=0: IF A$="F" THEN SX=1
160 PRINT "ARE YOU PREGNANT": GOSUB 980: IF YES THEN PREG=1
170 PRINT "ARE YOU NURSING": GOSUB 980: IF YES THEN NU=1
180 GOSUB 1020
190 PRINT "ENTER O IF NOT KNOWN":";
200 TRAP 220: PRINT "(UP) (DEL LINE) NUMBER OF CALORIES CONSUMED 2 LEFT": POKE 752, 0: INPUT CAL: POKE 752, 1: TRAP 40000
210 IF CAL=0 THEN PRINT "(DOWN) (BELL)"
220 IF CAL<0 THEN PRINT "(UP) (DEL LINE)" AND GOTO 200
230 IF CAL>4500 THEN PRINT "(DOWN) CALL";
240 IF CAL>4500 THEN PRINT "(DOWN) CALL";
250 IF CAL<0 THEN PRINT "(UP) (DEL LINE)" AND GOTO 200
260 PX=0: PY=10: GOSUB 1020
270 FOR I=1 TO 26
280 READ FOOD$, CL, AMOUNT$;
290 IF FOOD$="END" THEN 330
300 POSITION PX, PY: PRINT CHR$(I+192);
310 IF I=13 THEN PX=20: PY=10
320 NEXT I
330 REM
340 IF PEEK(20)>60 AND PEEK(20)<120 THEN
FILE-IT 2 by Jerry White
A powerful financial database management system. 6 user defined fields are created with up to 5 sub-fields beneath each main field. Alphabetically handles data and also does math computation on any selected fields. Data files are stored on separate disks with full field and sub-field sorting with file merging. Supports up to 4 drives including the 128K Axlon Ramdisk. The “alternative” to more costly database management systems. 24K Disk. $49.95

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HEN POSITION 2, 23: "ENTER # OR L
ETER OF FOOD";

350 IF PEEK(20) > 120 AND PEEK(20) < 180 THEN PRINT "PRESS "T5 WHEN DONE(4 SPACES)";

360 IF PEEK(20) > 180 THEN POSITION 2, 23: "PRESS TO GO ON(5 SPACES)";

365 IF PEEK(764) = 255 THEN 340

370 GET #1, A: A$ = CHR$(A): IF A$ = "A" OR A$ = "B" AND A$ < CHR$(115) AND A$ > "Z" AND A$ > "Z" THEN 340

375 IF A$ = CHR$(115) THEN 410

380 NX = NX + 1: IF FOOD$ = "END" THEN RESTORE

390 IF QU = 0 THEN 590

400 IF QU < 0 THEN PRINT "(DOWN) ENTER QUANTITY"; IF FOOD$ = "END" THEN RESTORE

410 RESTORE

420 IF A$ = "" THEN 600

430 IF A$ = "" THEN 660

440 FOR I = 1 TO NX$26 + ASC(A$) - 64

450 READ FOOD$, CL, AMOUNT$

460 NX = NX + 1: IF FOOD$ = "END" THEN RESTORE

470 RESTORE

480 GET #1, A: A$ = CHR$(A): IF A$ = "A" OR A$ = "B" THEN 580

490 PRINT "CALORIES PER "; AMOUNT$ = "": ";

500 PRINT "(DOWN) ENTER QUANTITY OF ABOVE FOOD";

510 PRINT "CONSUMED, USING A MULTIPLE OR"?;

520 TRAP 520: PRINT "(UP) (DEL LINE) A DECIMAL FRACTION"? (2 LEFT)?; POKE 752, 0: INPUT QU: POKE 752, 1: TRAP 40000

530 IF QU = 0 THEN 590

540 IF QU < 0 THEN PRINT "(DOWN) (BELL)";

550 PRINT "(DOWN) ENTER QUANTITY OF ABOVE FOOD";

560 PRINT "(DOWN) ENTER QUANTITY OF ABOVE FOOD";

570 PRINT "(DOWN) ENTER QUANTITY OF ABOVE FOOD";

580 GET #1, A: A$ = CHR$(A): IF A$ >= CHR$(115) THEN 580

590 RESTORE

600 GET #1, A: A$ = CHR$(A): IF A$ >= CHR$(115) THEN 580

590 RESTORE

610 PRINT "(DOWN) ENTER QUANTITY OF ABOVE FOOD";

620 TRAP 620: PRINT "(UP) (DEL LINE) 70 (2 LEFT)"; POKE 752, 0: INPUT CL: POKE 752, 1: TRAP 40000

630 IF CL = 0 THEN NX = 0: GOTO 260

640 IF CL < 0 THEN PRINT "(DOWN) (BELL)";

650 PRINT "(DOWN) ENTER QUANTITY OF ABOVE FOOD";

660 PRINT "(DOWN) ENTER QUANTITY OF ABOVE FOOD";

670 PRINT "(DOWN) ENTER QUANTITY OF ABOVE FOOD";

680 PRINT "(DOWN) ENTER QUANTITY OF ABOVE FOOD";

690 IF YES THEN 730

700 PRINT "(DOWN) DO YOU WANT TO";

710 IF YES THEN 730

720 PRINT "(CLEAR)";

730 GOSUB 1020: GOTO 700

740 PRINT "(UP) (DEL LINE) WHAT IS YOUR AGE? (3 LEFT)";

750 IF AGE = 20 OR AGE = 70 THEN PRINT "(DOWN) YOU MUST BE BETWEEN 20 AND 70";

760 IF AGE = 20 OR AGE = 70 THEN W = 1

770 IF AGE = 20 AND AGE = 30 THEN CPD = 3

780 IF AGE = 30 AND AGE = 40 THEN CPD = 3

790 IF AGE = 40 AND AGE = 50 THEN CPD = 2

800 IF AGE = 50 AND AGE = 60 THEN CPD = 2

810 IF AGE = 60 AND AGE = 70 THEN CPD = 2

820 PRINT "(DOWN) ENTER AGE NOT ON LIST";

830 PRINT "(DOWN) ENTER AGE NOT ON LIST";

840 PRINT "(DOWN) ENTER AGE NOT ON LIST";

850 PRINT "(DOWN) ENTER AGE NOT ON LIST";

860 PRINT "(DOWN) ENTER AGE NOT ON LIST";

870 PRINT "(DOWN) ENTER AGE NOT ON LIST";

880 PRINT "(DOWN) ENTER AGE NOT ON LIST";

890 IF AGE = 20 OR AGE = 70 THEN W = 1

900 IF AGE = 20 AND AGE = 30 THEN CPD = 3

910 PRINT "(DOWN) ENTER AGE NOT ON LIST";

920 PRINT "(DOWN) ENTER AGE NOT ON LIST";

930 PRINT "(DOWN) ENTER AGE NOT ON LIST";

940 PRINT "(DOWN) ENTER AGE NOT ON LIST";

950 PRINT "(DOWN) ENTER AGE NOT ON LIST";

960 PRINT "(DOWN) ENTER AGE NOT ON LIST";

970 PRINT "(DOWN) ENTER AGE NOT ON LIST";

980 PRINT "(DOWN) ENTER AGE NOT ON LIST";

990 PRINT "(DOWN) ENTER AGE NOT ON LIST";

1000 PRINT "(DOWN) ENTER AGE NOT ON LIST";

1010 PRINT "(DOWN) ENTER AGE NOT ON LIST";

1020 PRINT "(CLEAR)";

1030 PRINT "(CLEAR)";

1040 PRINT "(CLEAR)";

1050 PRINT "(CLEAR)";

1060 PRINT "(CLEAR)";

1070 PRINT "(CLEAR)";

1080 PRINT "(CLEAR)";

1090 PRINT "(CLEAR)";

1100 PRINT "(CLEAR)";

1110 PRINT "(CLEAR)";

1120 PRINT "(CLEAR)";

1130 PRINT "(CLEAR)";

1140 PRINT "(CLEAR)";

(continued on p. 94)
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One of the functions of a computer is to organize data. There are all kinds of sort routines or algorithms to arrange your data. You may want to alphabetize lists or arrange events by date or list a class in order by test scores. You'll need a sort routine to take your raw data and arrange it in ascending or descending order (from A to Z or Z to A).

Computer programmers and analysts often enjoy looking at sort routines and comparing speed and efficiency. Usually the amount of time it takes a computer to sort depends on how many items are in the list and how out-of-order the items are. Different computers vary in speed also. (Note: Although the TI-99/4A computer is slower than other microcomputers in PRINTing or LISTing, it is just as fast or faster in calculations and comparisons. The sort routines presented here were not significantly slower on any particular microcomputer.)

Here are four different sort routines written in BASIC for you to try, and to implement in your own programs. The computers and languages used are TI-99/4A (or TI-99/4), TI-99/4A Extended BASIC, VIC-20, and TRS-80 Color Computer with 16K Extended BASIC. Only BASIC programs are presented here; machine language routines are also available for some computers and are, of course, faster.

In the listings, Line 100 tells which computer and which sort is used. Lines 100-190 randomly choose 50 integers from 1 to 100. Ordinarily, you would INPUT, READ, or calculate the numbers used. The actual sorting starts at Line 200. Lines 500 to the end print the final sorted list of numbers in the example.

Bubble Sort

The Bubble Sort (or simple interchange sort) is probably the most common and easy to understand sort. It is fine for small numbers of items or for a list of items that is not much out of order. The program compares each number to the next number and exchanges numbers where necessary.

If one switch has been made during a pass through all the numbers, the loop of comparisons starts over. In this example, if the 50 numbers happened to be in exact opposite order, the maximum number of passes would be necessary, and the process would take longer than if only a few numbers were out of place. For larger numbers of items, this sort can seem to take forever.

Shell Sort

The Shell Sort is considerably faster than the Bubble Sort. In general, for a random order of 50 numbers, the shell sort is about two or three times as fast as the Bubble Sort. The Shell Sort speeds up execution because the number of comparisons that need to be made is reduced.

In an array of N numbers, it first determines B so that $2^B < N < 2^{B+1}$ and then the variable B is initialized to $2^B - 1$. The loop varies the counter I from 1 to N-B. First, it checks if $A(I) < A(I + B)$. If so, it increments I and continues with the comparisons. If not, it exchanges $A(I)$ and $A(I + B)$ and changes the subscript.

When I reaches the value of N, it reduces B by a factor of two and starts the loop again. When B = 0 the sort is complete. I've used a couple of extra variables in the example for clarity.

Sort C

The third kind of sort routine offered here is also faster than the Bubble Sort if the numbers are quite mixed up. The program goes through all the numbers and places the minimum value in the first spot of the array. The loop keeps finding the minimum of the numbers remaining and replaces it in order.

Sort D

This sort is similar to the previous one, except that with each pass through the numbers, both the minimum and the maximum numbers are found and placed at the appropriate end spots.

The way these sorts are listed, the given numbers will be arranged in ascending order. To change to descending order, simply exchange the less than
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or greater than signs in the sort comparisons.

If you are alphabetizing, the variable terms will be string variables, such as A$(I).

You may have several items which need to be associated as they are sorted. For example, suppose you have names and scores to be arranged by score. The names and scores are first arranged as NS$(1), S$(1); NS$(2), S$(2); etc. In the interchange you would need to sort the S values, and then switch both terms, such as:

\[
\begin{align*}
SS &= S(I) \\
NNS &= NS(I) \\
S(I) &= S(I+1) \\
NS(I) &= NS(I+1) \\
S(I+1) &= SS \\
NS(I+1) &= NNS
\end{align*}
\]

Keep in mind that for sorts for the TRS-80 Color Computer and the VIC-20, you should use lower line numbers and leave out spaces to conserve memory. You may also save memory by naming your variables with only one letter. Too, you could combine a few more lines than I did in these examples. You should, of course, use the VIC-20 abbreviations wherever possible (such as D-shift-I for DIM).

### TI-99/4 BASIC Sorts

#### 100 REM TI BASIC BUBBLE SORT

```basic
100 REM TI BASIC BUBBLE SORT
110 DIM A(50)
120 FOR I=1 TO 50
130 RANDOMIZE
140 A(I)=INT(RND*100+1)
150 PRINT A(I);
160 NEXT I
170 PRINT ::
200 LIM=49
210 SW=0
220 FOR I=1 TO LIM
230 IF A(I)<A(I+1)THEN290
240 AA=A(I)
250 A(I)=A(I+1)
260 A(I+1)=AA
270 SW=1
280 LIM=I
290 NEXT I
300 IF SW=1 THEN 210
310 N=N-1
320 GOTO 130
330 PRINT ::
340 NEXT I
350 END
```

#### 100 REM TI BASIC SHELL SORT

```basic
100 REM TI BASIC SHELL SORT
110 DIM A(50)
120 FOR I=1 TO 50
130 RANDOMIZE
140 A(I)=INT(RND*100+1)
150 PRINT A(I);
160 NEXT I
170 PRINT ::
200 M=A(1)
210 IM=1
220 FOR I=2 TO N
230 IF A(I)<M THEN 260
240 M=A(I)
250 IM=I
260 NEXT I
270 AA=A(N)
280 A(N)=A(IM)
290 A(IM)=AA
300 N=N-1
310 IF N>1 THEN 200
320 END
```

#### 100 REM TI BASIC SORT C

```basic
100 REM TI BASIC SORT C
110 DIM A(50)
120 N=50
130 FOR I=1 TO N
140 RANDOMIZE
150 A(I)=INT(RND*100+1)
160 PRINT A(I);
170 NEXT I
180 PRINT ::
200 M=A(1)
210 IM=1
220 FOR I=2 TO N
230 IF A(I)<M THEN 260
240 M=A(I)
250 IM=I
260 NEXT I
270 AA=A(N)
280 A(N)=A(IM)
290 A(IM)=AA
300 N=N-1
310 IF N>1 THEN 200
320 END
```

#### 100 REM TI BASIC SORT D

```basic
100 REM TI BASIC SORT D
110 DIM A(50)
120 N=50
130 FOR I=1 TO 50
```
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100 REM TI EXTENDED BASIC BUBBLE SORT
110 DIM A(50)
120 FOR I=1 TO 50::RANDOMIZE::A(I)=INT(RND*100+1)::PRINT A(I);::NEXT I::PRINT ::
200 B=1
210 B=2*B :: IF B<=50 THEN 210
220 B=INT(B/2) :: IF B=0 THEN 500
230 FOR I=1 TO 50-B :: C=I
240 D=C+B :: IF A(C)<A(D)THEN260
250 AA=A(C) :: A(C)=A(D) :: A(D)=AA :
: C=C-B :: IF C<0 THEN 240
260 NEXT I :: GOTO 220
500 FOR I=1 TO 50 :: PRINT A(I);:: ~ NEXT I
510 END

100 REM TI EXTENDED BASIC SHELL SORT
110 DIM A(50) :: N=50
120 FOR I=1 TO N::RANDOMIZE::A(I)=INT(RND*100+1) :: PRINT A(I);::NEXT I::PRINT ::
200 M=A(1) :: IM=1
210 FOR I=2 TO N
220 IF A(I)>=M THEN M=A(I) :: IM=I
230 NEXT I
240 AA=A(N) :: A(N)=A(IM) :: A(IM)=AA :
: N=N-1 :: IF N>1 THEN 2 $0
500 FOR I=1 TO 50 :: PRINT A(I);:: NEXT I
510 END

100 REM TI EXTENDED BASIC SORT C
110 DIM A(50) :: N=50
120 FOR I=1 TO 50::RANDOMIZE::A(I)=INT(RND*100+1) :: PRINT A(I);::NEXT I::PRINT ::
200 MN=A(S) :: IMIN=S :: MX=MN :: IMAX=S
210 FOR I=S TO N
220 IF A(I)>MX THEN MX=A(I)
230 IF A(I)<MN THEN MN=A(I)
240 NEXT I
250 IF IMIN=N THEN IMIN=IMAX
260 AA=A(N) :: A(N)=A(IMAX) :: A(IMAX)=AA :: N=N-1 :: IF N>1 THEN 2 $0
500 FOR I=1 TO 50 :: PRINT A(I);:: NEXT I
510 END

100 REM TI EXTENDED BASIC SORT D
110 DIM A(50) :: N=50 :: S=1
120 FOR I=1 TO 50::RANDOMIZE::A(I)=INT(RND*100+1) :: PRINT A(I);::NEXT I::PRINT ::
200 MN=A(S) :: IMIN=S :: MX=MN :: IMAX=S
210 FOR I=S TO N
220 IF A(I)>MX THEN MX=A(I) :: IMAX=I
230 IF A(I)<MN THEN MN=A(I) :: IMIN=I
240 NEXT I
250 IF IMIN=N THEN IMIN=IMAX
260 AA=A(N) :: A(N)=A(IMAX) :: A(IMAX)=AA :: N=N-1 :: IF N>1 THEN 2 $0
280 IF N>S THEN 200
500 FOR I=1 TO 50 :: PRINT A(I);:: ~ NEXT I
510 END

continued on p. 104
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### TRS-80 Color Computer Sorts

#### TRS80C Bubble Sort

```basic
100 REM TRS80C BUBBLE SORT
110 DIM A(50)
120 FOR I=1 TO 50: A(I)=RND(100): PRINT A(I);: NEXT: PRINT
200 LIM=49
210 SW=0: FOR I=1 TO LIM: IF A(I)<=A(I+1) THEN 230
230 NEXT
240 IF SW=1 THEN 210
500 FOR I=1 TO 50: PRINT A(I);: NEXT: PRINT
510 END
```

#### TRS80C Shell Sort

```basic
100 REM TRS80C SHELL SORT
110 DIM A(50)
120 FOR I=1 TO 50: A(I)=RND(100): PRINT A(I);: NEXT: PRINT
200 B=1
210 B=2*B: IF B<=50 THEN 210
220 B=INT(B/2): IF B=0 THEN 500
230 FOR I=1 TO 50-B: C=I
240 D=C+B: IF A(C)<=A(D) THEN 260
250 AA=A(C): A(C)=A(D): A(D)=AA: C=C-B: IF C>0 THEN 240
260 NEXT: GOTO 220
500 FOR I=1 TO 50: PRINT A(I);: NEXT: PRINT
510 END
```

#### TRS80C Sort C

```basic
100 REM TRS80C SORT C
110 DIM A(50): N=50
120 FOR I=1 TO N: A(I)=RND(100): PRINT A(I);: NEXT: PRINT
200 M=A(1): IM=1
210 FOR I=2 TO N
220 IF A(I)>=M THEN M=A(I): IM=I
230 NEXT
500 FOR I=1 TO 50: PRINT A(I);: NEXT: PRINT
510 END
```

#### TRS80C Sort D

```basic
100 REM TRS80C SORT D
110 DIM A(50): N=50: S=1
120 FOR I=1 TO N: A(I)=RND(100): PRINT A(I);: NEXT: PRINT
200 MN=A(S): IM=S: MX=MN: IX=S
210 FOR I=S TO N
220 IF A(I)>MX THEN MX=A(I): IX=I
230 IF A(I)<MN THEN MN=A(I): IM=I
240 NEXT
250 IF IM=N THEN IM=IX
```

### VIC-20 Sorts

#### VIC 20 Bubble Sort

```basic
100 REM VIC 20 BUBBLE SORT
110 DIM A(50)
120 FOR I=1 TO 50: A(I)=INT(RND(X)*100)+1: PRINT A(I);: NEXT: PRINT
200 L=49
210 S=0: FOR I=1 TO L: IF A(I)<=A(I+1) THEN 230
220 AA=A(I): A(I)=A(I+1): A(I+1)=AA: S=S+1: L=L-1
230 NEXT: GOTO 220
500 FOR I=1 TO 50: PRINT A(I);: NEXT: PRINT
510 END
```

#### VIC 20 Shell Sort

```basic
100 REM VIC 20 SHELL SORT
110 DIM A(50)
120 FOR I=1 TO 50: A(I)=INT(RND(X)*100)+1: PRINT A(I);: NEXT: PRINT
200 B=1
210 B=2*B: IF B<=50 THEN 210
220 B=INT(B/2): IF B=0 THEN 500
230 FOR I=1 TO 50-B: C=I
240 D=C+B: IF A(C)<=A(D) THEN 260
250 AA=A(C): A(C)=A(D): A(D)=AA: C=C-B: IF C>0 THEN 240
260 NEXT: GOTO 220
500 FOR I=1 TO 50: PRINT A(I);: NEXT: PRINT
510 END
```

#### VIC 20 Sort C

```basic
100 REM VIC 20 SORT C
110 DIM A(50): N=50
120 FOR I=1 TO N: A(I)=INT(RND(X)*100)+1: PRINT A(I);: NEXT: PRINT
200 M=A(1): IM=1
210 FOR I=2 TO N
220 IF A(I)>=M THEN M=A(I): IM=I
230 NEXT
500 FOR I=1 TO 50: PRINT A(I);: NEXT: PRINT
510 END
```

#### VIC 20 Sort D

```basic
100 REM VIC 20 SORT D
110 DIM A(50): N=50: S=1
120 FOR I=1 TO N: A(I)=INT(RND(X)*100)+1: PRINT A(I);: NEXT: PRINT
200 M=A(1): IM=1
210 FOR I=2 TO N
220 IF A(I)>=M THEN M=A(I): IM=I
230 NEXT
500 FOR I=1 TO 50: PRINT A(I);: NEXT: PRINT
510 END
```

continued on p. 106
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CRABS
Agility is the key to successfully guiding HERBIE (the halibut) through the maze, avoiding the deadly gaze of SONIC CRABS while feeding on delectable night crawlers.

The more you eat, the higher your score. Each time you clear the maze of tasty morsels, you will receive more time, additional lives, and a new group of night crawlers, as the game of SURVIVAL continues.

But beware! With the passing of time your presence becomes increasingly aggravating to the KILLER crabs who lurk within, improving the accuracy of their menacing sonic waves.

Set at beginner or advanced levels, each game is played in a totally new maze, and may consist of any number of rounds that start identically for each player.

CRABS can be played using your VIC-20 keyboard or joystick, and will work on all standard VIC-20 memory configurations.

TANK WAR
Your opponent watches closely as the BATTLEFIELD unfolds, and you both carefully plan strategies for the pending CONFLICT. Suddenly, both LASER TANKS fire to initiate movement. You begin to thread the way through your home territory, avoiding obstructions and buildings, as you proceed toward enemy ground.

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One of three skill levels, with a new battlefield created for each game, provides a new challenge for both players every time.

TANK WAR may be played using your VIC-20 keyboard or paddles, and will work on all standard VIC-20 memory configurations.

CYCLONS
Continuing with their plan to conquer the universe, the CYTRON EMPIRE has chosen your sector as the first target in our galaxy. As COMMANDER of the protective forces, you must manoeuvre your craft, avoiding collision and enemy missiles, to attack and destroy enemy warships.

The CYCLON fighters relentlessly enter the battle zone, attempting to lure you into making errors that will lead to your destruction. The menacing PULSAR DEATHSHIP also begins to attack, its only purpose to zero in on your location, chase you down, and put an end to your defense of civilization as we know it.

Our future lies with your skill.

CYCLONS requires memory expansion to function. When loaded on a system with a 3K expander (or Super Expander) you will play an advanced level game. Loading the cassette onto a system with 8K or more expansion, you will be allowed to choose between a variety of difficulty/game-feature options. The game is controlled with the VIC-20 joystick.

Check for availability with your local dealer, or use the order form provided. Dealer enquiries are welcome.
100 REM VIC 20 SORT D  
110 DIM A(50); N=50; S=1  
120 FOR I=1 TO 50: A(I)=INT(RND(X)*1  
00+1): PRINT A(I); PRINT  
T: PRINT  
200 MN=A(S); IM=S; MX=MN; IX=S  
210 FOR I=S TO N  
220 IF A(I)>MX THEN MX=A(I); IX=I  
230 IF A(I)<MN THEN MN=A(I); IM=I  
240 NEXT  
250 IF IM=N THEN IM=IX  
260 AA=A(N); A(N)=A(IX); A(IX)=AA: N=N  
-1  
270 AA=A(S); A(S)=A(IM); A(IM)=AA; S=S  
+1  
280 IF N>S THEN 200  
500 FOR I=1 TO 50: PRINT A(I); PRINT  
510 END

Apple Sorts

100 REM APPLE BUBBLE SORT  
110 DIM A(50)  
120 FOR I=1 TO 50: A(I)= INT ( RND (1) * 100  
+ 1); PRINT A(I);" ; NEXT :PRINT:P  
RINT  
200 L = 49  
210 S = 0: FOR I = 1 TO L: IF A(I) < A(I + 1  
) THEN 230  
220 AA = A(I); A(I)= A(I+1); A(I+1) = AA: S  
- = 1; L = I  
230 NEXT: IF S = 1 THEN 210  
500 FOR I=1 TO 50: PRINT A(I); " ;: NEXT  
510 END

100 REM APPLE SHELL SORT  
110 DIM A(50)  
120 FOR I=1 TO 50: A(I)= INT ( RND (1) * 100  
+ 1); PRINT A(I);" ;: NEXT :PRINT:PRI  
NT  
200 B = 1  
210 B = 2 * B: IF B < 50 THEN 210  
220 B = INT (B / 2): IF B = 0 THEN 500  
230 FOR I = 1 TO 50 - B: C = I  
240 IF C > 0 THEN 240  
250 AA = A(C); A(C)= A(D); A(D)= AA: C = C -  
B:  
260 NEXT: GOTO 220  
500 FOR I=1 TO 50: PRINT A(I); " ;: NEXT  
510 END

100 REM APPLE SORT C  
110 DIM A(50); N = 50  
120 FOR I=1 TO N: A(I)= INT ( RND (1) * 100  
- + 1); PRINT A(I);" ;: NEXT :PRINT:PRIN  
T  
200 M = A(1); IM = 1  
210 FOR I = 2 TO N  
220 IF A(I) > M THEN M = A(I); IM = I  
230 NEXT  
240 AA = A(N); A(N)= A(IM); A(IM)= AA: N = N -  
1: IF N > 1 THEN 200  
500 FOR I = 1 TO 50: PRINT A(I); " ;: NEXT  
510 END
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<tr>
<th>Consumer Description</th>
<th>Part #</th>
<th>CE quant. 100 price per disc ($)</th>
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<td>3062</td>
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<tr>
<td>8&quot; SSDS Shugart Compatible, 32 Hard Sector</td>
<td>3015</td>
<td>2.99</td>
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<tr>
<td>8&quot; SSDS CPT 8000 Compatible, Soft Sector</td>
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**SAVE ON MEMOREX COMPUTER TAPE**

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<td>Memorex IV 2400 feet Widthline Seal</td>
<td>25JW</td>
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<td>Memorex IV 2400 feet Easy Load II Cartridge</td>
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<tr>
<td>Memorex IV 1200 feet Widthline Seal</td>
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<td>Memorex Quantum 2400 feet Widthline Seal</td>
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<td>Memorex Cubic HD 2400 feet Widthline Seal</td>
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<td>Memorex Cubic HD 1200 feet Widthline Seal</td>
<td>39FW</td>
<td>13.99</td>
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<th>Consumer Description</th>
<th>CE quant. Part #</th>
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<td>Mark III 5 MB, Cartridge Front Load (8 to 32 Seg)</td>
<td>95-522XX-03</td>
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<td>Top Load (1-24 sectors)</td>
<td>94-522XX-03</td>
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<td>CMD-16 &quot;Phoenix Type&quot; CDC Cartridge</td>
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<td>CDC Cartridge</td>
<td>98-26600-32</td>
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<td>Mark VIII 80 MB, Error Free</td>
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<td>530-3501</td>
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<td>Flag Free</td>
<td>03-35031-02</td>
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<td>DEC Flag Free</td>
<td>03-35031-03</td>
<td>560.00</td>
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<td>Mark XII 200 MB, NCR/CDC Flag Free</td>
<td>03-39001-01</td>
<td>515.00</td>
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<td>Honeywell Flag Free</td>
<td>03-39001-02</td>
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<td>Mark XIII 300 MB, Error Free</td>
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<td>Mark XIV 80 MB, Unformatted Error Free</td>
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<td>Flag Free</td>
<td>03-4901-01</td>
<td>725.00</td>
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It hit the national news wires and was quickly picked up by local media: a letter in October’s New England Journal of Medicine suggested that home computers and video game machines used with old color TV sets could expose people to potentially hazardous doses of radiation.

Is Your TV A Radiation Hazard?

Tom R. Halfhill
Features Editor

It might be considered a flattering measure of the exploding popularity of home computing that a small item in a medical journal could attract so much attention. Could an old color TV hooked up to your computer or video game really create a radiation hazard? Or was all the fuss just a rerun of the color TV “radiation scare” of the late 1960s? What does it really mean to home computerists and video game addicts?

First, in case you missed the story - or more likely, in case your local media carried a frustratingly abbreviated version -- here are the details.

The New England Journal of Medicine, a respected medical publication closely watched by the general news media, published a letter from two doctors at the Veterans Administration Medical Center in Washington, D.C. The letter warned that pre-1970 color TVs emit more X-radiation than sets built later. This could pose a danger, especially to young people, when these TVs are hooked up to home computers and video game machines. The doctors reasoned that many families plug their computers and game machines into “spare” color TVs to avoid tying up the household’s main set. Also, they noted that people playing video games or involved in programming tend to sit much closer to the screen than they do when watching TV shows. They also tend to become engrossed for hours.

Doctors Suggest Caution

Close exposure over prolonged periods to older-model color TVs raises the possibility of radiation doses larger than recommended limits, suggested the doctors. Specifically, a young person using a computer or video game for two hours a day over one year would receive about eight times the government’s recommended limit -- which is 100 millirems per year for a person under 18. The two-hour-a-day game addict would absorb 780 millirems in the eyes and 890 millirems in the thyroid gland.

(The radiation limits are different for adults, and some adults get higher doses because of their occupations; a typical flight attendant, for example, might get 500 millirems per year due to exposure in the upper atmosphere.)

Now, before you panic and start worrying about acquiring a permanent glow from playing Space Invaders, there are several things to keep in mind. First, the doctors’ caution covers only color TVs made before 1970 which are used at closer than average viewing distances. (The doctors defined the average viewing distances as roughly five feet for children and eight feet for adults.)

Second, the doctors did not actually measure radiation levels or perform any primary research. Instead, they took data published in the late 1960s on TV radiation emissions and used standard formulas to estimate the radiation absorption at closer distances. It was not a formal study.

“It was a lark,” says Dr. Louis Korman, one of the letter’s authors. “I am not a radiation expert. We were just sitting around one day talking about buying microcomputers, and the subject came up that most people who buy home micros tend to hook them up to older color TVs to avoid tying up the newer set. They’ll get this TV from the attic, or buy it used at a shop... We were aware of the radiation scare in the late sixties and just wanted to caution that these sets should be used with prudence.

“You’ll probably see a lot of letters next month from people who’ll say we don’t know what we’re talking about.”

One of those letters may well be written by someone from the Electronic Instrument Association. A trade group representing TV manufacturers, the EIA did not take kindly to all the fuss. “We want to make two main points,” says Alan Schlosser, EIA public relations director. “There are a statistically insignificant number of pre-1970 color TV sets out there. And also, we believe the people who use home microcomputers tend to use these state-of-the-art devices on up-to-date TV equipment. We don’t want to pooh-pooh all this,
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---

**SuperGraphics 2.0**

**NEW Version with TURTLE GRAPHICS**

SuperGraphics, by John Fluharty, provides a 4K machine language extension which adds 35 full featured commands to Commodore BASIC to allow fast and easy plotting and manipulation of graphics on the PET/CBM video display, as well as SOUND Commands. Animations which previously were too slow or impossible without machine language subroutines now can be programmed directly in BASIC. Move blocks (or rosette ships, etc.) or entire areas of the screen with a single, easy to use BASIC command. Sroll any portion of the screen up, down, left, or right. Turn on or off any of the 4000 (8002/8032) screen pixels with a single BASIC command. In high resolution mode, draw vertical, horizontal, and diagonal lines. Draw a box, fill a box, and move it around on the screen with easy to use BASIC commands. Plot curves using either rectangular or polar co-ordinates (great for Algebra, Geometry and Trig classes.)

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A B Computers
but we don’t think the body of evidence supports it.”

**Solid State Is Safer**

Congress passed radiation standards for color TVs in the late 1960s, but the standards applied only to new models. Models then in use were not required to be modified because it was never actually proven that they emitted dangerous radiation, says the EIA. The whole scare was triggered when one manufacturer recalled one model which leaked radiation through a small vent-hole in the bottom of the set.

Before Congress passed the regulations, about 25 million color TVs were made between 1960 and 1970, nearly all in the late 1960s. It has been estimated that 1.5 to 10 percent of these sets exceeded the radiation limits set by the Food and Drug Administration’s Bureau of Radiologic Health in 1971. Since the average life of a tube-type TV is 11 years, most of these sets are no longer in use.

Nearly all the radiation is emitted from the vacuum tubes, not the picture tube. After the scare, manufacturers beefed up the shielding and turned toward safer solid-state circuitry. By 1972, virtually all TV’s were solid-state. The greatest hazard is from older TV’s which were improperly serviced, says Gene Koschella, who heads the EIA’s technical training program. If a serviceman did not replace the tube shielding, or jacked up the voltage to prolong the life of a fading set, more radiation than normal may be leaking from the TV. Due to the nature of the radiation, the dosage is more acute at close range.

“The radiation decreases rapidly as you back away from the set,” explains Koschella. “We’ve taken measurements and found that at four or five feet there’s practically no radiation at all. At any rate, the radiation we’re talking about is very soft. It’s not anything like the radiation you’d get from an atomic bomb or something. In fact, it will be absorbed by clothing or glasses.”

(That’s why the VA doctors calculated radiation absorption in the eyes and thyroid, areas normally unprotected by clothing – unless the computerist is wearing glasses and a neck scarf.)

If you are using a pre-1970 set for prolonged periods at close range, and are still worried about radiation exposure, Koschella suggests having the TV checked out to insure that no shielding was removed and that the picture tube voltage was not cranked up. But he emphatically warns against checking the voltage yourself – the voltage is very high and probably a lot more dangerous than the radiation.

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Part II:

This is the conclusion of a tutorial begun last month. Part II demonstrates how to handle complex multiplication in machine language. Though specific to Commodore machines, the techniques can apply to any microcomputer. In addition to providing an introduction to the use of SYS which allows you to take advantage of the machine language routines in your BASIC's ROM chips – this article also demonstrates a way to pass information between BASIC and machine language.

How To Use SYS

John C. Johnson
McKinney, TX

With knowledge of the subroutines discussed last month, it is now possible to write some extremely powerful machine language extensions to BASIC with reduced effort. Our example problem is a complex arithmetic subroutine; the complex multiplication portion will be discussed in detail. This problem was selected both because it is useful and because it illustrates the concepts of multiple inputs and outputs. (A discussion of the rules for complex arithmetic is given in Ruel V. Churchill's Complex Variables and Applications, McGraw-Hill, 1960.) The format for the statement is that given last month in line 200. A and B are the outputs, and C, D, E, and F are inputs; the asterisk (*) signals complex multiplication. The sequence of steps required to produce the result is given below.

1. Fetch the operation character (* or /) and save it.
2. Save the line scanner address for later use.
3. Scan past the output variables.
4. Evaluate each input expression and save it.
5. Save the line scanner position onto the stack, and reset the line scanner to locate the output variables.
6. Test for operation character.
7. Perform the multiplication operation for the real part.
8. Save the result in the output variable #1.
9. Perform the multiplication operation for the imaginary part.
10. Save the result in output variable #2.
11. Fix up the stack and CHRGET address.

A description of the program operation tied to the above description follows. The initialization portion is contained in lines 52 to 64. The purpose of this section is to change the USR vector to point to the start of the subroutine to allow a call with SYS 0. This is important because the conversion time for ASCII 0 is quite efficient, but the time to convert 30747 is substantial.

For example, you could avoid this by assigning 30747 to some variable and call by SYS A1. The efficiency of this approach is slightly better than SYS 0, but lacks the programming convenience. The initialization also sets the top of memory to protect the machine code from BASIC strings. Type SYS 30720 to initialize: the screen will clear and show READY.

The first two steps are accomplished by lines 68-73 and 77-80, respectively. The line scanner is operated to retrieve the operation character, * or /, to determine which of two subroutines will be active. Some error checking is accomplished, and the address of the line scanner is saved.

Accommodating Commodore BASIC

Step 3 is accomplished by lines 84-89. This section merely scans the line for all items between the commas so the line scanner will be positioned for accessing the inputs. One may ask, "Why omit picking up the output addresses at this point?"

The reason is strategic and involves the way in which Commodore BASIC handles variables that are subscripted. The subroutine as written allows subscripted variables as inputs and outputs. If an array element's address is determined before computing the inputs, then the output variable's location may change. This will occur only when a variable is used as an input before it has been defined. The BASIC interpreter will put the variable into the variable list and move array elements as necessary. If the destination variables are skipped at this point and all inputs are evaluated first, this problem will not exist.
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Step 4 activates the expression evaluator and computes input expressions. This is done by lines 93-107. The program sets the number of inputs to four (line 93), and a loop evaluates the input expressions and stores them in memory locations labeled V1 to V4. Some error checking is also employed. When this loop is finished, the last input will be in V4 and will also remain in the floating accumulator.

Step 5 is accomplished by lines 111-118. This step saves the line scanner address onto the 6502 stack. It will be necessary to restore it before returning to BASIC. The line scanner position is reset so that the subroutine is left in a position to scan for the output variables.

Step 6, lines 122-127, is required to direct the subroutine to the proper segment of code. This method is adequate for small table sizes like this example, but for larger table sizes this technique would certainly not be optimum. An alternate technique can be found in the MONITOR listing in the PET manual.

Steps 7 and 9 (lines 160-173 and 181-196, respectively) begin the actual computation for a complex multiply. The real part is computed first, and the result in line 173 is incorrect by a sign which subroutine NEGATE corrects. Step 9 does much the same thing for the imaginary part.

Steps 8 and 10 are identical in code allowing the use of a subroutine. DEST, lines 217-260, activates the variable lookup for each output variable and stores the contents of the FACC there. This subroutine could be used for any number of numerical outputs. Lines 250-256 handle the special case when the output variable is INTEGER.

Lines 217-227 handle the divide option and cause the FACC to be divided by the magnitude of the complex divisor which was calculated in lines 131-154 if a divide was specified. In this way the complex multiply section is common to both and saves memory. Lines 228-233 saves the FACC temporarily onto the stack, and lines 235-241 restore the FACC to allow the use of subscripted variables as outputs.

Step 11, lines 204-208, concludes the subroutine by retrieving the line scanner address from the stack and placing it into TXTPTR. When BASIC resumes control, the line scanner will be positioned at the end of the calling statement either on a colon or null character to allow BASIC to continue normally.

Speed Increases
The above technique for creating machine language subroutine linkages with BASIC offers considerable flexibility in passing information between the BASIC program and the subroutine. It avoids the problem of having to POKE and PEEK the transferred information.

The program, as written, incorporates a few optimizing decisions both from the standpoint of conserving memory and speeding execution. No claims are made that the program is optimum in either respect. Optimizing in either case is frequently accomplished at the expense of the other. The program was written, however, in a manner that would make the linking concepts described easy to understand.

Ultimately, the results will be put to the test with timing comparisons and with as many different results as there are people trying them. My results, which may not be optimum, show about an eight percent faster execution for a complex multiply and about 30 percent for a complex divide. These results were obtained by carefully allocating the variables for BASIC so that the variable lookup times would be minimized; however, in actual programs the machine language version could show even greater improvement.

The algorithm for the BASIC and machine language versions are the same; they even use the same arithmetic subroutines in ROM. The only saving comes from the variable lookup, which must be done twice for a BASIC program and only once for the machine language version. More complicated subroutines could save considerably more time than this.

Mr. Johnson has offered to supply tape or disk copies of the program for Commodore computers. Send tape (or
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Apple® BASIC For the Apple II®
A program is really two things working together: data and instructions. The instructions are in a numbered list and they are the jobs for the computer to do. The data is the information that gets worked on. That's why computing is sometimes called data processing. Your list of instructions to the computer (your program) will process information the way a food processor transforms food. You put in a potato and it comes out french fries.

"Processors" have several advantages over conventional tools. For instance, they are quite versatile. By slipping different cutting disks into a food processor, you instantly change the process. The potato can come out as hash browns, slices, or even soup. A similarly simple adjustment will change a program which calculates home mortgages into one which analyzes inflation or general investment strategy.

Data, the other part of a computing process, is even simpler to change. Change one number and a mortgage-calculating program will print out the payment schedule for a different interest rate. Change another number and you can see the effects of a 20-year instead of a 30-year mortgage. To see how instructions and data interact, and how easily one program can serve many purposes, let's make a general-purpose educational game.

**Easy Transformations**

One of the most valuable uses for a computer in the home is computer assisted instruction, often called CAI. Using the little program below, you can bring your child's textbooks to life. And if you add color, sound, or animation to this program, you'll have made learning into an exciting game. Good CAI can bring a child the best possible kind of education: joy in learning. Don't be surprised if your child heads for the computer instead of Saturday morning cartoons.

If you type in Program 1, your child can play a short, personalized vocabulary game. You'll want to change the name in lines 100, 190, and 210. Line 130 contains the answers and lines 230 and 240 contain the questions, each followed by the number of the correct answer. The BASIC instruction "READ" will go down these DATA lists, picking each one in order and keeping track of where it left off. To make a much larger game, just add more questions and answers in the same fashion. And be sure to change the number in line 10 to equal the total number of questions in the quiz. To print more answers on the screen, just add more **PRINT** statements anywhere between lines 130-150.

To easily transform this game into a test of world capitals, just replace the DATA and change the messages in lines 100 and 150. Program 2 demonstrates how little effort it takes to change this into CAI on another topic. Take any textbook and make a list of the facts being taught in it and enter them into the DATA of this program. You could even use numbers like "1 + 5" in place of word answers.

If you make the screen change colors, or add music, or design some graphics characters which dance around ecstatically after a correct answer you'll add to the attractiveness of this learning game. Perhaps have a little figure put a picture puzzle together, adding new pieces each time the child makes the right guess in the quiz. Or you could construct a game around your child's favorite cartoon character. Have the "hero" of the game climb stairs. A perfect score puts the character at the top where he can open the treasure chest.

Whatever special touches you decide to add, your child is sure to respond to this personalized, interactive, and very patient teacher. And no matter how elaborate the game becomes, it can always be quickly transformed with new questions and answers in the DATA lines.
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Program 1: Vocabulary Game

100 PRINT "HELLO, SUSAN, LET'S PLAY THE VOCABULARY GAME."
110 FOR T = 1 TO 100: NEXT T: PRINT
120 FOR I = 1 TO NUMBER
130 PRINT "1. SILENT 2. HOPE 3. PERFECT 4. DENTIST 5. PRETTY"
140 PRINT
150 READ QUS: PRINT QUS "-- MEANS THE SAME AS WHAT NUMBER ABOVE?"
160 INPUT GUESS: IF GUESS < 1 OR GUESS > NUMBER THEN GOTO 160
170 READ KEY
180 IF KEY <> GUESS THEN PRINT "SORRY, THE RIGHT ANSWER IS" KEY: GOTO 200
190 PRINT "GOOD! YOU GOT IT RIGHT, SUSAN!": S = S + 1
200 PRINT
210 PRINT: PRINT "SUSAN'S FINAL SCORE IS" S
220 PRINT "TO PLAY AGAIN, JUST TYPE RUN AND PRESSTHE RETURN KEY"

Program 2: Capitalism Game

100 PRINT "HELLO, SUSAN, LET'S PLAY THE CAPITALISM GAME."
130 PRINT "1. ENGLAND 2. FRANCE 3. CHINA 4. EGYPT 5. RUSSIA"
150 READ QUS: PRINT QUS "-- WHICH COUNTRY ABOVE?"
230 DATA PEKING, 3, PARIS, 2, CAIRO, 4
240 DATA MOSCOW, 5, LONDON, 1

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To run the PET/CBM version on the VIC-20 the following changes must be made:

- **line 120** — change PRINT TTAB(12) to PRINT
- **line 305** — change 44 to 22

On the VIC-20, names must be no more than 15 characters long.

NAME PLAY

Bob Sullivan
Oak Park, IL

Youngsters will enjoy producing a printout of the names typed into the computer. These printouts are great for copying with crayons.

After the REM statements are removed, the program uses less than 1K and takes only a few minutes to type into the computer. First, personalize the data list in lines 1000-1080 with the names of family members, pets, friends, and close relatives. Next, assist your neophyte computerist with the following commands:

1) Press 1-9 for the desired name.
2) Press the correct sequence of letters.
3) Press @ for a printout of copied names.
4) Press the home key to turn the screen off or on.

To break into the program, make sure that the screen is off and then press the STOP key.

This program works well with the QUADRA-PET techniques that were outlined in the July 1981 issue of COMPUTE!:

1) Load and run QUADRA-PET.
2) SYS926 and NEW each PET.
3) Append NAME SUCCESS into PET 4.
4) SYS926 to PET 1.

If you avoid machine language and greater than (> ) DOS commands, PET 1 will operate, load, and save as an ordinary 8K PET. Additionally, you will be able to switch from PET 1 to PET 2 in less than six seconds, thus allowing yourself a short break while the young ones are in the mood for their program.

Beginner’s Note

The key to this program is in line 400:

```
CLS = MIDS(D$(A),1,1)
```

A MIDS function is used to look at each letter in the name. The instruction is set up to take the letters one at a time from left to right. The first item in the parentheses, D$(A), indicates the word chosen from the menu. The next item, I, refers to the current number in the for-next loop and insures that we progress from letter number one to the last letter in the word.

Conveniently, the MIDS function uses this center area to designate the number of spaces in from the left side of the string to start identifying characters. The 1 at the right in the parentheses shows that the function is to use only one letter at a time. Finally, we let this function equal CLS. After this line in the program instructions, CLS is used to represent the next letter that should be pressed by the user.

Program 1: PET/CBM Version

```
0 CLR:PRINT"{CLEAR}":POKE59468,12
1 POKE144,49:REM ###DISABLE STOP KEY (UPGRADE)###
110 N=9:DIM D$(N),PS(20)
120 FOR I=1 TO N:READ D$:D$(I)=D$:PRINT:PRINT TAB(1)$(I)"D$(I)":NEXT
199:
200 REM *** MENU COMMANDS ************************
210 GOSUB 63998:IFA$=n@"THEN GOSUB 0:GOTO 0
220 IFAS="{HOME}" THEN PRINT{"CLEAR}":GOSUB63997
230 IFAS="@" THEN PRINT:"{CLEAR}":GOSUB63998:GOTO:0
240 V=V+1:PS(V)=D$(A):REM *** LOAD PRINTOUT LIST***
299:
300 REM *** DISPLAY NAME AND GET READY FOR COPY***
310 PRINT"{CLEAR}"{07 DOWN}":GOSUB380:PRINT D$(A)
320 PRINT D$(A):GOSUB380
330 FOR I=1 TO L:CLS= MIDS(D$(A),I,1)
340 GOSUB63998:IFAS=CLS THEN PRINTCLS:GOTO440
350 GOTO420
399:
400 REM *** ACCEPT ONLY CORRECT RESPONSES ****
410 FOR I=1 TO L:CLS=MIDS(D$(A),I,1)
420 GOSUB63998:IFAS=CLS THEN PRINTCLS:GOTO440
430 GOTO420
440 NEXT
499:
500 REM *** RETURN TO MENU *********************
510 GOSUB63998:PRINT{"CLEAR}":RESTORE:GOTO120
599:
600 REM *** PRINTOUT THE NAMES ******************
610 OPEN4,4:PRINT#4:FOR I=1 TO V:PRINT#4,PS(I):NEXT:PRINT#4:CLOSE4:RETURN
699:
```
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1000 REM *** DATA LIST OF NAMES ****************
**
1010 DATAMOM
1020 DATAPRETZEL
1030 DATACAD
1040 DATAMELISSA
1050 DATABETH
1060 DATAGRANDMA
1070 DATATAUNTDENISE
1080 DATAGRANDPA
1090 DATAGRANDMASULLIVAN

63995 : 63996 REM *** WAIT & GET SUBROUTINE ************
**
63997 POKE144,46:REM ### ENABLE STOP KEY (UPGRADE

**
63998 GETAS:IFA$=nnTHEN63998
63999 RETURN

Program 2: Atari Version
110 DIM N$(20),P(9)
115 OPEN #1,4,0,"K:"
120 GRAPHICS 2+16:RESTORE
130 FOR I=1 TO 9:SOUND 0,I*20,10,B
140 READ N$(I);CHR$(I+176);CHR$(169 )
170 NEXT I:SOUND 0,0,0,0
170 GET#1,A
190 IF A=44 THEN 500
200 A=A-48:IFA<1ORA>9THEN170
210 FOR I=1 TO V:IF P(I)<A THEN NEXT
220 RESTORE
230 FOR I=1 TO A:READ N$:NEXT I
240 GRAPHICS 2+16
250 POSITION 9-LEN(N$)/2,5:?#6;N$
250 FOR I=1 TO LEN(N$)
270 GET #1,A:IF A>ASC(N$(I)) THEN 27
280 POSITION 9-LEN(N$)/2+1,6
290 PUT #1,A+128
295 FOR W=15 TO 0 STEP -1:SOUND 0,A,1
295 O,W:NEXT W
300 NEXT I
310 FOR W=1 TO 50:POKE 710,PEEK(53770)
310 :SOUND 0,PEEK(53770),10,B:NEXT W
320 GOTO 120
330 REM PRINT OUT
500 REM PRINT OUT
505 TRAP 580
510 GRAPHICS 2+16: ? #6;"PRINTING NAME
510 GET:"
520 FOR I=1 TO V
530 RESTORE
540 FOR J=1 TO P(I):READ N$:NEXT J
540 FOR W=15 TO 0 STEP -1:SOUND 0,W,0
545 O,W:NEXT W
550 ? #6,N$:LPRINT N$:LPRINT
560 NEXT I
570 RUN
580 GRAPHICS 2+16: ? #6;"PRINTER NOT O
580 N!"
590 FOR W=1 TO 500:NEXT W:GOTO 120
1000 REM LIST OF NAMES ()
1010 DATA MOM
1020 DATA PRETZEL
1030 DATA DAD
1040 DATA MELISSA
1050 DATA BETH
1060 DATA GRANDMA
1070 DATA AUNT DENISE
1080 DATA GRANDPA
1090 DATA GRANDMA SULLIVAN

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A Monthly Column

Being language literate is absolutely essential in our society. Being computer literate is a great advantage and is rapidly becoming a necessity. What is being done to meet the need for this new area of education? Getting computers into classrooms across the country is a start, but just a start. There is a great deal more involved.

Learning With Computers

Computer Literacy: Can We Get There From Here?

Mary Humphrey
Teaching tools: Microcomputer Services, Palo Alto, CA

literate / adj. 1: educated, cultured  2: able to read and write

Computer literacy is now a common term in education circles, and with it has come a growing demand to develop programs to teach it. For some educators, a new literacy is the chance to open additional avenues of thinking and communicating. For others, the mention of computer literacy causes reactions from deep sighs and “here-we-go-again” looks to near panic. Why the difference?

Language Literacy And Computer Literacy
An analogy between language literacy and computer literacy is often made, and there are many useful similarities. Just as one need not know how to physically make a book, but should be able to create and comprehend a written passage, one need not know how to build a computer, but should be able to successfully use one and to create at least a simple program. This analogy has been the basis for several recent articles proposing definitions or guidelines for computer literacy. The difference in reactions is not due to debate over what it is. The goals of computer literacy, like the goals of language literacy, are valuable skills that can be generally regarded as critical for members of our society.

Those who react to computer literacy with eager anticipation are thinking about the end product; those who dread it are thinking about delivering that product. Here the analogy between language literacy and computer literacy breaks down. Many education departments have been given a mandate to develop definitions of computer literacy, establish criteria for teacher certification, and begin pre-service and in-service teacher training programs.

Shortly thereafter, school districts and local boards are expected to create and implement student curricula. For these administrators and teachers, the concerns are not “Where are we going?” but rather “How are we going to get there?” For them, the differences between language literacy and computer literacy are glaring.

Becoming A Computer Teacher
Reading and writing competency criteria, instructional programs and standardized tests have been developed over many years with the support of much study. Computer literacy has been pondered for only a relatively short period of time. There has been little opportunity to test any of the guidelines offered, and many authors on the subject encourage educators to develop their own definitions.

Reading and language arts teachers have themselves received many years of training in these skills and in how to teach them. The criteria for teacher certification are quite explicit. Teachers charged with computer education have typically had little computer training and even less instruction in how to teach computer skills. Becoming a computer instructor is often more a matter of personal interest and initiative than of formal qualifications.

Support materials for teaching reading and language arts are big business. Teachers are accustomed to readily available, high quality textbooks, films and slides, classroom display materials, worksheets, and student activity kits for reading and writing. Currently there are few computer literacy materials. Publishers and software developers have had time to produce only a first generation of computer literacy materials, and as yet have had little feedback from educators.

The role of home-based education is also quite
different for these two types of literacy. There have always been some parents who have actively encouraged their children to learn to read and write, but reading or writing together as a family activity is usually limited to bedtime stories and thank you letters to Grandma.

Those parents who have personal computers at home seldom have to coax their children, no matter what age, to use the computer. There is a great deal of commercial promotion of various uses of computers as family activities. Teachers are realizing that this considerable amount of home learning is a welcome change, but also a challenge to the schools.

Added to these differences are two common misconceptions about computer literacy. First, it's a new and often unfamiliar area to many educators. Unfamiliarity can be confused with difficulty. This has been especially true of computing. The stereotype of high technology as a scientist's domain still lingers, despite the current efforts to promote personal and home computers as "user friendly." Because many educators have not been given adequate training in computer skills, they suspect that this new curriculum area may be beyond the capabilities of the schools, particularly the elementary schools.

There are also many educators who are confident computer-users, but who fall prey to a different intimidation. They are aware of the potential of computers in education and the amazing pace at which new developments are occurring. For them the implementation of a computer literacy program is a scramble to get it all done within the current school year. The pressure to catch up to the needs of business and industry for computer literate graduates can seem overwhelming if viewed from this perspective.

Getting There From Here

At this point it all sounds very discouraging, and you may be wondering whether schools can overcome these obstacles and go on to develop a new curriculum. There is lack of teacher training, lack of support materials, and pressure from outside the school. Do schools even want to try? The best answers to these questions come from the schools' own reports.

During the 1981-82 school year, many districts and local school boards began computer literacy programs. This year they were joined by more schools, and still others are laying the groundwork for programs in the 1983-84 school year. Several school districts, computer-education groups, and even individual teachers have written reports on their own computer literacy programs. Their enthusiasm is clear. The strongest encouragement can be found in evaluations of existing programs.

These "how-to" accounts are sincere attempts to help others through the first steps of implementing a computer literacy curriculum. Many are available for the asking or for a minimal charge to cover costs. I strongly recommend that those involved with a computer literacy project get these materials.

Several reports are of interest for those who are beginning a computer literacy program. They are particularly helpful in dealing with the difficulties of establishing a program of teacher training. "Instructional Uses of Microcomputers: A Report on British Columbia's Pilot Project" (research conducted by JEM Research) describes the planning and implementing stages, the training and other services provided, and a complete evaluation of the impact of these services. This report is also useful as a guide to planning for future evaluation. Requests for copies of the report should be sent to: Project Planning Centre, Ministry of Education, Legislative Building, Victoria, British Columbia, Canada V8V-1X4.

Computers in the Classroom is another especially thorough guide. This "booklet explaining the process of implementing computers into the elementary classroom" is written by Susan Burleson, an assistant principal in the San Ramon Valley Unified School District. It is a step-by-step account of what this district did and did not do and their recommendations to others.

Chapters cover setting goals in a district, identifying resources, computer awareness and readiness for in-service training, obtaining funds and budgeting, in-service training, school-wide use and home use of computers, anticipating problems, and evaluating progress. Copies cost $11 and are available from Susan Burleson, 599 Bridgewater Rd., Danville, CA 94526.

A highhearted but quite useful guide to over-

Developing A Curriculum

In addition to issues of teacher training, I discussed the need to develop a student curriculum and the lack of supporting teaching materials as difficulties in teaching computer literacy. Again, the response from those with experience is encouraging and enthusiastic. Many groups have committed a great deal of time and effort to developing curriculum guides complete with resource lists and bibliographies, tables of computing topics and their objectives, and descriptions of classroom activities and necessary materials.

An excellent example is the CLAS (Computer Literacy and Awareness for Students) package developed by the TRI-County Computer Consortium of Southeastern Michigan. Macomb County Intermediate School District, Oakland Schools, and Wayne City Intermediate School District combined efforts to produce a comprehensive and detailed computer curriculum. The cost is $10. Write to Tom Hartsig, Macomb County School District, 44001 Garfield Rd., Mt. Clemens, MI 48044.

The “home-made” materials developed by teachers and school groups may not have the glossy, typeset appearance of professionally produced materials, but they are carefully constructed and genuinely useful teaching aids. There aren’t enough of them. Educators still have to search them out, and the schools are not prepared for mass distribution, but they are invaluable models. Publishers and software developers will also find them useful guides.

A quick look at the resources I’ve mentioned here is enough to demonstrate how much interest and effort is being generated. Schools are putting more into computer literacy than just computers. Even those who sigh or panic at the mention of computer literacy can see evidence of the payoff. It may be sooner than we think that we will be able to spend less time accomplishing computer literacy and more time enjoying the benefits of its new avenues of thinking and communicating.

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Recursion – Part 2

Last time, we explored recursion as a powerful programming tool. The basic elements of a recursive procedure include:

1. A conditional statement to tell when to stop the recursive process;
2. A series of commands to be executed at each recursive level; and,
3. The use of the procedure itself with, perhaps, new values for the procedure’s variables.

The sequence and intermixing of these elements determine the type of recursive process being followed. Recursion can range from simple looping to the more complex forms we used for drawing fractals.

Because of the obvious visual relationship between certain fractals and the recursive procedures that generate them, we will examine some more of these this month.

Before doing that, however, let’s make a small digression to examine the difference between the conditional branching commands commonly used with Logo programs for the Apple computer and the conditional branching command used by TI Logo.

The structure of the command we have been using is:

IF predicate instructionlist

This means that the structure of the command is the word IF followed by an operation whose result is either true or false (the predicate), followed by a list of instructions to be executed if the predicate is true. An alternate form of this command is:

IF predicate THEN instructionlist

This form of the command is common to most BASICs as well, and might be familiar to many of you.

TI Logo uses a different type of conditional command, one which is more reminiscent of PILOT. In TI Logo the IF ... THEN ... construction is replaced by:

TEST predicate
IFT instructionlist1
and also
IFF instructionlist2

This construction allows you to test a predicate in a line all by itself, and to then execute certain instructions selectively, based on the result of the test, anywhere after the TEST command. The command IFT will execute instructionlist1 if the result of the test was true, and the command IFF will execute the list if the result was false.

In Apple Logo our conditional command in the fractal procedure is:

IF :SIZE < :LIMIT [FORWARD :SIZE STOP]

In TI LOGO this would be replaced by:

TEST :SIZE < :LIMIT
IFT FORWARD :SIZE STOP

One other note for TI Logo users; you may find that your turtle’s pen “runs out of ink” on the more complex curves. You might want to try drawing smaller versions of them to minimize this problem. Of course, you should be sure to clear the screen before drawing anything, just to be sure you have recovered as much “ink” as possible.

And now, on with the show!

One type of fractal that generates pretty pictures is the Koch curve we drew last time. In its most general form, we can define the motif for this type of curve as starting with a horizontal line, making some construction using line segments of the same length, and ending with a horizontal line on the same level as the first one. The following three fractals are particularly pleasing to me and to the people who have seen them exhibited at shows, so I am pleased to also share them with you. As in the past, all procedures will be shown in Apple Logo, and you can easily translate these to any other version of the language you might be using.

Before creating the curves, we will define a general setup procedure that puts the turtle in the correct starting position and orientation for each curve:
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The first curve we will explore is a square meander.

The procedure for creating fractals based on this figure is the following:

```
TO MEANDER :SIZE :LIMIT
IF :SIZE < :LIMIT [FORWARD :SIZE STOP]
MEANDER :SIZE / 4 :LIMIT
LEFT 90
MEANDER :SIZE / 4 :LIMIT
RIGHT 90
MEANDER :SIZE / 4 :LIMIT
RIGHT 90
REPEAT 2 [MEANDER :SIZE / 4 :LIMIT]
LEFT 90
MEANDER :SIZE / 4 :LIMIT
LEFT 90
MEANDER :SIZE / 4 :LIMIT
RIGHT 90
MEANDER :SIZE / 4 :LIMIT
END
```

Before using this procedure, let's examine it. The first thing to notice is that the value of SIZE is reduced by a factor of four for each successive use of the procedure. The reason for this is that the total horizontal extent of the original motif is four times the length of the line segment. The second thing to notice is that the double length of line in the motif is created by a double repetition of the procedure.

To see the motif, enter:

```
CLEARSCREEN
SETUP [-128 0]
MEANDER 256 256
SUCCESSIVE GENERATIONS CAN BE SEEN BY ENTERING:
MEANDER 256 64
MEANDER 256 16
MEANDER 256 4
```

As you look at each successive generation of this figure, it is interesting to note the development of secondary meanders resulting in a final highly convoluted (but strangely symmetrical) form.

The second curve I want to share is called the T-shirt fractal, since it was designed for use on a T-shirt (write me at Friends of the Turtle for details). In making this design, I thought that a fractal T-shirt should use a fractal T-shirt fractal, thus carrying the recursive process one step backwards to the overall shirt itself. The motif I designed looks like this:
The fractal procedure based on this motif is given by:

```
TO TSHIRT :SIZE :LIMIT
   IF :SIZE < :LIMIT [FORWARD :SIZE STOP]
   TSHIRT :SIZE / 3 :LIMIT
   LEFT 90
   TSHIRT :SIZE / 3 :LIMIT
   LEFT 90
   TSHIRT :SIZE / 3 :LIMIT
   RIGHT 90
   TSHIRT :SIZE / 3 :LIMIT
   RIGHT 90
   TSHIRT :SIZE / 3 :LIMIT
   RIGHT 60
   TSHIRT :SIZE / 3 :LIMIT
   LEFT 120
   TSHIRT :SIZE / 3 :LIMIT
   RIGHT 60
   TSHIRT :SIZE / 3 :LIMIT
   RIGHT 90
   TSHIRT :SIZE / 3 :LIMIT
   RIGHT 90
   TSHIRT :SIZE / 3 :LIMIT
   LEFT 90
   TSHIRT :SIZE / 3 :LIMIT
   LEFT 90
   TSHIRT :SIZE / 3 :LIMIT
END
```

To generate the motif on the display, enter:

```
CLEARSCREEN
SETUP [-81 -60]
TSHIRT 162 162
```

Successive generations can be formed with the following commands:

```
TSHIRT 162 54
TSHIRT 162 18
```

Notice that, for this pattern, there is a lot of overlapping in successive generations that makes it harder to identify the original motif. But, if you look closely, you will be able to see the motif hidden (in full size) in each generation.

The last pattern I wanted to show is from a piece of artwork entitled *F is for Fractal*. The motif is quite simple:
The procedure for this curve is a bit on the lengthy side:

```
TO F :SIZE :LIMIT
IF :SIZE < :LIMIT [FORWARD :SIZE STOP]
F :SIZE / 5 :LIMIT
LEFT 90
REPEAT 5 [F :SIZE / 5 :LIMIT]
RIGHT 90
REPEAT 3 [F :SIZE / 5 :LIMIT]
RIGHT 90
F :SIZE / 5 :LIMIT
RIGHT 90
REPEAT 2 [F :SIZE / 5 :LIMIT]
LEFT 90
F :SIZE / 5 :LIMIT
LEFT 90
F :SIZE / 5 :LIMIT
RIGHT 90
F :SIZE / 5 :LIMIT
RIGHT 90
F :SIZE / 5 :LIMIT
LEFT 90
REPEAT 2 [IF :SIZE / 5 :LIMIT]
LEFT 90
REPEAT 3 [F :SIZE / 5 :LIMIT]
END
```

The motif can be generated by entering:

```
CLEARSCREEN
SETUP [-85 -110]1
F 175 175
```

Further generations are created with the commands:

```
F 175 35
F 175 7
```

What I find particularly interesting is the manner in which the figure of the F in the motif becomes the background in the third generation.

By now, you probably have recursive programming firmly under control. You should continue to experiment on your own. The results may surprise you with their beauty!

**Calling All Atari PILOTs**

COMPUTE! reader Elliot Maggin sent me a delightful extension of a fractal program we described some months back. His program generates King Tut’s Headdress. I think you will like the result.

```
2 R:**************
3 R:*                *
4 R: 90-DEGREE     *
5 R:*                *
6 R:*     FRACTAL   *
7 R:*                *
8 R:**************
10 GR:PEN RED
20 GR:CLEAR
30 C:#A=54
40 GR:GOTO -79,-31
50 GR:TURNTO 90
60 U:*FO
70 GR:PEN BLUE
80 GR:GOTO -24,-32;TURN -90;FILL #A
90 GR:PEN RED
100 C:#A=#A/3
110 GR:GOTO -79,-31
120 GR:TURNTO 90
130 U:*F1
140 C:#A=#A/3
150 GR:GOTO -79,-31
160 GR:TURNTO 90
170 U:*F2
180 C:#A=#A/3
190 GR:GOTO -79,-33
200 GR:TURNTO 90
```
may be interested in *The Fractal Geometry of Nature*, a new book by the father of this study, Benoit Mandelbrot. I will be reviewing this book and commenting on the controversy in this field in a forthcoming “Computers and Society” column.

In the meantime, let me know what you want to read, and I’ll see what I can do to meet your needs.

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**A Year-end Note To All**

Before leaving this year behind, I thought you should know some of the things we have in store for you in 1983. First, I have received the Turtle Graphics package for the VIC designed and manufactured by HES, and will report on it in January. Also, I am now using the Radio Shack Color Logo package and will be reporting on it in the same issue. Those of you who are interested in fractals
This Commodore version of the language concludes the series on PILOT which began four issues ago and included Apple and Atari versions. This program needs at least 8K memory and works on tape or disk-based systems.

VIC And PET PILOT Interpreter

Michael Tinglof Merrimack, NH

PILOT is an acronym for Programmed Instruction, Learning, or Teaching. Because it is a simple language, teachers can easily develop lesson programs, and beginning students can quickly learn how to program.

This version of PILOT contains all of the core commands used for displaying information and accepting responses. It also has some mathematical capabilities.

The interpreter is written in BASIC so that it is transportable between machines. There is, however, one machine language routine called by line 3 and loaded by the following statement in line 20:

```
20 ....: FOR X = 826 TO 831: READ Z: POKE X, Z: NEXT
```

The routine can be loaded anywhere to suit your system needs by simply changing the 826 and 831 values. For the VIC, I would suggest changing the values to 820 and 825. Don't forget to change the SYS call in line 3 if you change the above values.

For computers other than Commodore, the routine must be replaced by an input routine which will accept colons and commas.

The next section describes the editor, the commands, and the implemented PILOT statements.

The Editor

The editor behaves just like the BASIC editor. To enter a line, type the line number, the PILOT statement, and hit RETURN. Any statement entered without a line number is assumed to be a command (see Commands) and is executed as such.

The screen editor is fully active during program entry. To correct an error in a statement or command, just move the cursor to it and enter the correction. Remember, the RETURN key must be pressed for it to be changed in memory.

When the editor is storing a PILOT program line in memory, it first removes the PILOT command and tokenizes it. Thus, if an illegal command is used, an error message will be generated before the program is run.

Commands

The following describes the editor's commands.

- **LIST xx-yy** – Lists the specified lines from memory. xx, yy, or both can be removed.
- **RUN** – Executes the PILOT program currently in memory.
- **SAVE 0:name** – Saves the program in memory to disk on drive 0. No quotes are necessary.
- **LOAD name** – Loads the program from disk. No quotes are necessary.
- **NEW** – Clears the current program from memory.
- **BASIC** – Exits the interpreter and returns to BASIC.
- **PLIST xx-yy** – Same as the list command, except the output is sent to device 4.

PILOT Variables And Statements

PILOT variables consist of either a “$” for a string variable or a “#” for a numeric variable, followed by a single letter. For example, #N and $S are correct, whereas $NAME is not.

The PILOT statements implemented are:

**T:** Type

Outputs text and variables to the screen. For example:

```
1 T: VALUE #X
```

will type "VALUE xx".

If the statement is ended by a ";" no carriage return will be printed.

**J:** and **U:** Jump and Use

Transfer program execution to the specified routine. In the case of Use, the current line number is stored so it can be returned to (see End). For example:

```
2 J:*PRINT
```

jumps to the routine labeled PRINT. Labels are designated by beginning a line with an "*" sign. No statement should follow this label on the same line.

**E:** End

Transfers control back to the statement following the last Use statement executed.

**M:** Match

Match is the most complicated and powerful of the PILOT commands. It checks to see if certain keywords are present in a string variable or in the input buffer (see Accept). For example:
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Fred D’Ignazio, Associate Editor—Computel,  Associate Editor—Softside, Author of bestseller—Katie and the Computer

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- Sub.—Vertical/Horizontal
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- Letter Sequence
- Like Symbol Discrimination
- Different Symbol Discrimination

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10 M: YES, OK, ALRIGHT
checks to see if YES, OK, or ALRIGHT are present in the input buffer. To check a string for keywords:

15 M$n YES, OK, ...
If a match is found the Y flag is set; otherwise the N flag is set (see Modifiers).

I: If
If is a nonstandard command which allows for mathematical testing. It can check to see if a given variable is less than, greater than, or equal to a second given value or variable. For example:

20 I: #N < 9

or

25 I: #C = #F
Only >, <, and = can be used.

C: Compute
Performs simple four-function calculations in a linear order (no parentheses) and assigns the value to a numeric variable. The calculations are performed in floating point mode so reasonable accuracy can be expected. For example:

30 C: #N = #C * 10 / #T + 10
If a "#R" is encountered in the expression, a random number between 0 and 1 is substituted.

A: Accept
Inputs a response from the user. If no destination variable is given, the response is stored in a buffer which can be used by Match. For example:

40 A: #N inputs a value into N
41 A: input a response into the buffer

H: Home
Clears the screen and returns the cursor to home.

End
Stops the program execution and returns to the editor. This statement cannot be modified by a "Y" or "N". For example:

50 END

Modifiers
Any of the commands can be modified with either a "Y" or "N". If a command is modified, it will be executed only if the specified flag is set. For example:

1 TY: YES
will print YES only if the Y flag is set. The Y and N flags are set by either a Match or If statement.

Error Messages
The following are the error codes generated during program run:

1 – Illegal variable name
2 – Unknown label
3 – Stack overflow (too many Uses)
4 – Stack empty (an E: with no Use)
5 – Bad format
6 – Division by zero
7 – Numeric out of range (greater than 32767)

Notes On Program Operation
1. To stop a PILOT program run, hit the "@" key. To stop a list, hit any key.
2. If for some reason the program returns to BASIC level, just type GOTO 40 <RETURN> to re-enter without losing the current program.
3. If a NEW statement is not given before loading a new program, the current program and the new program will be merged in memory.
4. The maximum number of lines allowed is contained in the variable M and is set in line 10. This can be changed.
5. For cassette operation, make the following changes:

500 OPEN 1,1,1, RS: PRINT "SAVING" RS
600 OPEN 1,0, RS: PRINT "LOADING" RS

6. This interpreter is about 3K bytes long, and about 4K bytes are taken after system initialization. This still leaves 3K on an 8K PET!

This program gives the user access to a fairly complete set of PILOT commands, while at the same time leaving enough space for program development even on an 8K PET.
240 FOR Z=7 TO 15: IF LEFT$(X$, 1) = "Y" THEN Z = Z + 10
250 IF MID$(X$, 2, 1) = "N" THEN Z = Z + 20
260 LS(L) = CHR$(Z-6) + MID$(X$, X): GOTO 50
290 OPEN 1, 4: GOTO 410
300 OPEN 1, 3
310 FOR X = L TO H: IF LS(X) = "": GOTO 450
320 X$ = "": Z = ASC(L$(X)): IF Z > 30 THEN X$ = LEFT$(LS$(X), 1): GOTO 440
330 IF Z > 20 THEN Z = Z - 20: X$ = "N" + X$
340 IF Z > 10 THEN Z = Z - 10: X$ = "Y" + X$
350 X$ = CHR$(Z + 6) + X$
360 PRINT USING $RS
510 FOR X = 1 TO M: IF LS(X) = "": GOTO 530
520 PRINT$(1, X, CHR$(13) + CHR$(34) + LS$(X) + CHR$(13) + CHR$(34) + CHR$(13);
530 NEXT X: CLOSE 1: GOTO 40
600 OPEN 1, 8, 2, R$: PRINT "SAVING" R$
610 FOR X = 1 TO M: IF LS(X) = "": GOTO 630
620 PRINT#1, X; CHR$(13) + CHR$(34) + LS$(X) + CHR$(13) + CHR$(34) + CHR$(13);
630 NEXT X: CLOSE 1: GOTO 40
700 OPEN 1, 8, 2, R$: PRINT "LOADING" R$
710 INPUT#1, X: IF X = 0 THEN GOTO 730
720 INPUT#1, L$(X): IF X = 0 THEN GOTO 710
730 CLOSE 1: GOTO 40
800 GOTO 10
1000 L = 0: FOR X = 1 TO 25: N%(X) = 0: S$(X) = "": NEXT: P = 0: F%= 0
1010 L = L + 1: IF L > M OR L$(L) = "END" THEN 40
1011 GETS$: IF XFS$ = "#" THEN 40
1015 IFLS(L) = "": GOTO 1010
1020 X = ASC(L$(L)): IF X > 40 THEN 1010
1030 IF X > 20 THEN X = X - 20: IF F% = 1 THEN 1010
1040 IF X > 10 THEN X = X - 10: IF F% = 0 THEN 1010
1050 C$ = MID$(L$(L), 2): GOTO 1100
1090 PRINT "ERROR in LINE" L: GOTO 40
1100 Z = 0: IF RIGHT$(C$, 1) = ";" THEN Z = 1: C$ = LEFT$(C$, LEN(C$) - 1)
1150 FOR X = 1 TO LEN(C$): X$ = MID$(C$, X, 1): IF LEFT$(C$, X) = "" THEN P = 0: F% = 0
1190 X = X + 1: Y = ASC(MIDS(C$, X, 1)): IF Y > 9 THEN GOTO 1200
1195 IF X = 4 THEN GOTO 1010
1200 IF Y = THENE = 3: GOTO 1090
1210 P + P = 1: S% = P: I = P
1220 IF VAL(C$) <> 0 THEN 4 THEN 1080
1230 FOR L = 1 TO M: IF C$ = L$(X): GOTO 1240
1240 L = X: GOTO 1080
1300 IF THENE = 4 THEN GOTO 1090
1310 L$ = "": P = 1: GOTO 1080
1500 X = 1: C$ = C$ + ": X$ = ACS$ + IFS$(C$, 1) = "": GOTO 1080
1510 FOR X = TOLENS(C$): IF MIDS(C$, Z, 1) <> "": THEN X = X + 1: Y = ASC(MIDS(C$, Z, 1)): IF Y > 9 THEN GOTO 1200
1520 Z$ = MIDS(C$, Z, 2 - 1): FORY = I TOLENS(X$): IF MIDS(X$, Y, LEN(Z$)) = Z THEN N% = 1: GOTO 1080
1560 NEXT X: IF IPS$ = "": GOTO 1080
1570 P = 0: GOTO 1080
1590 Y = ASC(MIDS(C$, 2)): IF Y > 9 THEN GOTO 1090
1595 X$ = S%: Y = 4: RETURN
1600 A = 3: Z = 0: X$ = "": IFLETS(C$, 1) = "": ORMIDS(C$, 3, 1) = "": GOTO 5: GOTO 1090
1620 IFMIDS(C$) = "": IF Y = 1 THEN N% = 1: Y = 1: A = 1: LEN(STR$(Y - 1)) = 1: GOTO 1650
1630 X$ = MIDS(C$, A - 1): IF Y = 1 THEN N% = 1: Y = 1: A = 1: LEN(STR$(Y - 1)) = 1: GOTO 1650
1635 IF Y = 1 THEN Y = 1: RND(1) = GOTO 1650
1640 Y = Y*%: X$ = A + 2
1650 IFPS$ = "": GOTO 1660
1655 IFPS$ = "": GOTO 1660
1660 IFPS$ = "": GOTO 1670
1665 IFPS$ = "": AND$ = THENE = 6: GOTO 1690
1670 IFPS$ = "": THENE = 2: GOTO 1690
1675 IFPS$ = "": THENE = 2: GOTO 1690
1680 IFAC = LEN(C$) = GOTO 1690
1695 Y = N%(X): IF Y = NOT(1) THEN N%(X) = "": GOTO 1690
1696 GOTO 1690
1697 X = ASC(MIDS(C$, 2)) = 64: IF 1 = 10 THEN GOTO 1690
1698 GOTO 1690
1699 Y = ASC(MIDS(C$, 2)): IF Y = 1 THEN GOTO 1690
1700 IFPS$ = "": THENE$ = 1: GOTO 1690
1720 X = ASC(MIDS(C$, 2)): IF 1 = 10 THEN GOTO 1690
1730 GOSUB 2: VAL(I$(S)) = PRINT: IFLETS(C$, 1) = "": THENE% = 1: GOTO 1690
1740 IFLETS(C$, 1) = "": THENE$ = 1: GOTO 1690
1750 GOTO 1010
1760 IFLETS(C$, 1) <> "": THEN 5 = GOTO 1690
1810 X = ASC(MIDS(C$, 2)): IF 1 = 10 THEN GOTO 1690
1830 X = ASC(MIDS(C$, 5)) = 64: IF 1 = 10 THEN GOTO 1690
1835 X$ = "N$(X)
1840 P = 0: IF XFS$ = "": AND$ = XTHEN% = 1
1850 IF XFS$ = "": AND$ = XTHEN% = 1
1860 IF XFS$ = "": AND$ = XTHEN% = 1
1870 GOTO 1010
1890 PRINT "CLEAR": GOTO 1010

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Last fall, Recreational Computing merged into COMPUTE! and we are now offering available back issues. Whatever your interest, you'll find something here — from BASIC to Computers in Sports Medicine, from Future Fantasy Games to Robot Pets.

September 1974 A Practical, Low-cost Home/School Microprocessor System. The Computer Literacy Problem, Eight Games in BASIC.

March 1975 Build Your Own BASIC. The Computer in Art.

March/April 1976 A TYT Game, Games With The Pocket Calculator, Digdood, Square, Tiny BASIC TO.


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Part II

Last month we featured the skeleton of the world's most intelligent Christmas card - an Atari program which would use several of the machine's special features to delight youngsters and involve them right away in using their computer Christmas present. The article concludes this issue with the spectacular music and animation version of the program. It requires 16K RAM.

An Atari For Christmas
Adding Music And Movement

Brenda Balch
Redondo Beach, CA

We completed the basic framework last month for the Christmas computer program. It should introduce my sister's family to computers in a most friendly way. Now I can think of something unique about each person who will be there Christmas day and turn that into a picture and melody. After a number of attempts my list looks like this:

<table>
<thead>
<tr>
<th>Name</th>
<th>Picture</th>
<th>Song</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brenda</td>
<td>Renaissance</td>
<td><em>Battle Pavane</em> (this sounds good only</td>
</tr>
<tr>
<td></td>
<td></td>
<td>instruments in four parts)</td>
</tr>
<tr>
<td>Carolyn</td>
<td>Children</td>
<td><em>It's a Small World</em></td>
</tr>
<tr>
<td>Kathy</td>
<td>Dancer</td>
<td><em>Dance of the Sugar Plum Fairy</em></td>
</tr>
<tr>
<td>Ruth</td>
<td>Cake</td>
<td><em>This is the Way We...</em></td>
</tr>
</tbody>
</table>

Making Melodies
First the music. All I want is short melodies. All these tunes are in my head, but how do I get them into my computer? I don't play by ear, but fortunately I have a friend who does. I watch his fingers and write down the notes as he plays.

Now I need to determine how long each note is. Out comes the Music Composer, and a lot of trial and error begins. Any mistakes left in these tunes are probably in my head, as well as in my Atari.

Since I think of music in terms of quarter notes, eighth notes, etc., I would like to enter each note as a pitch number (using the table in the BASIC Reference Manual is easy), followed by a 4, 8, etc. I also want to change the tempo easily until I like the speed. Thus the PNOTE (play note) subroutine is born. (Later I notice a dotted quarter becomes an awkward 2.66. Next time I'll try something different.)

The first time I wrote this subroutine, I tried to use the variable NOTE, which BASIC would stubbornly turn into NOT E. I finally decided to heed the advice to stay away from variables which start with keywords. (The use of INPUT$ can also give problems in certain contexts.)

The only four-part music I attempt is the Renaissance *Battle Pavane*. One interesting characteristic of this musical phrase is how the parts move at different times. This makes data entry difficult, and requires a different philosophy about when to turn off a note. I use zero as a flag to indicate that a note is not to be turned off (i.e., that it is to be held). I turn each note off just before the next note in that voice starts. If zero were needed to provide rests, one could be used as the flag to hold a note.

As I try various options, the code in the routine takes long enough that it affects the tempo. After several attempts I get a slow but regular beat (see lines 850-895). This involves using the subroutine to give a sixteenth note duration and using the main routine and hold flags to fill out quarter notes, etc. (I'll leave finding a better solution to a rainy day.)

Animation
I look through my list of pictures for required motion. Dancers certainly must dance, and I want to try simple player/missile graphics. Horizontal movement will be enough for me. I bring out my graph paper and discover my major problem is lack of artistic talent. How do dancers dance? Several tries (including walking around on my toes to watch what I do) produce the routine at lines 17000-17240.

A dancer should move in time to the music, so calls to PNOTE are alternated with changing the dancer's feet.

Nothing else in my list seems to require motion. But I find I can give the impression of something
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K-RAZY ANTIKS
From K-Byte/CBS
The White Ant needs all your help! You must guide it safely through the maze of tunnels in the Anthill; help it deposit and protect its White Eggs—while looking out for the Anteater and Enemy Ants who are trying to hatch their Enemy Eggs. Choose one of 8 mazes and 99 levels of difficulty. Requires joystick.
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happening by building cakes in layers, and changing background colors for the children.

The Pictures
I draw all of my pictures on graph paper and then turn them into X,Y coordinates. I try to standardize colors, but end up with a sizable list anyway. The only color which gives me much trouble is yellow. I need two sets of parameters for yellow. The color I get seems to depend upon the context of the colors around it. (If the coconut cake looks green on your screen, try the other yellow.) The colors I used are:

<table>
<thead>
<tr>
<th>a</th>
<th>b</th>
<th>color</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>black</td>
</tr>
<tr>
<td>0</td>
<td>4</td>
<td>dark gray</td>
</tr>
<tr>
<td>0</td>
<td>8</td>
<td>gray</td>
</tr>
<tr>
<td>0</td>
<td>14</td>
<td>white</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>gold</td>
</tr>
<tr>
<td>1</td>
<td>14</td>
<td>yellow #1</td>
</tr>
<tr>
<td>2</td>
<td>14</td>
<td>light orange</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>red</td>
</tr>
<tr>
<td>4</td>
<td>12</td>
<td>pink</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>purple</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>light blue</td>
</tr>
<tr>
<td>8</td>
<td>2</td>
<td>green</td>
</tr>
<tr>
<td>12</td>
<td>2</td>
<td>brown</td>
</tr>
</tbody>
</table>

Common Subroutines
I need common subroutines in this program for four things: delays, plotting, sound, and checking input strings.

Delay Subroutines:

<table>
<thead>
<tr>
<th>Name</th>
<th>Location</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDELAY</td>
<td>900</td>
<td>Short delay</td>
</tr>
<tr>
<td>MDELAY</td>
<td>930</td>
<td>Medium delay</td>
</tr>
<tr>
<td>LDELAY</td>
<td>960</td>
<td>Long delay (to allow a first grader to read two lines)</td>
</tr>
</tbody>
</table>

The delay subroutines simply loop a fixed number of times.

Plotting Subroutines:

<table>
<thead>
<tr>
<th>Name</th>
<th>Location</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>HPLOT</td>
<td>100-110</td>
<td>Plot horizontal lines, reading start x,y values and length</td>
</tr>
<tr>
<td>VPLOT</td>
<td>150-160</td>
<td>Plot vertical lines and reflected vertical lines (around an x-axis of REFL) reading start x,y values and length</td>
</tr>
<tr>
<td>PPOINT</td>
<td>200</td>
<td>Plot points, reading the number of points, and then the x,y values</td>
</tr>
<tr>
<td>HPLOTT</td>
<td>250-260</td>
<td>Same as HPLOT, except lines are translated by (OFFX, OFFY)</td>
</tr>
<tr>
<td>HPLOTTL</td>
<td>250-260</td>
<td>Same as HPLOTT except lines are reflected around an x-axis of REFL</td>
</tr>
<tr>
<td>SQPLOT</td>
<td>350</td>
<td>Plot 3x3 squares, reading the number of squares and the x,y values of the upper left corner of each square</td>
</tr>
</tbody>
</table>

The plotting subroutines are written as they are needed. For example, the only times I need vertical line segments to make my picture, the picture is symmetrical around an x-axis. Therefore, the only vertical plot routine plots the original and the reflected values.

Sound Subroutines:

<table>
<thead>
<tr>
<th>Name</th>
<th>Location</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>PNOTE</td>
<td>800-810</td>
<td>Reads a pitch and duration and plays a note; if it reaches the end it starts over</td>
</tr>
<tr>
<td>PCHORD</td>
<td>850-895</td>
<td>Plays the chord in ANOTE for one sixteenth duration (see earlier discussion)</td>
</tr>
</tbody>
</table>

Input Checking Subroutine:

<table>
<thead>
<tr>
<th>Name</th>
<th>Location</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHECKI</td>
<td>700-720</td>
<td>Described in Part I</td>
</tr>
</tbody>
</table>

Main Subroutines
The main subroutines are entered by using the GOSUB expression in line 3050. Therefore, each routine starts on a line number which is a multiple of 1000. Note that printing to the screen after graphics mode x + 16 returns to graphics mode 0. Therefore, the only explicit Graphics 0 commands are required after the Christmas tree which uses graphics mode 3. There is one main subroutine for each person on Christmas day:

<table>
<thead>
<tr>
<th>Location</th>
<th>Picture</th>
</tr>
</thead>
<tbody>
<tr>
<td>11000-11330</td>
<td>Renaissance instruments</td>
</tr>
<tr>
<td>15000-15440</td>
<td>Children</td>
</tr>
<tr>
<td>17000-17240</td>
<td>Dancer</td>
</tr>
<tr>
<td>19000-19210</td>
<td>Cake</td>
</tr>
</tbody>
</table>

One miscellaneous note: the Renaissance instruments pictured are krumhorns.
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=50: FOR CT = 1 TO 2: GOSUB PNOTE: NEXT CT
15090 FOR CT = 6 TO 14 STEP 2: SETCOLOR 4, 1, CT; GOSUB PNOTE; NEXT CT: RETURN
15200 DATA 4, 7, 5, 4, 8, 6, 4, 9, 10, 4, 10, 10, 4, 11, 6, 3, 12, 8, 2, 13, 10, 1, 14, 12, 0, 15, 14, 0, 0, 0
15210 DATA 4, 4, 4, 1, 6, 4, 2, 3, 8, 2, 2, 4, 3, 6, 4, 4, 6, 5, 6, 5, 6, 4, 4, 16, 2, 4, 17, 2, 4, 8, 2, 4, 19, 2, 4, 20, 2, 4, 21, 2, 8, 18, 2, 8, 19, 2
15220 DATA 8, 16, 2, 8, 17, 2, 8, 16, 2, 9, 19, 2, 10, 20, 2, 11, 21, 2, 0, 0
15250 DATA 4, 8, 6, 0, 9, 14, 0, 10, 14, 11, 0, 14, 12, 0, 14, 16, 0, 15, 8, 4, 16, 2, 8, 16, 2, 14, 17, 2, 8, 17, 2, 0, 0
15260 DATA 5, 0, 4, 4, 1, 6, 4, 2, 1, 6, 2, 2, 9, 2, 1, 4, 3, 6, 4, 4, 6, 5, 6, 5, 6, 4, 5, 7, 4, 4, 16, 2, 4, 19, 2, 3, 20, 2, 21, 2, 8, 18, 2, 8, 19, 2
15270 DATA 9, 20, 2, 9, 21, 2, 0, 0
15400 DATA 121, 2, 66, 121, 8, 96, 4, 121, 4
15430 DATA 96, 2, 66, 96, 8, 81, 4, 96, 4, 91, 2, 66, 92, 8, 91, 4
15440 DATA 96, 8, 108, 8, 162, 2, 128, 2, 121, 2, 0, 0
17000 ? "YOU LIKE TO DANCE."; ?GOSUB LDelay
17100 GRAPHICS 19: SETCOLOR 4, 2, 14
17200 POKE 559, 46, A = PEEK (106) - 8: POKE 54279, A: PEEK (128) + 256 * A = 52
17300 RESTORE 17200: FOR I = PMBASE + 512 TO PMBASE + 639: POKE I, 0: NEXT I
17400 FOR I = PMBASE + 512 + 9: POKE I, 0: NEXT I
17500 POKE 704, 132: POKE 53277, 3: MUSIC = 17210: TEMPO = 30
17600 FOR X = 192 TO 49 STEP -2: POKE 53248 + X: POKE 53248, 8: POKE 53249, 8
17700 POKE PMBASE + 519 + Y, 4; POKE 53277, 3: MUSIC = 17210: TEMPO = 30
17800 FOR X = 192 TO 49 STEP -2: POKE 53248 + X: POKE 53248, 8: POKE 53249, 8
17900 FOR X = 192 TO 49 STEP -2: POKE 53248 + X: POKE 53248, 8: POKE 53249, 8
18000 ? "YOU LIKE TO BAKE ―? "; ? "CU CONUT CAKE."; ?GOSUB LDelay
18100 GRAPHICS 19: RESTORE 19200: SETCOLOR 0, 13, 12: SETCOLOR 1, 0, 14: MUSIC = 19200: TEMPO = 30
18200 COLOR 1: PLOT 10, 17: DRAWTO 29, 17: PLOT 10, 16: DRAWTO 29, 16: FOR CT = 1 TO 4: GOSUB PNOTE:NEXT CT
18300 COLOR 2: PLOT 10, 15: DRAWTO 29, 15: FOR CT = 1 TO 4: GOSUB PNOTE:NEXT CT
18400 COLOR 1: PLOT 10, 14: DRAWTO 29, 14: PLOT 10, 13: DRAWTO 29, 13: FOR CT = 1 TO 3: GOSUB PNOTE:NEXT CT
18500 COLOR 2: PLOT 10, 12: DRAWTO 29, 12: FOR CT = 1 TO 3: GOSUB PNOTE:NEXT CT
18600 COLOR 1: PLOT 10, 11: DRAWTO 29, 11: PLOT 10, 10: DRAWTO 29, 10: FOR CT = 1 TO 3: GOSUB PNOTE:NEXT CT
18700 COLOR 2: PLOT 10, 9: DRAWTO 29, 9: FOR CT = 1 TO 4: GOSUB PNOTE:NEXT CT
18800 COLOR 1: PLOT 10, 8: DRAWTO 29, 8: FOR CT = 1 TO 4: GOSUB PNOTE:NEXT CT
18900 FOR CT = 1 TO 4: GOSUB PNOTE:NEXT CT
19000 COLOR 2: PLOT 10, 6: DRAWTO 29, 6: SETCOLOR 0, 0, 14: FOR CT = 1 TO 2: GOSUB PNOTE:NEXT CT: RETURN
19100 DATA 162, 8, 162, 8, 162, 8, 162, 4, 12, 8, 108, 4, 128, 8, 162, 2, 66, 144, 4, 144, 8, 144, 2, 66, 173, 4, 193, 8, 217, 2, 66
19210 DATA 162, 8, 162, 8, 162, 8, 162, 4, 12, 8, 108, 4, 128, 8, 162, 2, 66, 144, 4, 144, 8, 217, 4, 173, 8, 162, 2, 66, 1, 62, 2, 66, 0, 0, 0

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Hidden Maze

Gary Boden
Narragansett, RI

Mazes present a challenge different from arcade-type “shootout” games, but the appeal of a maze can quickly fade once it has been solved. A special program, “Maze Generator” (COMPUTE!, December 1981, #19), remedies that problem by drawing a different maze on each run. I have enhanced its challenge by hiding the complete maze from the player and showing only a realistically limited view from any position inside it. Although the view is from above rather than ground level, the player still gets a claustrophobic feeling similar to that of actually being inside the maze and groping along the corridors.

The objective is simply to find a way out of the maze in the least amount of time. Realism is added by showing at most only seven cells in any of the four possible directions of movement. This simulates holding up a lantern and peering down various avenues of escape – at a certain point the light either illuminates a wall or disappears into the gloom.

Moves are made by pressing a key for a particular direction. If no wall obstructs, the player’s token advances one cell and a new limited view is displayed. Time ticks on relentlessly whether the player is moving or thinking. Hitting a “panic button” reveals a quick glimpse of the whole maze, but at a high price – 500 time units.

After instructions are given, a seed number is typed in to start the game and feed a random number generator used for drawing the maze and placing the exit. Because the original maze generator results in a maze with only one possible path to the exit, I use the RND function to knock out some interior walls randomly to produce more pathways and more choices for the player. A greater value for the seed removes more walls.

Next the maze is generated, but in memory rather than on the screen. Starting and finishing locations are established, the player’s token is moved to the start, and play begins with display of the first limited view. The start, determined in line 660, is at the center of the maze, and the exit is placed at a randomly selected point on either the left or right wall (lines 360-370). The updated score is given with each new limited view, and play continues until the exit is reached.

Three final notes: 1) The program requires about 30 seconds to set up the maze. To indicate all is working well, a POKE S2,J in lines 210 and 320 produces a rapidly changing character in the center of the screen. 2) The maze size given in this listing is 23 x 23 cells, but smaller sizes can be created by changing the values of H in line 605 according to this table:

<table>
<thead>
<tr>
<th>Size</th>
<th>Value of H</th>
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</thead>
<tbody>
<tr>
<td>7 x 7 cells</td>
<td>H = 7</td>
</tr>
<tr>
<td>11 x 11 cells</td>
<td>H = 11</td>
</tr>
<tr>
<td>15 x 15 cells</td>
<td>H = 15</td>
</tr>
<tr>
<td>19 x 19 cells</td>
<td>H = 19</td>
</tr>
</tbody>
</table>

Other sizes do not work. Centering of the whole view is done by line 650. 3) Several OSI-specific items were changed to convert the program for other machines. The video display on the C1P is 32 characters/line; in line 605 change VL to an appropriate value. Also, variables WL, HL, S2, and symbol numbers for the token (240 in line 160) and the exit (69 in lines 370, 440) were changed to something meaningful in each computer’s graphic character set.

Program 1: PET Version

10 GOTO 400
100 REM - LIMITED VIEW
110 GOSUB 730: PRINT CT: FOR J = 0 TO 3: D = A: C = S2
120 FOR I = 1 TO 7: POKE C, M(D)
130 POKE C - E(J), M(D - D(J)): POKE C + E(J), M(D + D(J))
140 IF M(D) = WL THEN 160
150 D = D + A(J)/2: C = C + E(J + 1): NEXT I
160 NEXT J: POKE S2, 240: M(A) = 240: RETURN
200 REM - LAYOUT FIELD
210 FOR I = 1 TO H: FOR J = 2 TO H + 1: POKE S2, J
300 REM - GENERATE MAZE
310 M(A) = 4
320 J = INT(RND(R) * 4): Z = J: POKE S2, J
330 B = A + A(J): IF M(B) = WL THEN M(B) = J: M(A + A(J)/2) = H
340 J = -(J + 1)*-(J < 3): IF J = 0 THEN M(A) = HL: IF J > H THEN M(A + A(J)) = H
350 IF M(A) = H THEN M(A + A(J)) = H
360 M(A + A(J)/2) = H
370 M(A) = 69: M(Z) = WL: M(Z + Q1) = WL: M(Z + Q2) = WL
380 FOR I = 1 TO H
382 M(3*(H + 2) + INT(RND(R) * (H - 5)) + (H + 2) + INT(RND(R) * (H - 5))) = HL
384 NEXT I: RETURN
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Program 2: OSI Version

Make these changes to Program 1.

415 \texttt{K=PEEK(57100):CT=CT+1}
420 \texttt{J=-(K=252)*0} OR \texttt{(K=222)*1} OR \texttt{(K=250)*2}
425 \texttt{R(K=255)*3})
425 \texttt{IFK=126THEN50}
430 \texttt{IFK=254THEN145}
520 \texttt{POKES+L+F,M(L):NEXTJ}
605 \texttt{VL=32:H=23:FF=VL:REM FOR 80 COLS., CHANGE}
VL TO 80.
605 \texttt{VL=32:H=23:FF=VL:REM FOR 80 COLS., CHANGE}
VL TO 80.
640 \texttt{VL=160:HL=32:82=32768+INT(VL/2):CT=0}
710 \texttt{POKE13,34:POKE12,6:POKE574,96}
720 \texttt{FORX=0TO27:Y=PEEK(65036+X):POKE546+X,Y:NEXTX}
730 \texttt{X=USR(X):RETURN}
940 \texttt{PRINT"'ESC IS UP,"}
950 \texttt{PRINT"'CTRL IS DOWN,"}
960 \texttt{PRINT"'LEFT & RIGHT USE SHIFTS,"}
PRINT
970 \texttt{PRINT"'REPEAT' SHOWS THE FULL MAZE BUT COS}
TS POINTS,"}
PRINT
980 \texttt{INPUT"ENTER SEED NUMBER (1 TO 9);R:"}
100 \texttt{DIM DIR(3)}
100 \texttt{DIM DIR(3)}
150 \texttt{DIM(0)=20:DIR(1)=21:DIR(2)=19:DIR(3)=1}
160 \texttt{POKE 20,0:POKE 19,0}
170 \texttt{FOR I=0 TO 3}
180 \texttt{ZP=PP (1)+20:POKE 20,0:POKE 19,0}
170 \texttt{FOR I=0 TO 3}
180 \texttt{ZP=PP (1)+20:POKE 20,0:POKE 19,0}

Program 3: Atari Version

100 \texttt{REM HIDDEN MAZE: ATARI VERSION}
110 \texttt{GRAPHICS 17:GOSUB 360:GOSUB 480}
120 \texttt{POKES=SC+230}
130 \texttt{POKE PP0S,5}

Atari Notes

Charles Brannon
Editorial Assistant

For the OSI and PET versions, the maze is constructed inside an array, rather than directly in screen memory, as with the original maze-generator. This is necessary to allow an "invisible maze" which only gradually opens up as the player travels.

With the Atari, we have another option. We can construct the maze directly on the screen (GRAPHICS 1 is used here, with custom characters for the walls and player). We make it invisible by setting its color equal to the background color (done here with SET-COLOR 2.0, 0).

Then, to open up the maze, we just have to PEEK (into screen memory) the eight characters surrounding the player character, and if the PEEKed character is an "invisible wall," replace it with a visible wall.

Scoring is provided with RTCLOCK, Atari’s realtime clock, which is found at locations 18, 19, and 20. These are used in the opposite of the normal LSB/MSB order. Chaining all three locations together will give the current "jiffy time" since the machine was turned on, measured in sixtieths of a second:

\[
\text{JIFFY} = \text{PEEK(20)} + \text{PEEK(19)} \times 256 + \text{PEEK(18)}
\]

Since location 18 only ticks every once in a long while, you can leave it out for most measurements. Dividing the jiffy time by 60 gives you the time in seconds:

\[
\text{SEC} = (\text{PEEK(20)} + 256 \times \text{PEEK(19)}) / 60
\]

Playing Hidden Maze

Use the joystick to move your ebullient little character around the maze, your goal being the upper-left-hand corner of the screen. The challenge is in how long it takes you to get there. You can take a "cheat peek" of the entire maze by pressing the fire button. This will display the maze for about three seconds, then turn to black and delay your movement for another three seconds as a penalty. If you want a really good score, don’t use it!
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Shutterbug! This game was designed for kids but adults will find it hard to wait for their turn at the shutter! You are a passenger on a tourist bus. You have a camera and a roll of film. The object is to take pictures of houses, trees, and horses. Don't waste film on telephone poles! Shutterbug! it's easy to learn (only one key to push) and has very nice graphics to keep kids entertained for hours (teaches eye/hand coordinations). Plays from keyboard or joystick. For 5K VIC-20, Cassette $8.95, Disk $12.95.

Mad Painter! This game is a little unique and a lot of fun. You control a paint brush, moving it around a colorful maze. Your job is to paint the entire maze. This is not as easy as it sounds, because in the maze you are two voracious Briar Birds (they love paint brushes). Occasionally you will receive a visit from an Invisible Stomper who leaves footprints in your fresh paint! Requires joystick. Cassette $8.95, Disk $12.95.

Snake! A fast and fun action game for one player. You're a big snake roaming around the screen. Mice, nibbles, eggs, and feet appear at random. Your mission in life is to bite these targets. You have to be quick—targets don't stay long. The main problem is: you always seem to be running into the wall or into yourself! The longer you play, the longer, and harder to avoid your tail! Snake! Keeps high score and requires joystick. Cassette $8.95, Disk $12.95.

Munchmaid 5K! Due to popular demand, Munchmaid is here in a new 5K version for the unexpanded VIC-20. Fun to play with great graphics, of course! Munchdots, power dots, chase monsters and be chased. Munchmaid 5K! keeps high score and requires joystick. Cassette $10.95, Disk $13.95.

Snailball! Don't let the name fool you. This game is arcade action all the way! Your job is to protect a flower bed from an onslaught of killer snails. You are armed with a springy-tailed insecticide (environmentally approved, of course). As they zip across the field on their way to inhale your flowers, the snails lay eggs which you'd better destroy, too! For one player, keeps high score and requires joystick. 5K VIC-20, Cassette $10.95, Disk $13.95.

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P,PK-64*(PK=129)
190 ZP=PPPOS-DIR(I):PK=PEEK(ZP):POKE Z P,PK-64*(PK=129)
200 NEXT I
210 ST=STICK(0):TPOS=PPPOS+20*(ST=13)- 20*(ST=14)+(ST=7)-(ST=11)
220 CHR=3*(ST=11)+4*(ST=7)+5*(ST=14)+ 6*(ST=13)
230 IF STRIG(O)=0 THEN SETCOLOR 2,0,1 4:FOR W=1 TO 500:NEXT W:SETCOLOR 2,0,0:FOR W=1 TO 500:NEXT W
240 IF STRIG(O)=0 THEN 240
250 IF PEEK(TPOS) THEN 270
260 POKE PPPOS:0:POKE TPPOS,CHR:PPPOS=TP OS
270 IF PPPOS<SC+21 THEN 170
280 FOR I=1 TO 50:FOR J=0 TO 3:POKE 7 08+J,P:PEEK(53770):NEXT J:NEXT I
290 GRAPHICS 18:R"#6:you did it(!)"
300 SEC=INT((PEEK(20)+256*PEEK(19))/60):
310 IF SEC=0 THEN SETCOLOR 2,0,0
320 IF STRIG(O)=0 THEN 240
330 IF PEEK(711,B)=PEEK(53770):GOTO 340
340 POKE 711,PEEK(53770):GOTO 340
350 RUN
360 CHSET=(PEEK(106)-B)*256:FOR I=0 T O 7:POKE CHSET+I,0:NEXT I
370 RESTORE 410
380 READ A:IF A=-1 THEN RETURN
390 FOR J=0 TO 7:READ B:POKE CHSET+A* 8+J,B:NEXT J
400 GOTO 380
410 DATA 3,56,124,174,174,254,186,68, 56
420 DATA 4,56,124,234,234,254,186,68, 56
430 DATA 5,56,84,214,254,254,186,68, 56
440 DATA 6,56,124,254,214,214,186,68, 56
450 DATA 1,255,255,255,255,255,255,25 5
460 DATA 5,255
470 DATA -1
480 GRAPHICS 17:POKE 756,CHSET+256
490 SC=PEEK(BB)+256*PEEK(B9):SETCOLOR 2,0,0
500 DIM A(3):A(0)=2:A(1)=40:A(2)=2-A(3)=-40:WL=129:HL=0:TRAP 32767
510 A=SC+21
520 FOR I=1 TO 21:R"#6:))))))))))))))))))))))))))))))))))):
530 J=INT(RND(1)*4):X=J
540 B=A+A(J)
550 IF PEEK(B)=WL THEN POKE B,J+1:POK E A+A(J)/2,HL:A=B:GOTO 530
560 J=(J+1)*J(J<3):IF JCX THEN 540
580 RETURN

Program 4: VIC-20 Version
100 REM HIDDEN MAZE: VIC-20 VERSION
110 PRINT"(CLEAR)":GOSUB 360:GOSUB 400
120 PP=253
130 POKE SCR+PP,5:POKE CMEM+PP,2
140 DIM DIR(3)
150 DIR(0)=22:DIR(1)=23:DIR(2)=21:DIR(3)=1
160 T=TI

VIC-20 Notes
The VIC-20 version of Hidden Maze will run on a standard 5K VIC. Use your joystick controller to move the smiling face around the maze, which gradually appears as you move about. Try to reach the upper left-hand corner of the maze as quickly as you can. You can press the fire button to see the entire maze for a few seconds, but you will be “paralyzed” for another few seconds as a penalty.

This game is a direct translation of the Atari version and, as such, is an illustration of some aspects of converting Atari programs to the VIC. The Atari GRAPHICS 1 screen is similar to the VIC-20 screen (20x24 vs. 22x23). Both machines store custom characters in the same format (but at different memory locations). POKEs can be used on both machines to manipulate redefined characters as “shapes,” such as the face used in the VIC version.
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260 POKE SCR+PP,32:POKE SCR+TP,CHR:POKE CMEM+T P,2:PP=TP
270 IF PPK>23 THEN 170
280 FORI=1TO100:POKE CCTRL,255*RND{0):NEXT:POKECCTRL,27
290 PRINT"{CLEAR}{REV}{PUR}YOU DID IT!";POKE36
300 SEC=INT((TI-TJ/60)
310 PRINT"{GRN}IN";SEC;"SECONDS"
320 PRINT:PRINT"{CYN}PRESS{RED}{REV}SPACE{OFF}{CYN}TO";PRINT"PLAY AGAIN.{BLU}"
340 GETA$:IF A$=""THEN340
350 RUN
360 REM LOAD CHARACTER SET
365 CHSET=7168:POKE51,240:POKE52,CH/256-1:POKE55,240:POKE56,CH/256-l
370 FORI=0TO7:POKECH+256+I,0:NEXT
380 READA:IFA=-1THENRETURN
390 FORJ=0TO7:READB:POKECHSET+A*8+J,B:NEXTJ
400 GOTO380
410 DATA3,56,124,174,174,254,186,68,56
420 DATA4,56,124,234,234,254,186,68,56
430 DATA5,56,84,214,254,254,186,68,56
440 DATA6,56,124,254,214,214,186,68,56
441 DATA7,255,255,255,255,255,255,255,255
470 DATA-1
480 POKE36869,255
485 PRINT"{CLEAR}{22DOWN}{REV}GENERATING MAZE";HOME{OFF}
490 SC=7680:CMEM=38400:CCTRL=36879
500 DIMA(3):A(0)=2:A(1)=-44:A(2)=-2:A(3)=44
510 A=S+23:WL=7:HL=32
520 FORI=1TO21:PRINT"GGGGGGGGGGGGGGGGGGG"
530 J=INT(RND(1)*4):X=J:POKEA+505,J+128:POKEA+505,8*RND(0)
540 B=A+A(J)
550 IF PEEK(B)=WLTHENPOKEB,J+1:POKEA+A(J)/2,HL:
560 A=B:GOTO530
570 J=-(J+1)*(J<3):IF J<X THEN 540
570 230
580 PRINT"{HOME}{22DOWN}{HOME}";POKE505,32
590 RETURN

Program 5: Apple II Version
100 REM HIDDEN MAZE:APPLE II VERSION
110 HOME
120 GR : REM GO INTO LO-RES MODE
130 HTAB 13: FLASH : PRINT "GENE RATING MAZE": NORMAL
140 REM INITIALIZE VARIABLES
150 A(O) = 2:A(1) = -80:A(2) = -2:A(3) = 80
160 WL = 8:HL = 7:CT = 0
170 DIM M(1680)
180 A = 859:L = 40
190 REM GENERATE MAZE
200 FOR I = 2 TO 38: FOR J = 0 TO 38
210 M(I * L + J) = WL: COLOR= J: PLOT L * RND (1),L * RND (1): NEXT :
220 M(A) = 4: GR
230 J = INT ( RND (1) * 4): Z = J
240 COLOR= 16 * RND (1)
250 PLOT L * RND (1),L * RND (1)

Apple II Notes
The Apple II version of Hidden Maze uses low-resolution graphics (40x40). The maze is
hidden inside a 40x40 array, and each part of the maze is displayed using the standard
PLOT and COLOR commands. A good enhancement to the game would use page-flip-
ning in the high-resolution mode (to quickly flash the completed maze), and a series of
shapes for the player character.

Your player character is represented by a white square. Use the I,J,K, and M keys (I=up,
J=down, J=left, and K=right) to move the square within the maze. Try to "escape" the
maze by reaching the upper left-hand corner as quickly as possible. If you get stuck, press
SPACE for a brief view of the entire maze (you will be charged 500 extra "time units"
for this, however, and the screen will clear, erasing all the paths you've uncovered).
December 1982, Issue 31

Hidden Maze — Apple Version

159

460 IF DIR = 32 THEN 60 SUB 620;
470 IF M(TX + TY * 40) < > HL THEN
480 M(TX + TY * 40) = 15: M(PX + P Y * 40) = HL

500 IF (PX + PY * L) < > 121 THEN
510 FOR K = 1 TO 10
520 FOR I = 1 TO 10: A = PEEK( -
530 FOR W = 1 TO 10 - I:
540 TEXT: HOME: FLASH
550 FOR I = 1 TO 24: PRINT ";
560 FOR W = 1 TO 500: NEXT
570 FOR W = 1 TO 5000: NEXT
580 HOME: INVERSE
590 PRINT "YOUR SCORE:"; CT
600 NORMAL
610 END
620 REM DISPLAY WHOLE MAZE
630 FOR I = 2 TO 39
640 FOR J = 0 TO 38
650 COLOR = M(I * L + J): PLOT J, I
660 NEXT J
670 NEXT I
680 FOR W = 1 TO 500: NEXT
690 CT = CT + 500: BR : RETURN

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Fred D'Ignazio is a computer enthusiast and author of several books on computers for young people. He is presently working on two major projects: he is writing a series of books on how to create graphics-and-sound adventure games. He is also working on a computer mystery-and-adventure series for young people.

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

Letters From Readers:
Software, Sexism, And Other Topics

Fred D'Ignazio
Associate Editor

I have received lots of mail from people who read this column. Most people write to compliment me and tell me I'm on the right track. But I also get letters that are critical. I welcome both types of letters. Please keep them coming.

Recently, I received a letter from Jan Murphy who wrote that she had been enjoying my column each month. Then she read the column on the computer friend (COMPUTE!, August 1982). On page 82, she read the following words:

"Is this child a boy or a girl? The computer friend should know.
This line profoundly angered and upset Jan. Why? I'll let her tell you in her own words:

"Why am I mad? I said to myself, 'How refreshing it would be to have a friend who didn't care if you were a boy or a girl. And this computer friend idea would be a great chance to do that, but if everyone makes the computer friend know then that chance would be wasted.'

"Why "should" the computer friend know the gender of a child? So the friend can treat the child in an "appropriate" way? How about letting the computer friend treat the child like a child instead?

"I don't go around saying all men are horrible, or get active in political things, or do many other things that people imagine "feminists" do. I reject the term feminist; I want human liberation, freedom for both men and women to be who they are. So if my brother can't fix a car, who cares? That makes him bad at fixing cars, not "less masculine". And if I like computers, why shouldn't I? This is the kind of trap I see us all falling into when I read that the computer friend "should know" the child is a boy or a girl.

"It can't be coincidence that girls often do better in math in elementary school, yet by the time they are in the 12th grade, they can't cope with numbers. There were 3 out of 30 in my physics class, 3 girls and 27 boys. Why do you think I never learned which way to turn a screwdriver until one of my (male) friends taught me, in high school? Because "girls" don't get building toys for Christmas, that's why. Or telescopes, or chemistry sets, or tools. Why? There's no reason -- it's just the way things have always been done, that's all, and we don't bother to cast off all the old baggage from the past when a better way of doing things turns up. (Perhaps I should say it this way: nobody likes to give up old software.) That's natural. But (as
usual) Ursula K. Le Guin has said it before, and said it better than I ever could:

To oppose something is to maintain it. They say here that "all roads lead to Misknory." To be sure, if you turn your back on Misknory and walk away from it, you are still on the Misknory road. To oppose vulgarity is inevitably to be vulgar. You must go somewhere else; you must have another goal; then you walk another road.

-The Left Hand Of Darkness (Estraven, in chapter 11)

I want our children to be people first, and doers of great deeds, and makers of great works, creators and conservers and heroes; all these things first, and then, later, when they know who they are and that they can do great things, and that the world is full of wonderful things for them to learn, when they are firmly settled with a sense of their worth, then, they can also learn to be boys and girls (if it is still necessary) or men and women. But I want us to break the circle, as LeGuin would say, and go free. That's my goal. You want kids to be able to learn and grow, too, otherwise you wouldn't write such a neat column. Right?

So when you make your computer friend with your child (and this goes for both your children) please be careful and think about what you might be doing (unconsciously, I know) when you tell the computer friend things about your child. You've been pretty good so far, using "she" and "her" some of the time (I've noticed, yes, and I was impressed), so keep up the good work.

Well, you wanted input on your idea for a computer friend/pet. I don't know if this is quite what you had in mind. But a computer named after the Archmage of Roke deserves the best, and it would break my heart to see him acting like the computer in a bad Heinlein novel.

Thanks for your columns (I loved the story about Eric and your floppy disks; I'm glad you didn't lose anything) — I'm looking forward to Catie and Eric's further adventures.

A Response To Jan's Letter

Jan's letter was thoughtful and thought-provoking. It angered me and upset me. It also convinced me that I had made a serious blunder.

I spent several days thinking about what Jan said and talking it over with my wife. I've come up with a tentative response.

First, I'm glad Jan wrote. The issue she raises is vital. The more "friendly" that software becomes — the more it acts like a person — the more it will carry hidden values. The question is: what are those values? Are they fair to all people? Or are they prejudiced and unfair?

Also, this issue assumes even greater importance now that young children are beginning to use personal computers. These children's values are largely unformed or, at least, extremely malleable. Values hidden inside computer-friend and computer-tutor software might be easily transmitted to young children. Again, it's important for us, as parents and teachers, to uncover these values and make sure they are similar to our own values.

In this specific case, however, I'm afraid that I disagree with Jan over whether the computer friend should ask the child's sex. I still think it should. It should for two reasons.

First, the child's sex is a biological fact. Second, the child's sex is an important, perhaps decisive, factor in determining how other people will treat the child. For good or bad, it is too big a factor for the child, or the friend, to ignore. Only by dealing with it can the child (and the friend) overcome it.

Back to reason number one: biology. For biological reasons alone, the child's sex is a central fact of the child's life. The child identifies himself or herself, in part, based on that fact.

I'm not saying what that fact means. I'm not saying that girls and boys shouldn't be free to express their personalities. I'm only saying it is an important fact and should not be covered up, rationalized, or denied. If I were a girl or a boy and I had a computer friend, I would want my friend to know my sex.

Second, unlike the computer friend, the child does not live in a vacuum. It lives in the real world. And the real world is filled with people who discriminate against women and men (in different ways, of course). Prejudice is built into the laws, into people's values and opinions, into institutions, and into almost every activity of our lives.

If the friend is to become a real friend, it must learn which side of the sexual fence the child is on. Only then will it be able to relate to the challenges the child will face in trying to overcome the injurious sexual stereotypes that pressure the child into a certain kind of behavior, career, style of life, or whatever.

This issue seems a little over-dramatized, given the extremely simple computer friend we have discussed so far. But a major trend in computer software is to anthropomorphize computers and make them more lifelike, human, and friendly. Computer friends in the near future won't be toy programs to amuse preschoolers. They will be built into silicon chips and be an intimate part of our daily lives — in the office, in the school, and in the home. Therefore, the type of values our "friends" should have is a good issue to be thinking about right now.

What Do You Think?

Now it is your turn, readers. What do you think about all this? Please write and tell me how you
feel. Send your letters to:
Fred D'Ignazio
e/o COMPUTE!
P.O. Box 5406
Greensboro, NC 27403

A couple of months from now, I'll revive this issue and print some of the most thought-provoking letters I receive.

Computer Friends For Adults
A couple of weeks after I'd received Jan's letter, I got a letter from Irwin J. Davis of Bridgewater, New Jersey. In his letter, he proposed a computer friend for adults. Here is an excerpt from his interesting letter:

I read with interest your article about building a computer friend for a child. It did occur to me that the same concept could apply to adults. Why not build into the computer an adult personality like The Sage or Chief Mentor. The programmer could put in all his favorite sayings or aphorisms from secular or religious sources as Thoreau, Montaigne, The Bible, etc. The computer could suggest meditation exercises, relaxation techniques depending on how the person felt. In the past people would keep a journal and write sayings or thoughts of importance in them. Why not put them into a computer under certain categories and recall them for certain moods. Suggested types:

- The Sage or Philosopher
- The Psychologist
- The Swami
- The Man of Action
- The Rabbi, Minister, or Priest

The programmer would have to know quite a bit about his character, which would be a good exercise for him.

What do you think about this adult computer friend? Write me if this letter has given you any ideas.

Computing In The Third World
I am tucked away in a nice little city in the U.S. This city has every kind of computer support system I could possibly want. But what would happen if I were a total novice who wanted to acquire a personal computer and I lived somewhere in the Third World (a developing country in Africa, Asia, or Latin America)?

This was the issue posed to me when I received a letter from J. J. Bichier, in Caracas, Venezuela. Bichier is a bush pilot and author. He wants to get a personal computer.

Here is his story:

I am a bush pilot-operator, out there in South America. Though the idea has been floating in my mind for a long time, a couple of months ago on a flight to Miami, I

cought up with computers.

Flight plans, maintenance, operations, costs, losses and profits, all could nicely be automated and streamlined down to the nearest decimals, if I put together the proper hard- and software (within a reasonable budget) and learned how to use it.

To the good!

Besides the natural fascination for the technology itself, my main interest in computers lies in the fact that I am also an author.

When I think of the tedious time-and energy-consuming process of writing large books with paper, pen, typewriter, and dictionaries, my mind overflows with the reams of crumpled and unfinished versions I have to go through to get to the final copy. I am sixty and, besides the hard labor, there may not be that much time available.

That's where an adequate word processor, proofreading attached, comes in.

When I think of the possibility of pouring schematics, material, partial or polished chapters into the box, with the ability to retrieve the text instantly, look at it, work on it and store it again to maturation of page, chapter, book, I drool.

I naturally surrounded myself with all the magazines and a couple of books I could find, haphazardly, to fill in the blanks. I went through them hungrily. I am learning PET/CBM BASIC and it doesn't seem that far off.

But all the ads do not tell the whole story. Venezuela, my country, lies thousands of miles and weeks away from the mainstream of marketing, support and maintenance infrastructures of any technology, computation to the fore. That has to be considered as well. Another fact is my total lack of experience with the equipment, technologies, and skills concerned.

For weeks I have sent letters to manufacturers, wholesalers, dealers and others, to make up my mind as to hardware, softwares, methods and prices. I thought their literature might fill some of the gaps. To my dismay, there was no feedback. Nothing flat.

Since no one in my surroundings is interested enough or possesses the necessary experience to help me, I am calling blind: I beg of you to do so, if you would and could find the time.

After reading all the ads and related articles, promising the "ultimate tool" for so many dollars less than their competitors and a lot of mulling over, I come up with the following system layout:

- Commodore 8032 (main unit)
- Z RAM board (summing 96K main working memory and Z 80 64K CPM compatible memory)
- Commodore 8250 2 mega floppy storage
- C 1toh F 10 daisy wheel silent printer
- Word Pro 5+
- Compatible proof reader (unidentified)
- Small business management software I could easily adapt to airplanes (unidentified)
- Odds and cables
- Spare daisy wheels and ribbons
- Spare floppy disks
- All user and maintenance manuals for each piece of equipment
- Fast access to parts, boards, chips, bits and pieces
- Sourcing some $5000
- To be delivered at Fort Lauderdale Executive Airport, Florida, which is of easy reach for me.

Questions abound. Are the components wholly compatible with each other? How reliable and gremlin proof? Is the whole system compatible with my goal? Did I shoot short of the necessary memory to manipulate the making of books? Etc.

My audacity may surpass my ignorance and you may have a good laugh.

There is no 100% proof reason for me to espouse the Commodore system rather than any other in its price range. It just seems to fit and for no valid reason at all I like it. My philosophy on the matter is that whichever system I end up with, my task will be hundreds of times easier, once I master its particularities, learn it inside out, and stick with it.

Another factor in favor of Commodore is that it is represented in Caracas, though it carries a 100% markup over stateside retail prices. There may be some support there. On the other hand, a son of mine is trouble shooting for Ohio Scientific in Venezuela. With the proper manuals in hand, there should be no fuss to keep going.

Still, the decision is intimidating.

Another interesting challenge I can come up with is this: I am trilingual, but do word processors and proofreaders exist for Spanish or French tongues? The answer to that might make of me another non-native English writer, though most of what I have to say is a lot tastier in its native Spanish.

This is my story. I hope your secretary will be kind enough to let it reach you — so you may decide to help.

Whichever happens, I shall be counting the days to thank you.

If you have any knowledge that would help Señor Bichier, please write him directly:

Cap J. J. Bichier
Apartado de Correo Este 60409
Caracas 1060
Venezuela
South America

Also, I would very much like to hear from readers who know what it is like to use personal computers outside the United States, particularly in the Third World. In a couple of months, I will touch on this subject again and print excerpts from some of the letters I receive.

Upcoming: Teacher And Pet
In two months, I'll return to my discussion of the computer friend. We'll make the friend capable of remembering things it learns from the child. Then we'll experiment with this feature by creating a "friendly" computer teacher and a "friendly" computer pet.

As you read the column and try the friend programs, please write me with your comments and send me copies of program enhancements you develop — on any of the popular machines. At the end of my discussion about computer friends, I will print the most helpful letters and listings.
High res graphics can be used for games, math equation plotting, light pen applications, drawing designs — any application where you want to turn on one dot on the TV screen. This article explores high resolution graphics on the 5K and extended 8K VIC-20.

Understanding VIC High Resolution Graphics
Roger N. Trendowski
Randolph, NJ

The VIC performs high res graphics through bit mapping the screen. Bit mapping is a method where each dot of resolution on the screen (called a pixel) is assigned its own bit in memory. If the bit is one, then the pixel is on; if zero, the pixel is off.

Your screen displays 506 alpha/numeric/graphic characters, 22 horizontal and 23 vertical. Since each character is made of 8x8 pixels, your screen consists of 32384 pixels. With high res graphics, you can selectively turn off or on each of these 32384 pixels — if you have enough memory (more about memory requirements later). Without enough memory, the X or horizontal coordinate may vary from 0 to 176, and Y from 0 to 184.

VIC Technique
Bit mapping is done on the VIC using the “programmable character” technique — when you POKE a screen location with a number from within that location. Try this on an unexpanded VIC: press the [RUN STOP] [RESTORE] keys, then type in:

POKE36879,62
POKE7690,0

This places a character display code of zero in the top middle of your screen (location 7690). An “@” character should appear. The first POKE turns the screen blue so that you can see the character. To display this character, VIC takes the display code and looks up the corresponding eight lines in ROM (Read Only Memory) starting with location 37768.

In the case of display code “0”, the first eight bytes (memory locations) of ROM are used — 37768 through 37775. Each eight-bit byte in ROM defines a row of pixels which make up part of the “@” character. Now, if the display code “1” was POKEd instead of “0”, an “A” would be displayed — it is stored in eight bytes of ROM starting at 32776.

The next step in understanding the bit mapping technique is to see how programmable characters are changed. Since the ROM area where the alpha/numeric/graphic characters are stored cannot be changed by a POKE command, we must change the VIC pointer from ROM to unused locations in RAM (Random Access Memory). To change this pointer, type in:

POKE36869,253

This memory location, which contains both the character memory pointer and a screen memory pointer, now points to RAM location 5120. The graphic garbage on your screen represents random data stored in the new eight-byte character RAM locations. Hit the [RUN STOP] [RESTORE] keys to clear the screen.

Try this short program which will show some of the fundamentals of high res graphics and bit mapping.

10 POKE36879,62
20 FORI=5120TO6143:POKEI,0:NEXT
30 POKE7680,0
40 POKE36869,253
50 POKE5120,1
60 GOTO50

Look at what has happened at the top left of the screen. A pixel has been turned on in the first row. Line 20 of the program cleared random data out of the RAM memory locations 5120-6143. Line 30 put a display character code of zero in 7680 (normally an @ character equals display code zero). Line 40 changed the character pointer from ROM to RAM location 5120. Line 50 created a new character in the first of eight bytes that define display character zero. The remaining seven bytes of display character zero (locations 5121 through 5127) remain cleared, meaning their bits are equal to zeros. Line 50 causes bit position 0 (right-most bit in the byte) to equal one. Line 60 causes VIC to remain in a loop so that the screen does not display “READY” and interrupt our demonstration. A conclusion from this exercise is that setting a bit to one in programmable character memory (e.g., 5120, bit #0) turns on a corresponding pixel.

Try using binary word encoding with different values (0-255) in line 50 of the above program.

Bit # 76543210
Byte 5120 ~~~~~~~~~
00000001 = 1
00000010 = 2
10000000 = 128

To expand your understanding, type the following change to the above program and run it:
WORD PROCESSOR?

You bet! Quick Brown Fox word processing software has more features than Word Star and runs on even a standard VIC-20. And it can grow and grow. Add memory, 80 column display, disks, even a letter quality printer. We'll show you how a first-class word processor can be yours for less than $2000!

It all starts with the Quick Brown Fox at $65.

Call or write for our free brochure
Quick Brown Fox 548 Broadway New York NY 10012 (800) 547-5995 Ext 194
Dealer Inquiries Invited (212) 925-8290
30 U=0:FOR J = 7680 TO 7701: POKE J, U: U = U + 1: NEXT
50 POKE 5128, 1

The screen should show a pixel set in the 16th position from the left. Line 20 POKEs display codes of 0, 1, 2...21 into VIC's screen memory 7680 through 7701. Corresponding eight-byte blocks of RAM, starting with 5120, are cleared except for the bit 0 in byte 5128 – the top row of character number 1. Therefore, VIC turns on the corresponding screen pixel.

New
Programmable Character Memory

Screen Memory

<table>
<thead>
<tr>
<th>5120</th>
<th>5121</th>
<th>5122</th>
<th>5123</th>
<th>5124</th>
<th>5125</th>
<th>5126</th>
<th>5127</th>
</tr>
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<tr>
<td>00000001</td>
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</tbody>
</table>

For 8 Byte Display Character 0

(Note)

Note: When 8x16 character size is used, 16 bytes are used to define a display character on the screen.

Display Characters

If there are 506 character positions on the screen and only 256 possible display characters, then the question is: how do you fill up the rest of the screen? Use an obscure memory location – 36867, bit 0.

Type “NEW” and then type the following lines without line numbers:

POKE 36879, 62
POKE 36867, (PEEK(36867) OR 1)
POKE 7690, 0

Among graphic garbage, two characters should have appeared at the top center of the screen: an “@” over an “A”. The second line changed the VIC to a character matrix size of 8x16 (when bit 0 of this location equals 1). The VIC now uses the first 16 bytes to define display character 0. The third line POKEs display code zero into location 7690. In this way, by POKEing from 0 through 253 display codes on the screen, we can display all 506 character positions.

Memory Requirements

As mentioned earlier, bit mapping the entire screen would require 32384 pixels or 4048 bytes of RAM (32384 divided by eight bits per byte). With the original VIC-20, you have only 3583 bytes of BASIC RAM to work with for both the program and bit mapping. Therefore, you will have to limit the area of the screen you map. With a +3K or +8K memory expander cartridge, you can map a larger portion of the screen. It takes both the 3K and 8K expansions to bit map the entire screen.

When using an 8K expander, you must also perform some extra operations. A critical step will be to locate your high res program above screen memory and programmable character memory. I suggest location 8192, which is the first location in the 8K expander. The following 8K high resolution demonstration program will explain this technique.

X and Y Coordinate Calculations

Given that we now know how to turn a pixel off or on by changing a bit in programmable character memory (5120 +), we still must have the program take an X or Y coordinate and translate it to the corresponding byte number and bit location. The following calculations must be made by the program:

```
CHAR = INT(X/8)*11 + INT(Y/16)
ROW = (Y/16-INT(Y/16))*16
Byte = 5120 + CH*16 + R0
Bit = 7-(X-(INT(X/8)*8))
```

The last calculation to be made identifies which bit must be changed.

```
POKE BY, PEEK (BY) OR (2^BI)
```

Example

Program 1, for the unexpanded 5K VIC, bit maps approximately two-thirds of the screen and allows you to control pixel plotting with a joystick. The portion of the screen used for high res graphics is limited by your BASIC RAM area. Only 1022 bytes are left available for a BASIC program (locations 4096 to 5019). By changing the programmable character pointer from location 5120 to 6144 or 7168 (see Table 1), you make more bytes available for your BASIC program; therefore, there is less bit map area of the screen.

In Program 1, line 50 sets up parameters for joystick control and starting X and Y coordinates.
Line 60 colors the screen so that pixels will show. Line 70 clears all programmable character locations. Line 80 changes the VIC screen to an 8x16 character matrix size. Line 90 POKEs display codes zero through 153 in screen memory locations 7680 through 7832. If you insert an “END” statement between lines 90 and 100, you can see the display characters as taken from ROM. Line 100 changes the character pointer from ROM to RAM (location 5120). The screen clears to black because there are no programmable characters defined in 5120 to 7679.

The main program loop starts at line 110. This line points to the subroutine for reading the X and Y coordinates from the joystick. (If you want an explanation of this subroutine, look up David Malmberg’s article in the fall 1981 issue of Home and Educational Computing!) Lines 120 through 160 perform the necessary character (CH), row (RO), byte (BY), and bit (BI) calculations and operations to turn on a pixel. Warning: when you are playing with the demo program, don’t go out of bounds or else you will invade other important memory locations. Strange things will appear!

Example Program For 8K Expanded VIC-20

This demonstration program will bitmap approximately 75% of the screen, leaving 8192 bytes free for your application program. By the way, these 8192 bytes are all located in the 8K expander. The 75% limitation results from the VIC requirement that all screen memory and programmable character memory be resident in the VIC and not in the 8K RAM expander.

Before typing in or loading this program, type in the following:

```
POKE44,32
POKE642,32
POKE8192,0
```

These three POKEs are critical! The first and second commands place the new page number of where your BASIC program will be loaded into RAM. The page number is derived by dividing the intended starting address by 256 since there are 256 bytes per page in the VIC (8192/256 = 32). The third command zeros the first word of your BASIC program area - a must if you expect this thing to run. Now type in the program.

Poke 200 to 205 contains the difference (253 VS 205) is due to the dual function that 36869 performs. Only the lower four bits of this location contain the character memory pointer. Line 295 is also changed. The Y represents the maximum Y coordinate you can turn on with the joystick.

Program 1.

```
10 REM ORIGINAL 5K VIC EXAMPLE OF HIGH RES GRAPHICS
40 REM
50 DD=37154:P1=37151:P2=37152:X=10:Y=10
60 POKE36879,8:PRINT"[CLEAR]"
70 FORI=5120 TO 185:POKEI,0:NEXT
80 POKE36867,PEEK(36867)OR1
90 FORI=8192 TO 7680+I:I=NEXTI
100 POKE36869,253
110 GOSUB200
120 CH=INT(X/8)+INT(Y/16)*22
130 RO=(Y/16-INT(Y/16))*16
140 BY=5120+16*CH+RO
150 BI=-X-(INT(X/8)*8))
160 POKEBY,PEEK(BY)OR(2"BI)
170 GOTO110
180 REM
200 POKEED,127:P=PEEK(P2)AND128
210 J0=-(P=0)
220 POKEED,255:P=PEEK(P1)
230 J1=-(PAND8)=0)
240 J2=-(PAND16)=0)
250 J3=-(PAND4)=0)
260 IFJ0=1THENX=X+1
270 IFJ2=1THENVX=X-1
280 IFJ1=1THENVY=Y+1
290 IFJ3=1THENVY=Y-1
295 IFY>143THENY=143
300 RETURN
```
Table 1. Important Memory Locations For
High Res Graphics

<table>
<thead>
<tr>
<th>Location</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7680</td>
<td>Start of screen memory</td>
</tr>
<tr>
<td>5120 or 6144 or 7168</td>
<td>Start of special RAM for programmable characters</td>
</tr>
<tr>
<td>63869</td>
<td>Pointer to character set RAM memory</td>
</tr>
<tr>
<td></td>
<td>253 for location 5120</td>
</tr>
<tr>
<td></td>
<td>254 for location 6144</td>
</tr>
<tr>
<td></td>
<td>255 for location 7168</td>
</tr>
<tr>
<td>36867</td>
<td>Sets 8x16 dot character size</td>
</tr>
<tr>
<td></td>
<td>(Bit 0 = 1)</td>
</tr>
</tbody>
</table>

Table 2. VIC-20 With + 8K Expander

<table>
<thead>
<tr>
<th>Location</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>43,44</td>
<td>Pointer to start of BASIC Program</td>
</tr>
<tr>
<td></td>
<td>(Normally, 1,18; change to 1,32 for location 8193)</td>
</tr>
<tr>
<td>642,643</td>
<td>Pointer to start of BASIC Program</td>
</tr>
<tr>
<td></td>
<td>(Normally, 0,18; change to 0,32 for location 8192)</td>
</tr>
<tr>
<td>5120 or 6144 or 7168</td>
<td>Start of special RAM for programmable characters</td>
</tr>
<tr>
<td>8192</td>
<td>First memory location of BASIC program area. Must be set to zero.</td>
</tr>
<tr>
<td>63869</td>
<td>Pointer to character set RAM memory, normally 192; must be set to:</td>
</tr>
<tr>
<td></td>
<td>205 for 5120</td>
</tr>
<tr>
<td></td>
<td>206 for 6144</td>
</tr>
<tr>
<td></td>
<td>207 for 7168</td>
</tr>
<tr>
<td>36867</td>
<td>Sets 8x16 dot character size</td>
</tr>
<tr>
<td></td>
<td>(Bit 0 = 1)</td>
</tr>
</tbody>
</table>
For Apple Logo and Atari PILOT, this program provides a way to make the turtle draw the numerals from zero to nine. Using the techniques shown, you will be able to extend this method to include the alphabet as well. TI and Radio Shack Logo users can build a program from the examples given.

Making The Turtle Count

David D. Thornburg
Associate Editor

With the single exception of Apple SuperPILOT, none of the popular turtle graphics systems with which I am familiar allows the user to freely intermix text and graphics. One solution to this problem is to teach the turtle how to write!

If we are going to have the turtle draw numbers on the screen, we should pick a number drawing technique that lets us draw numbers of any size, orientation, location, and color we choose. The result will be a text display system that is more powerful than traditional dot matrix characters.

The character field I have chosen is three units wide and five units high. If the resultant characters are too high and skinny on your display, you will want to modify our method slightly to satisfy your own taste. The turtle starts and ends each character at the upper left corner of the grid, with its orientation pointing up along the left edge.

Using this grid we can design the numerals we want to draw, as shown below:

Each procedure for drawing consists of picking the turtle’s pen up, moving the turtle to the starting position, putting the pen down, drawing the character in one continuous motion, picking the pen up, and moving the turtle back to its starting position and orientation. The shapes of the characters are defined so that each line segment is either along a grid length or along a grid diagonal. Since the length of the diagonal is larger than the grid length by the square root of two, our procedures need to incorporate this number.

This is fairly easy for the Apple Logos since they all use floating point arithmetic. Atari PILOT, TI Logo, and Radio Shack Color Logo, however, use only integer arithmetic. So, for these languages, we need to find a way to approximate the multiplication of a number by the square root of two. Obviously, we can’t use the decimal number 1.414 because the language won’t know what to do with it. Similarly, we can’t just multiply by (1414/1000) because, if this division is performed first, the result will be one! But, if we first multiply the grid size by 1414 and then do the division by 1000, the result should be an effective approximation.

The following listings for the ten numeral
procedures are shown in Apple Logo and Atari PILOT. Users of T1 Logo, Radio Shack Color Logo, and other languages using integer arithmetic will have to mix and match from these two sets of procedures as needed.

Apple Logo

```
TO ZERO :SIZE
MAKE *ROOT :SIZE * 1.41421
PENDOWN
BACK :SIZE
PENDOWN
RIGHT 45 FORWARD :ROOT
RIGHT 45 FORWARD :SIZE
RIGHT 45 FORWARD :ROOT
RIGHT 45 FORWARD :SIZE * 3
RIGHT 45 FORWARD :ROOT
RIGHT 45 FORWARD :SIZE
RIGHT 45 FORWARD :ROOT
RIGHT 45 FORWARD :SIZE * 3
PENDUP
```

```
END
```

```
TO ONE :SIZE
MAKE *ROOT :SIZE * 1.41421
PENDOWN
BACK :SIZE RIGHT 90
FORWARD :SIZE LEFT 45
PENDOWN
FORWARD :ROOT
RIGHT 135 FORWARD :SIZE * 5
RIGHT 90 FORWARD :SIZE
BACK :SIZE * 2
PENDUP
RIGHT 90 FORWARD :SIZE * 5
LEFT 90 FORWARD :SIZE * 3
RIGHT 90
PENDOWN
END
```

```
TO TWO :SIZE
MAKE *ROOT :SIZE * 1.41421
PENDOWN
BACK :SIZE
PENDOWN
RIGHT 45 FORWARD :ROOT
RIGHT 45 FORWARD :SIZE
RIGHT 45 FORWARD :ROOT
RIGHT 45 FORWARD :SIZE
RIGHT 45 FORWARD :ROOT
LEFT 135 FORWARD :SIZE * 3
PENDUP
LEFT 90 FORWARD :SIZE * 5
LEFT 90 FORWARD :SIZE * 3
RIGHT 90
PENDOWN
END
```

```
TO THREE :SIZE
MAKE *ROOT :SIZE * 1.41421
RIGHT 90 FORWARD :SIZE * 3
LEFT 135 FORWARD :ROOT * 2
LEFT 135 FORWARD :SIZE
RIGHT 45 FORWARD :ROOT
RIGHT 45 FORWARD :SIZE
RIGHT 45 FORWARD :ROOT
PENDUP
RIGHT 45 FORWARD :SIZE * 4
PENDOWN
END
```

```
TO FOUR :SIZE
MAKE *ROOT :SIZE * 1.41421
RIGHT 180 FORWARD :SIZE * 3
LEFT 90 FORWARD :SIZE * 3
BACK :SIZE
LEFT 90 FORWARD :SIZE * 2
```

```
```
```
```
```
```
Now that these characters have been defined, it is easy to place a numeral anywhere you want on the graphics screen. For example, if (in LOGO) you enter:

```
CLEARSCREEN
HIDETURTLE
TWO 10
```

you will see the numeral 2 on the screen.

Expanding these ten numerals to the full alphabet is fairly straightforward. Any takers?

---

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Experiment with different numbers, sizes, starting points, and orientations. You will find that you can print numbers at any angle. This is very handy for labeling graphs.
Review:

Supergraphics For PET

Elizabeth Deal
Malvern, PA

Supergraphics, written by John Fluharty, is a language extension for PET/CBM computers. Versions are available for Upgrade and 4.0 systems, 40 and 80 column. A ROM version (for $19000 or $A000 location) is currently available. The RAM versions are being discontinued.

First Impressions
Supergraphics seems to be a well thought out enlargement of the PET's resident BASIC interpreter. Its Turtle graphics, commands to plot lines in quarter-graphics mode, and general picture handling make it an ideal graphics package for children and adults who daily face the need to move spaceships around the screen.

The program does everything as described in the advertising and in the book. The book is clear and concise.

All commands work without a glitch. The mnemonics are well chosen, and there is no ambiguity. Kids can use the system and have, in fact, for over a year in various schools. Several similarities to the Radio Shack language permit children to switch between the PET and the other computer with little difficulty. Words such as CLS and HOME are understood by both languages. PRINT-at is a new concept for PET users, but is easy to grasp and quite efficient.

The housekeeping is fine. The PET is left in a relatively clean state during and after use, and even the memory locations used by such common utilities as the Toolkit and Power have not been clobbered (though some utilities might get disabled).

The demonstration programs are dazzling, though somewhat misleading. Some things are a bit more difficult to do than the demo would suggest. But then graphics are always tough. The package is well worth the money, and John Fluharty should be congratulated for enriching the PET's vocabulary.

Graphics Commands
There are commands to clear the screen, reverse it, place cursor home, and to list a program on a printer in program or direct mode. A dump of the screen to a printer is supported, but is not quite accurate (quotes are replaced by single quotes). You may switch text/graphic modes without POKE-ing. Screen images can be transferred to several adjacent alternate areas, permitting animation by quick transfers. The screen cannot be saved, but alternate areas can, so the effect is almost the same. This method is particularly useful to tape users. Saving is done through the monitor.

Quarter-graphics commands include setting and turning off points, drawing lines, drawing boxes, and filling them. Lines can be drawn in normal X-Y coordinates (0,0 in the upper left-hand corner) or in polar coordinates (0,0 in the center of the screen). The 80-column program supports 2:1 scaling of the X-axis. Lines and boxes drawn in quarter-graphics mode can be moved by the MOVE command. The motion can preserve whatever non-quarter-graphics characters are already on the screen. The unit of motion is quarter-graphic, that is, half a row or half a column at one time.

Normal size graphics commands include printing at specified coordinates, Radio Shack fashion (PRINT@col,row,"string"), defining a window for further operation, moving a window in four directions, filling one with a desired character, saving one in an alternate area, and bringing it back. Reversal of a window can't be done.

You may move anything you draw. You can put a spectacular spaceship on the screen using the PRINT@ command (or normal PRINT or POKEs), define its boundaries with CSET X,Y,X1,Y1 and zoom it around with words such as CMOVU: CMOVEL. Diagonal motion is done by pairs, as in CMOVED:CMOVER. Motion is lightning-fast; you need PAUSE to keep it under control. More than one object can be moved "at the same time," but you'll need to keep track of the definitions, a process neither as easy nor as fast as it might seem.

The book provides little programming help in thinking graphics. Demonstration programs are hard coded with numbers, so you're on your own in the normal world of tedious graphics housekeeping. (Where are we, where are we going, what is there, what do we do if something is or isn't there, take it off, redraw, and back to start. Phew!)

These block move commands get plenty of use. One-object motion is unquestionably splendid. Two or three objects — such as the background that wraps around or continuously scrolls left to right, and two competing spaceships controlled by users — get a bit sluggish. The reason is that you have to keep track of who is where at the moment, and you have to keep track of collision with another spaceship or walls of the screen. Even though it
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takes only two or three extra lines of BASIC code to process the arrays of housekeeping definitions, it slows the process down, and the book confirms it.

I don’t mean this note as a criticism of the program. None of the multipurpose graphics packages I have seen on the PET can handle motion of multiple objects or evaluate the situation at the edges of the screen. It requires tricky coding of tricky possibilities—a mind-reading program, Wordpro scope.

**Turtle Graphics**

Turtle graphics are included in the package: set and reset modes control the process. Work on the reversed screen is logically reversed. Additional commands position a turtle, set its direction, move pen up or down, and perform turns and units of forward motion. All Turtle commands work with quarter-graphics in polar coordinates.

Turtle graphics are a big hit in computer education. Children can learn programming by working with tangible things. We find this implementation nice and easy to use, but sometimes a bit abstract. Since the turtle is invisible, placing it on the screen and setting its direction provide no feedback until the turtle has moved forward. Should the turtle go over an existing line, it is again invisible until its direction is changed. A directional cursor might be helpful.

The turtle can accomplish some nice things, like drawing and rotating objects. The name of the game is learning geometry, and programming things such as rotation of objects should do the job.

I wish that Turtle graphics programs meant for small children limited out of bounds parameters. “Illegal quantity error” on a too large Y is a fact of life people must accept. But little users have enough trouble spelling words correctly; they could be helped by programs that avoided picture-destroying error messages. A no-action on the turtle’s part would tell them they are wrong. I may be wrong; perhaps they should learn the hard facts of programming right away.

**Miscellaneous Commands**

There are several other nice commands. For example, PAUSEX pauses execution for X jiffies. If a zero is given, a message prints “press space to continue” on the bottom line. This can be used instead of a GET loop. Pause is designed mainly to control the rate of animation.

An EXEC command in direct mode loads and runs a program. In program mode, it permits you to overlay a program longer than the calling program. Quite handy. The variables are cleared.

The OFF command turns Supergraphics off when you no longer need it, or when you write files from the machine language monitor or do several I/O commands to tape. Supergraphics turns its IRQ vector off for most I/O commands, hence it does not interfere—a nice and necessary touch.

The provision for repeating-key on all keys is useful in editing programs.

The SOUND commands are incredible. There are two versions. One is a simplified normal use of CB2 sound; the three POKEs have been squeezed into one command, “SOUND pitch, jiffies duration”. The other is an elaborate system which can play music while the program is running or while you are editing the program. Once started, it will play on and on, until you turn it off with SOUND 0,0. A song maker provided in the book helps you include your own songs in a standardized manner.

**User Extensions**

We have seen that the IRQ routine has already taken a detour to repeat keys and play music. The IRQ routine can take another detour via a TASK command if you write a routine and tell the system where it is. This is valuable.

One more extension can be made in the IEF vector: during IEF processing the program checks to see if the user has his own wishes. Special routines can be added, such as a multi-user routine. One such routine has been implemented in a school system where the author teaches. I have not tried this command nor seen it in action.

The validity of the IRQ and the IEF extension vectors is not checked. There is no extension of the CHI vector.

**Documentation**

The package includes a well-written, concise booklet. There are practically no muddy spots; all commands are explained clearly. The book does not say, for example, that the screen dump command forces paging on the printer.

Both the startup procedure and the various tips on using the system are unambiguous. A valuable set of hints is offered for speeding the processing.

Even though the demo programs show how to work the system, some graphics instructions might be more useful to kids who have never heard of X and Y coordinates. I am sure the schools will take care of it, though they will have to cope with the 0,0 in a funny place.

For programming types, one of the most valuable features is a listing of memory locations used by the program. This helps in understanding the system and permits you to use some values to advantage. You may wish to check the book; however, it seems to me that six more locations are zeroed than used, hence you should stay away from them.

Incidentally, the code is written in tiny, clear
units. With Supermon's help, you can get at some little routines independently of **Supergraphics**.

**Housekeeping**

This section of my review deals with how the system is built, which has a bearing on how you use your PET. The discussion is not unique to this program; most programs of similar construction share these features.

**Supergraphics** adds some 35 commands to BASIC by intercepting the CHRGET routine. When you say SYS-supergraphics, you're asking PET to take a detour in its work to process the new commands. Unlike various editing utilities which are inactive during program execution, **Supergraphics** is designed to be enabled at all times. All commands are valid in program mode: they are interpreted, and, if needed, acted on, before BASIC gets a look at them. This slows BASIC down considerably — a do-nothing counting loop runs at a quarter of its normal speed.

PET needs time to process the new commands. Purely graphics programs, especially simpler ones of the type children write, don't suffer from the slow-down; in fact, it is unnoticeable. If you mix a lot of non-graphics commands, it is a good idea to use the OFF command frequently, for speed. The only time speed is a problem is in those calculations necessary to detect walls and collisions. At such times **Supergraphics** shouldn't be turned off, since turning it back on re-initializes all the working locations.

There are two things you should be aware of. First, a program written for **Supergraphics** obviously cannot run on a system that does not have **Supergraphics**. Users should be careful what they send to their friends, but this should cause no problem with its use in private or in schools. Second, while **Supergraphics** is enabled, any utility hooked up in any of the first five bytes of the CHRGET code is obviously disabled. You may have to cope with this in debugging. The current procedure is to do the OFF command before going SYS-utility. Use of OFF is mandatory: if you forget it, BASIC will not function.

**Supergraphics**

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If you have a 4K or 16K Non-Extended or Extended BASIC Color Computer and a cassette recorder, you might be interested in a new book titled *TRS-80 Color Programs*, by Tom Rugg and Phil Feldman. The well-documented programs are useful to both the novice and the more advanced programmer. The book is not only a useful source of programs for the Color Computer, but also a teaching tool for beginning programmers.

The book has 37 programs, only nine of which will not run on a 4K machine. Divided into six sections, the book covers such topics as home and office applications, education, games, graphics, and math, and also has some short miscellaneous programs.

Section one contains eight programs – two new ones, and six modified for the Color Computer from the authors' previous book, *TRS-80 Programs*. Section two, with one new and six modified programs, deals with education. Section three, games, has one new and six modified programs, along with some color pictures of screen displays. Section four presents four modified graphics programs. Section five, math, has six modified programs. In section six are miscellaneous programs, one new and four modified.

The screen displays for the programs in the authors’ new book are quite good. I have replaced some of my modified programs based on the earlier book with the new ones in the present book, primarily because of the enhanced screen displays.

*TRS-80 Color Programs* is a useful book for both the novice and the more advanced programmer. It goes beyond the example programs presented in the Color Computer manuals. In addition to helping you understand programming, the book also demonstrates some useful commands that help you shorten your programs and improve your screen displays.

*TRS-80 Color Programs* fortifies the authors' belief that most programs of similar language can be modified to run on other computers, and it helps to defuse the myth that the Color Computer is merely a toy or game computer.
Adventure games are older than Apple computers, and a high percentage of micro owners have played with them. These games give you a "world" containing dragons, demons, objects to be manipulated, etc. You use simple commands to move through the "world" and manipulate it.

**Adventure – Colossal Cave**

This is the original Adventure game, written first in FORTRAN for a PDP-10, by Willie Crowther and Don Woods. This program was implemented on the Apple by Master Jacobi. The program was compressed to fit entirely into 48K of RAM to avoid accesses to the disk.

Adventure has 15 treasures which add points to your score. It might not be obvious what a treasure is, so you might be tempted to pick up any object you find. There are 40 useful objects, but they have side effects. For example, the bird is afraid of the rod, and a certain magic word works only when you possess certain objects. The "world" is fairly large, containing 130 rooms. It is easy to find about a tenth of the rooms; the others are hard to find. In addition, there are 12 obstacles or opponents.

The game is complicated enough to keep you busy for a long time. If you are stumped, you can save the game to be resumed later. When you resume, you are asked if you want to load the saved game. If you say yes, you get back into the saved game, and the game is deleted from the disk. If you say no, you can start a new game while the saved game remains on the disk. You can save only one game.

**Help, For A Price**

A wizard, Arian, guides you through the world. A surprising, and amusing, feature of the game is that if you try many times to do a certain thing, but fail, the wizard will finally offer to help – for a price.

There is apparently a random element to the game. There is at least one situation in which you may or may not be killed, depending on chance.

The scoring scheme is somewhat unusual. You get points merely for discovering parts of the world and for finding objects. Getting killed costs you points. Your wizard might be able to bring you back to life, but you might lose the objects you were carrying.

The program is on a protected disk. The disk boots and the program loads in only nine seconds. At the beginning of the game a message appears briefly on the screen, and if you are a slow reader you might miss some of it. The message appears during the boot phase and disappears when the program executes. However, most of the program is well written and courteous to the user.

**Adventureland**

This Scott Adams’ game has several features unusual in adventure games. The graphics were done using Penguin Software’s Picture Editor, by Mark Pelczarski. The quality of the pictures is quite good. It takes 10-20 seconds, typically, to load a picture from the disk, and in case you don’t have the time, the program lets you switch between graphics mode and text mode. Often, a complete picture is "painted" on the screen, and then the disk drive comes on and certain objects are superimposed on the picture. This feature of the program gives you clues about the game, since the superimposed objects can generally move or be moved.

**Use Peripherals**

If you have a Votrax Type 'N Talk voice synthesizer, you can get the computer to speak the responses to your command. The responses will also be displayed on the screen.

If you have a lowercase adapter on your Apple, you can switch between all uppercase mode and upper/lowercase mode. And if you have a printer, you can get a hard copy of your adventure. The instruction booklet says that with some printer cards you might have to initialize the card in Applesoft before starting the adventure program. The Silentype printer does not require initialization before the game.

Another nice feature is that you can save up to four adventures to be resumed later. Considering that an adventure can occupy you for hours, this feature is desirable.

Before the game begins, you are invited to read an “open letter.” The letter is a lecture on software piracy and includes several high resolu-
graphic pictures (of pirates, the American flag, etc.).

It is very important to have the proper mind-set when playing Adventureland. You must be able to tolerate some frustration, since you might get “stuck” in part of Adams’ world. Also, you should realize that a game is not won in a few minutes of play; it might be complicated enough to keep you busy for weeks or months. Ideas may come to you while you are driving, and when you try them out that evening a whole new part of the world will be revealed to you.

The author’s sense of humor is evident. He has apparently anticipated some of the commands you are likely to give and has prepared comebacks for you.

There is little randomness in Adventureland. As a rule, the same set of commands will have the same effects in different games. Success is obtained by using reason and common sense. However, there is an element of magic in the game; for example, you can come back to life if you give the right commands after being killed. There are also magic words.

It is very difficult to “crash” the program by giving bizarre input. It simply returns a message that it doesn’t understand. Pressing RESET, however, will restart the game and clear out your adventure.

Adventure — Colossal Cave
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Logan, UT 84321
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Adventure International
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Taking inventory in Adventureland.

Teasing the dragon in Adventureland.
Review:

The VIC
“Cardboard”

Harvey B. Herman
Associate Editor

Inserting a VIC cartridge is not a task for small and sometimes clumsy fingers. I have always insisted that my younger children call me when they want to change games. Thus, they are occasionally frustrated when I am not available for the task. The “Cardboard” promised to relieve this headache.

“What is it?” you ask. I believe the technical term is “motherboard.” Its purpose is to extend, externally, the VIC expansion connector. All the pins on that connector are brought out by means of a ribbon cable to six exact duplicates of the VIC memory expansion port. You can plug in six cartridges, memory boards or games, and select any one of them easily with a dip switch. Yes, tiny fingers are ideal for this job, with no adult worries about mechanical damage to the VIC.

Next question, “Is it worth it?” The answer, “Yes and no.”

Yes, because it enables little children to change applications easily. Also, it is solidly constructed and comes with an easy to understand, 18-page breezily written manual. It even has a reset switch which can extend the life of your VIC if you frequently turn it on and off to reset.

No, because it is relatively expensive (although cheaper than some) when compared with the VIC’s original discounted price. Furthermore, the fact that it is not fused is bothersome. Can the VIC’s power supply handle an indefinite number of plug-ins at the same time? I wonder.

On balance, I like this product and recommend it. I am using it with four or five popular games, and it has worked beautifully for the children. If you do buy it, keep a watchful eye out for power supply overheating or have someone knowledgeable fuse it for you. Then, enjoy the convenience.

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Review:

Mikro Chip Assembler
For PET

Arthur B. Hunkins
School of Music
University of N. Carolina at Greensboro
Greensboro, NC

Mikro, from Skyles Electric Works, is a 4K ROM assembler chip for PET/CBM with Upgrade or 4.0 BASIC. It is not available for “Classic” PETs with original ROMs. Residing at hex address A000, Mikro is offered in a number of configurations that will otherwise accommodate virtually all PETs. For cassette-based systems, particularly those with limited memory, Mikro is a machine language programming boon, and well worth the $80.

Mikro is compatible with both Toolkit and Command-O. Indeed, a single SYS call initializes Mikro and the utility. All of Toolkit’s commands are active while Mikro is running, and a number of them are applicable to machine language program development. One example: since Mikro uses BASIC line numbers, Toolkit’s AUTO numbering command facilitates entering line numbers.

The user’s manual for Mikro is both thorough and comprehensive. Although organized in a non-traditional manner that takes getting used to, its 49 pages contain a wealth of information. Included are sample programs, bibliography, installation and crash recovery procedures, a listing of the more than 15 error/warning messages with explanations, an overview of 6502 opcodes and addressing modes, and the few known bugs along with suggested remedies. The manual is not a treatise on 6502 machine language and its applications. The short, annotated bibliography will point you in the right direction, however. (Skyles recommends Leventhal’s, DeJong’s, and Zaks’ books.)

Will Accept Four Number Bases

Since Mikro operates with pseudo-BASIC statements (programs are SAVED and LOADED as BASIC program files), PET’s superior screen editing features are available to the user, in either LIST or Mikro’s FORMAT mode. Mikro’s commands are: FORMAT, ASSEMBLE, and CONVERT (number base). The latter converts a number in decimal, hexadecimal, octal or binary to all the others. Incidentally, Mikro accepts numbers in any of these four bases!

Actual assembly of a short program is virtually instantaneous (hurrah for machine language assemblers!). Unless specified, assembly defaults to the second cassette buffer ($033A). Immediately following assembly, Mikro offers a partial or complete listing on a printer – the same listing as formatted input plus hex memory locations and their (hex) values. If you don’t have a printer, you are out of luck here: Mikro will not print to the screen. I tested the print option with an Axiom EX-801 printer, and the operation went very smoothly. The only inconvenience was the fact that printer formatting (e.g., selecting 80 rather than the default 40 columns) must be done prior to assembly, by opening, formatting, then closing a file.

Once assembly has begun, Mikro is in control, and there is no way of interrupting it until after the printout. This can be more inconvenient than it might seem, because one of Mikro’s “mites” is that during short printouts, it spews forth almost two extra pages of (often expensive) paper. The recommended fix is to turn off your printer. That effectively solves the immediate problem, but also means that you must reformat your printer. Perhaps you will not experience this problem.

Includes Five Pseudo-ops And Append

As an assembler, Mikro is easy to use. On an 8K PET it reserves 1K at the top of memory for its own use; with 16 and 32K machines, it takes proportionately more. Syntax is standard, and the only crucial point to remember is that spaces are used as delimiters. A semicolon is required to
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**IPUG Magazine Review** (British PET User Group) by Ron Geere
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indicate a leading remark, and remarks are also possible at the end of lines. One problem the manual cautions the user against is spaces following commas in remarks. When I did it anyway, there were no bad consequences at all. Maybe I was just lucky.

Five pseudo-ops are implemented: 1) =, for label setting including *= for program origination, 2) TXT, for ASCII text within quotes, 3) BYT, 4) WOR, and 5) END (optional). A special application of END involves appending (or merging) a BASIC program onto the end of one in machine language. Following assembly of the ML program (up to END), the appended BASIC program can be run by commanding RUNxxxx or GOTOxxxx, where xxxx is the first line number of the BASIC program.

No comments are allowed following BYT or WOR, nor are spaces permitted at the commas in the list of values. Although all values are assembled, only the first three appear in any listing. A useful variety of arithmetic operators and labels is allowed in the argument field.

One of Mikro’s handiest features is a GO option for JMP and branching statements. For example, JMP GO20 is a valid statement meaning jump to the instruction in BASIC line #20. These branches are also automatically handled by Toolkit’s RENUMBER command.

Mikro represents an excellent, cost-effective investment for Upgrade and 4.0 PET (and CBM) owners wishing to do small to moderate amounts of machine language programming. I particularly recommend it for PETs that are cassette-based and have limited amounts of memory (such as 8K).

Mikro Chip Assembler
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Epson Graftrax-80

Charles Brannon
Editorial Assistant

Graftrax-80 is a ROM upgrade for the Epson MX-80 printer. Epson introduced their MX-80, a small, fast, relatively quiet 80 character printer at under $800. They packed it with more intelligence than some of the computers using it. Among its features are: two character widths (80 and 132); elongated, double-strike, and emphasized printing; horizontal and vertical tabs; and definable form length and line spacing. The standard MX-80 also provides block graphics (compatible with the TRS-80) that can be used for low resolution screen dumps, pictures, charts, and graphs.

Epson announced that a $100 upgrade could be made to the MX-80 to provide graphics capabilities. And it would provide graphics twice as dense as the MX-70 (MX-80's lower priced relative).

Installation
Upgrading your MX-80 is easy, if you know how to remove and install IC's. Otherwise, you should have it installed by an authorized technician. The upgrade consists of three ROM chips that replace a single ROM resident on the board. With three times the memory, this should give you a hint of the potential of Graftrax. You also have to cut a jumper and set 12 tiny DIP switches.

After you have performed this surgery, what do you get? Well, prepare for a surprise – this transplant does more than add graphics – you’ve got a whole new printer!

Graftrax-80 adds a plethora of new features, and improves on others. All the modes can be mixed on a single line, a trick formerly impossible. The duration of the bell has been reduced from three seconds to a bearable 1/3 second. A backspace function permits underlining (but it’s slow).

A popular new feature is the alternate character set – italics. This looks quite fancy. You can easily mix the italics font with standard text. You can now go into the TRS-80 mode via software (formerly you had to set a DIP switch). You can set

**Figure 1. Graftrax-80 Character Sets**

- Default character set:
  - `!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz`
- Emphasized printing:
  - `!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz`
- Double-strike printing:
  - `!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz`
- Double-width characters:
  - `ABCDEFGHIJKLMNOPQRSTUVWXYZ`
- Italic characters set:
  - `!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz`
- Block Graphics:

**Figure 2. Graftrax Graphics**
an “MSB mode” that will force bit seven high (for sending a character greater than ASCII 128). This is useful for computers and interfaces that can only send seven bits per byte (such as the Apple II).

One of the most significant new functions is the ability to redefine all the printer codes. You can change almost any of the special codes into any code you like. For example, double-strike is set with ESC-G (ASCII 27 followed by ASCII 71). You could change this to ESC-D (easier to remember), but you would be replacing the “Set horizontal tab” command which is normally keyed to ESC-D. One possibility of this feature is that you could change the MX-80's special codes to approximate the codes of, say, the Centronics 737. You could then run software written for the 737 without modification.

**Extraordinary Graphics**

The graphics capabilities are superb—up to 120 dots per inch. This permits a total horizontal width of up to 960 dots. This is more resolution than most computers can display, so it is more than adequate for screen dumps. The 480 mode (480 dots per line) is faster than the 960 mode, and it is usually used for screen dumps. The graphics are fairly easy to use: you send a code specifying which mode, and how many bytes of graphics you are sending. Then, a byte at a time is sent from the computer that specifies each bit of the eight dot (vertical) line. For example, to print a special character, ten bytes would be sent.

```
7  000000  128
6  0  0  64
5  0  0000  0  32
4  0  0  0  16
3  0  0  8
2  0  0000  0  4
1  0  0  2
0  000000  1
```

The copyright symbol

The printhead is a strip with nine tiny needles set into it. Each needle is activated by a “1” bit, or left seated with a zero. Unfortunately, the ninth pin can't be fired because there are only eight bits in a byte. The first byte sent would look like: 00111100 (turned on its side). In this way, an 8xn “strip” of dots would be printed.

**Speed**

With 480 dots per line, using Graffrux from BASIC
is unbearably slow, since 480 bytes have to be individually calculated and sent, one at a time. You would probably want a machine language program to do the printing.

Graftrax Plus
A new version of Graftrax, called Graftrax Plus, is now available for $65. It improves and expands upon the already enhanced features of Graftrax. In addition, owners of the MX-100 (which already has Graftrax) can upgrade to Graftrax Plus and enjoy compatibility with the MX-80 equipped with Graftrax Plus.

In addition to the italics character set (missing on MX-100 Graftrax), Graftrax Plus adds several features, including; superscript and subscript (the printer doesn't really adjust the paper; it just uses tiny half-height characters), improved graphics, and true underlining, with underlining on/off commands.

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Inspector Fenwick – Please!

Hey, Rocky, I think I just saw the girl of my dreams!

Gee, Bullwinkle, where’s that?

At the Moose America Pageant — where else?

A Saturday morning replay of Rocky and His Friends?

No, this is a sample of the dialog that greets visitors to one of the newer purveyors of food and entertainment – Bullwinkle’s. What does this have to do with the social impact of computers? Read on, dear readers, read on.

It all began in the 1950s when Walt Disney and his designers concocted Audio Animatronics, an analog-based control system that gave motion to the mannequins in such Disneyland favorites as the Enchanted Tiki Room. This technology was further advanced by the Disney group to make such shows as Pirates of the Caribbean, Country Bear Jamboree, and America Sings. The result was the creation of remarkably lifelike animated stage shows using automatons. In the hands of Disney designers, the result was magical.

Dining With Computers

A few years ago, Nolan Bushnell (founder of Atari and godfather to a host of innovative companies) developed Cyberamics to bring animated characters into a combined arcade/restaurant — Chuck E. Cheese’s Pizza Time Theater. Visitors to this establishment are treated to various shows, including Dolly Dimples, a delightful animated hippopotamus night club singer, and, in another part of the restaurant, Chuck E. Cheese and his cohorts, who provide their own brand of cornball entertainment to go with the pizza. Central to Pizza Time is the arcade room, filled to the brim with a great diversity of video games, each operated with tokens marked “In Pizza We Trust.”

The success of this technology-based restaurant has been phenomenal, and it was clear from the start that others would soon develop their own version of this concept.

Next enters David Brown, developer of two Marriott’s Great America theme parks and the Roy Rogers’ Family Restaurant chain. David thought that Pizza Time was a great concept, but that the food quality could be improved. Brown’s idea was to create a place that was a restaurant first, but which incorporated entertainment in the dining area and a separate game room with a modest assortment of popular arcade games. This idea became Bullwinkle’s.

As luck would have it, the world’s first Bullwinkle’s was constructed only a few miles from my humble abode. In the interest of keeping my readers abreast of the latest in technology, I had to visit Bullwinkle’s many times, consuming vast quantities of chicken and pizza and ice cream, watching shows, and playing myriad games.

During one such visit it was my pleasure to meet their marketing maven, Larry Schuller. As he showed me around and answered my questions, it was clear that computer technology plays a critical role in this restaurant.

First, the animated characters themselves are controlled by Moosetronics, a set of distributed processors running off an S-100 bus. The song and dance routines are stored on both tape (audio and synchronization) and disk (for various body movements). Some of the characters are quite elaborate. Bullwinkle, for example, is about six feet tall. His eyes, mouth, head, arms, and legs all move in fairly realistic fashion (realistic for a moose based on a cartoon character), and this attention to detail characterizes several of the other eleven animals as well. The attention to detail includes placing the loudspeakers in each figure so the sound comes from each animal as it is singing or talking.

Fantasy Fountain

If this elaborate production weren’t enough, visitors are also treated to a computer-controlled fantasy fountain show in which 250 jets propel 300 gallons of water in a dazzling array of arcs and spirals. All this takes place under colored lights in accompaniment to such melodies as The Blue Danube and Raindrops Keep Fallin’ on My Head. This water show, more than anything else, appears to be the prime attraction to the over-30 crowd (your esteemed author included).

But the computers don’t stop here. The system which notifies people when their order is ready is none other than a trusty Apple II located near the
Over thirty years of down-to-earth experience as a precision parts manufacturer has enabled Star to produce the Gemini series of dot matrix printers—a stellar combination of printer quality, flexibility, and reliability. And for a list price of nearly 25% less than the best selling competitor.

The Gemini 10 has a 10” carriage and the Gemini 15 a 15½” carriage. Plus, the Gemini 15 has the added capability of a bottom paper feed. In both models, Gemini quality means a print speed of 100 cps, high-resolution bit image and block graphics, and extra fast forms feed.

Gemini’s flexibility is embodied in its diverse specialized printing capabilities such as super/sub script, underlining, back-spacing, double strike mode and emphasized print mode. Another extraordinary standard feature is a 2.3K buffer. An additional 4K is optional. That’s twice the memory of leading, comparable printers. And Gemini is compatible with most software packages that support the leading printers.

Gemini reliability is more than just a promise. It’s as concrete as a 180 day warranty (90 days for ribbon and print head), a mean time between failure rate of 5 million lines, a print head life of over 100 million characters, and a 100% duty cycle that allows the Gemini to print continuously. Plus, prompt, nationwide service is readily available.

So if you’re looking for an incredibly high-quality, low-cost printer that’s out of this world, look to the manufacturer with its feet on the ground—Star and the Gemini 10, Gemini 15 dot matrix printers.
kitchen. Monitors scattered throughout the restaurant show which orders are ready, and each new order is announced by a high resolution image of Bullwinkle holding up the new number.

The professionalism in their mechanical characters is reminiscent of Disney's Country Bear Jamboree, and for good reason. It was designed by a collection of Disney graduates who now ply their craft for others.

Aside from pure money, what motivated the people at Bullwinkle's to create this restaurant? According to Larry Schuller, microcomputer-based entertainment belongs in restaurants. The provision of electronic fun to go with the food is perhaps the next stage in the evolution of family dining.

Interestingly, the arcade seems to be almost an afterthought at Bullwinkle's. Off away from the eating area, 50 games provide entertainment for patrons who, in my opinion, show much greater care for the machines than I am used to seeing. While I was unable to get the exact figures, I found that Bullwinkle's derives a considerably smaller fraction of its revenues from the games than does Pizza Time Theater. That doesn't bother Bullwinkle's at all. As Schuller says, they are aware of the continuing controversy surrounding these games. When will the controversy go away? In Schuller's mind, the controversy surrounding these games will go away when the games become more educational.

The Next Step

There is no question that arcade games can be made more educational – Children's Television Workshop has shown that. But just as Bullwinkle's feels that it has improved the electronic entertainment/restaurant idea of Nolan Bushnell, they also feel that they can someday make improvements in the design of the arcade games themselves.

As nice as such improvements might be, they are not their first order of business. The next step is to carefully locate the next several restaurants. Not surprisingly, their first announced franchise was for 13 restaurants in Canada, with the first to open in Edmonton in March. Dudley Do Right of the Royal Canadian Mounted Police has been a popular character there for years, so the success of this expansion venture is virtually guaranteed.

This doesn't mean that the United States has been ignored. Twenty-nine restaurants are scheduled for construction here in 1983, 20% of which will be company owned. In addition, negotiations are underway to share this technology with the United Kingdom. One has to be "moost" impressed with this expansion plan, especially since each restaurant costs well over a million dollars to set up.

As the water show comes to a close, and the curtain falls on Dudley Do Right, one must wonder what computer pioneers like John von Neuman would have thought. Computer technology has advanced extraordinarily in the past 30 years. Have its applications advanced as well?

Boris, if I hear one more moose joke I will blow up the stage!

Natasha, darling, that would be moost devious of you!
A Monthly Column

COMPUTE! welcomes Keith Falkner, whose “Extrapolations” column begins this month. Keith, who has extensive experience at all levels of computing, has contributed several excellent Apple articles to COMPUTE! in the past. To start his monthly column, he demonstrates how to use a simple BRUN to bring in the power of the renumber program — without affecting the program in memory. There’s also a way to make yourself a simple assembler if you don’t have the Mini-assembler.

Extrapolations

Beat The “Applesoft Renumber” Blues

Keith Falkner, Toronto

On your System Master diskette there is a very powerful utility program called Renumber. This program can merge two Applesoft programs and can move several lines from one place to another within an Applesoft program. Of course, Renumber will also renumber the lines of an Applesoft program, and the options it offers in this function are as complete as anyone could wish.

Furthermore, Renumber is cleverly packaged as an Applesoft program so that no complicated machine language instructions are needed to run it.

Protecting Memory

When you run Renumber, a hidden machine language component relocates itself to the top 2048 bytes of memory, prevents Applesoft from overwriting it, and enables the ampersand (&) command. Thereafter you can LOAD, RUN, SAVE, etc., as usual, and the ampersand command invokes one of the three functions of Renumber. This is very clever packaging, because this way only one version of Renumber is needed for 32K or 48K Apples, regardless of the current upper limit of memory.

Setting MAXFILES or running the utility known as Program Line Editor both alter the upper limit of memory, but Renumber does not care. This versatility is commendable, but it comes at a price. If you have not bothered to run Renumber, but are working on an Applesoft program and wish to renumber it, you must first SAVE it, then run Renumber, then reload your Applesoft program. Generally, you do not need this flexibility. For example, if you have a 48K Apple, the machine language component eventually resides in locations $8E00-$95FF (36352-38399).

I’ll show you how to save this machine language routine, together with a prologue to do the minimum initialization. Then a simple BRUN command will activate the essence of the Renumber program, without affecting any Applesoft program in memory. At the same time we will deal with the more or less well-known bug. If the program being renumbered contains a multiplication by a constant, such as $X1 = J * 100$, and there is a line number 100 which becomes, say, line number 80 upon renumbering, the constant may become 80 as well.

This is a consequence of the clever relocation routine which makes the machine language code function in whatever memory locations it occupies. Specifically, the token for LIST is replaced by the token for multiplication because the sequence of tokens $AC$ $B0$ $BC$ is taken for the instruction LDY $BCB0$, and the relocation routine changes this to LDY $CAB0$.

So $BC$, the token for LIST, has been replaced by $CA$, the token for *. Hence, line number references following LIST (a rare verb to find in a BASIC program) can never be renumbered, and constants which appear to be line number references in a multiplication statement are subject to bogus renumbering! Fortunately, this is easy to fix.

One more thing should be done to Renumber. Some of us have a program to load PET tapes into our Apples, and some of these programs have spaces between the words or numbers in the program. In PETs this practice improves legibility, but not so in Apples, so Applesoft removes any extra spaces you may type in. Thus, Renumber does not expect spaces in, for example, GOSUB 400. Those spaces prevent Renumber from changing that 400 if renumbering gives line 400 a new line number. The fix for this problem is included in Programs 1 and 2.

Now it’s your turn to do some work: if you use DOS 3.2, type the lines in Program 1; if you use DOS 3.3, type the lines in Program 2. In either case, test your results as shown below.
Type in this trivial program:

```
1 INPUT X
2 IF X < 1 THEN 1
3 ON X GOSUB 39,87
27 END
39 LIST 87
45 RETURN
87 PRINT 99 * 39
99 GOTO 45
```

Now ready the renumbering routine:

**BRUN BRENUMBER**

Now renumber your program:

```
& LIST
```

The result should look like this:

```
10 INPUT X
20 IF X < 1 THEN 10
30 ON X GOSUB 50,70
40 END
50 LIST 70
60 RETURN
70 PRINT 99 * 39
80 GOTO 60
```

With the stock Renumber program in a 48K Apple, line 50 would still say LIST 87 and line 70 would now say PRINT 99 * 50. Now type NEW ... the above is worthless. Don’t proceed until you get it right, because an unreliable or inaccurate tool is much worse than none at all.

Here is what you have produced. **Brenumber** is a small (ten sector) binary program which loads into locations $8DE0-$9DF, sets the upper limit of memory to $8E00 (minus one), and sets up the ampersand (&) command to invoke the functions of Renumber. Brenumber may be used only in a 48K Apple, and then only when MAXFILES has its default value of three. There are no safeguards in Brenumber, so unpredictable results occur if these constraints aren’t met.

**Orderly Programs**

Now, suppose you are working on an Applesoft program and you decide to renumber it. Without bothering to save it, just BRUN Brenumber and you have all the facilities of Renumber available. It’s important to remember that the BRUN command did not renumber your program; it just enabled the ampersand (&) command which does the actual renumbering. So let’s think of clever ways to use the Renumber program. The program, with 16 screens of instructions, can be formidable to try to understand, but it’s worth learning.

Briefly, renumbering is done by typing the ampersand (&) and maybe some parameters. The parameters tell Renumber two things: what line numbers to assign and what portion of the program is to be renumbered. All the parameters are optional, the default being to renumber the whole program 10, 20, 30, etc.

- **FIRST** = 1000 the first line number will be 1000.
- **INC** = 20 successive line numbers increase by 20.
- **START** = 5000 only lines 5000 and later will be renumbered.
- **END** = 6990 only lines up to 6990 will be renumbered.

The FIRST and INC parameters are straightforward, so let’s see how the START and END parameters can help us. One way I make my programs neat and readable, as well as accurate, is to have a main routine whose line numbers are less than 1000, and a menu which eventually says something like ON SEL GOSUB 1000,2000,3000, ... 11000, for example, if there are 11 selections from the main menu. Then I use line numbers 20000 and up for subordinate routines such as formatting the screen, formatting numbers, etc.

So how do I preserve this orderly scheme in renumbering the program? Well, consider the effect of these commands:

```
& F100,S0,E999 (parameters can be abbreviated)
& F1000,S1000,E1999
& F2000,S2000,E2999
```

and so on, until finally

```
& F2000,S2000
```

The first command will renumber only the main routine; the second will renumber lines 1000-1999, etc., and the last will renumber only the elementary routines. All very fine, but who wants to type in 21 commands to renumber a program? Well, here is a simple six-line program to create an EXEC FILE named RENUM. Customize the program to suit yourself, then run it one time and keep its output on the same disk you have Brenumber on. Then, when you wish to renumber a program in the complex way outlined above, just type EXEC RENUM.

```
10 DS = CHRS (4):FS = "RENUM":QS = CHRS (34)
20 PRINT DS:"OPEN"FS: PRINT DS:"WRITE"FS: PRINT "MON I"
30 PRINT "IF PEEK(36352)<>164 THEN ?CHR$(4)"Q"
40 X = 100:Y = 999: FOR I = 0 TO 30: IF I THEN
50 X = X + 1:Y = Y + 1000
60 PRINT & F"X",S"X",E"Y": NEXT
```

RENUM can take several minutes to do its work on a large program, so you have an opportunity for a break. It is vital that you never press RESET while Renumber (or Brenumber) is operating — it’s almost certain to destroy your program! The MON I statement at the start of the EXEC FILE causes each command to be listed as it is read from disk, so watch and wait patiently.
Hiding And Moving Lines
The HOLD and MERGE functions of the Re-number program are probably poorly understood; here is an example which barely hints at the power of these commands.

LOAD PHONE LIST from System Master disk
BRUN BRENUMBER & 5400, F1000
to make a gap for more lines of DATA
SAVE PHONE INTERIM we need it on disk for a moment
DEl 1200 discard the prologue and credits
DEl 351, 63999 discard everything but DATA statements
& F351, 11 old DATA from 201-350 becomes 351-500
& HOLD put 150 lines into "hold-file" in memory
LOAD PHONE INTERIM you can DELETE it now or later
& MERGE combine old and new, now 300 DATA statements
In line 1720 and 2590, change the figure 150 to 300.
In line 1160, change the program name to PHONE LIST 300.
SAVE PHONE LIST 300 wherever you want the finished product.

We start with Phone List, a program on your DOS System Master disk, and double its capacity from 150 to 300 names.

This clever program actually stores names and telephone numbers in DATA statements with line numbers from 201 through 350. The two DEL statements eliminate all lines but these, which are then renumbered 351 through 500 by 1. The &HOLD command hides these lines and a LIST command at this point would show no lines. After the Phone Interim program is reloaded, the hidden lines are merged into the gap between lines 350 and 1000.

When you consider all that this involves, the process is very rapid. It's hard to see how such a significant change could have been wrought any other way, without a lot of tiresome typing. Using the techniques shown above, you can move a bunch of lines around within a program, combine two programs, and incorporate proven routines from one program to another without the error-prone step of retyping.

Some programs have lines with line numbers greater than 63999, the legal maximum. Renumber is clever enough to leave these alone, and this is probably for the best. A word of caution in this area: I once fabricated an illegal line number 65535 and spent several days looking for the mysterious cause of a number's silently changing from 2 to 2,000000007. The problem disappeared when I removed the bad line number.

As with most tools, practice improves skill. Do use the Brenumber program to its limit - it's very, very good. But, and it's a big but, be prudent. Save an important program before renumbering it, and don't overwrite that backup until the renumbered version is proven.

Homework Assignment: If you have an Apple II Plus with no Integer ROM Card nor Language Card, you may have no Apple Mini-Assembler. In that case, follow the instructions below. You will create a one-pass assembler which will be of use in future columns in this series. Please note that "CTRL-Y" means hold down the CTRL key and type "Y". In the lines where this is used, a space is shown for clarity only; do not type any spaces in those two lines!

How To Make A Mini-Assembler If You Have An Apple II Plus
Take a diskette to an Apple which has both Integer BASIC and Programmer's Aid.

If a 16K RAM card is installed, boot the System Master diskette.

|INT |
> CALL -151
*DIDSZ
*6000:4C 98 60
*6003:*F500,F63C CTRL-Y *
*6003:*F500,F63C CTRL-Y *
*BSAVE MINI-ASSM,AS6000,LS140
(THANK THE NICE APPLE.)

Program 1.

RUN RENUMBER
(PRESS RETURN WHEN INVITED.)
CALL -151
8DE0: 8A 8E 85 78 85 74 8D F7
8DE8: 03 A9 00 85 6F 85 73 8D
8DF0: F6 03 A9 4C 8D F5 03 20
8DF8: 6C D6 4C D0 03 4C D0 03
90DE: 20 F0 95
95ED: 30 8D 28
95F0: 20 85 94 88 C9 20 F0 F7
95F8: 20 80
94DA: BC ...BUG FIXER!!!
(INSERT DISK TO HOLD RESULT.)
BSAVE BRENUMBER,AS8DE0,LS820

Program 2.

RUN RENUMBER
(PRESS RETURN WHEN INVITED.)
CALL -151
8DE0: 8A 8E 85 78 85 74 8D F7
8DE8: 03 A9 00 85 6F 85 73 8D
8DF0: F6 03 A9 4C 8D F5 03 20
8DF8: 6C D6 4C D0 03 4C D0 03
90DA: 20 F0 95
95ED: 30 8D 28
95F0: 20 82 94 88 C9 20 F0 F7
95F8: 28 80
94D1: BC ...BUG FIXER!!!
(INSERT DISK TO HOLD RESULT.)
BSAVE BRENUMBER,AS8DE0,LS820
For PET/CBM computers with a disk drive, this program will list any program in a way that can be easily understood: all the special characters for all the Commodore computers are taken into account.

A Universal Program Lister

Jim Butterfield
Associate Editor

You'll need a PET/CBM disk system to run Lister. It will neatly list any BASIC program you have on disk to the screen or printer.

There are lots of Lister type programs around. This one isn't much different, except that it is very complete. It runs very slowly; have a cup of coffee while it's running.

Why Another?

Several months ago, I passed out a program at the Toronto PET User Group meeting. It contained a number of the 4.0 disk commands. I confidently said at the time, "Those of you with earlier systems won't have any trouble converting DOPEN to OPEN and so on...."

What I didn't think of was this: users with an earlier system couldn't list the program properly. Their computers couldn't understand DOPEN tokens and printed nonsense instead.

The problem is more general. If you don't have an 80-column machine, you won't be able to make any sense out of the window-making characters that are used there. If you don't have a VIC, you'll be baffled by the characters that set color.

So I embarked upon a new Lister which would contain the special characters for all Commodore machines: PET, CBM, and VIC. It seemed like an easy project.

Code Inflation

But the program grew. As it was written, a number of possibilities kept cropping up—things that would be handy for the user if provided.

The listing job wasn't hard. Just pick it off disk, translate the tokens, and put it on the screen. But then—it would be nice if the output could go to the printer.

As long as output goes to the printer, it should be neat. Why not put spaces in strategic places? That way, ONCEGOTO5,6 might print as ON CE GOTO 5,6 and be much more readable.

If we're stretching out a line of code, it might not fit onto a single line of listing. If we need to break it in two, it would be nice to pick a logical break point, so that a word like PRINT doesn't get split in the middle.

It's often nice to see cursor movements spelled out—especially the ones that do not work on your machine. And repeated cursor movements should be numbered, so that you don't print DOWN, DOWN, DOWN. Instead, DOWN 3 will deliver the message. Of course, there are other times when you would prefer to have the listing show in the same way that it does with a conventional screen LIST.

Sometimes, when your program is printing instructions, they are in upper- lower case ("text mode") and you'd like the listing to reflect it. At other times, you need the graphics because that's what your program is printing.

Of course, if you want to do different parts of your program in different modes, you'll need a line number range in order to list the parts you want at any particular time.

The long lines combined with text mode create another problem. My printer (a 2023) is too dumb to realize that if I print over 80 characters, I want the continuation line to be in the same mode as before. Instead, it drops back to graphics mode. So I had to count characters carefully and arrange my own split lines.

Spaces are a special problem. Most of the time, they should be printed as spaces; but sometimes that's hard to read, especially when the spaces are part of a cursor-movement stream. I made a compromise on this one.

Program Details

The program is in BASIC, so you can modify it to your particular needs and printer. It won't quite fit the VIC; if you want to try a VIC modification don't forget to change the POKEs on line 630 and the PEEK at line 32768. PET/CBM machines will list VIC programs directly from disk, even where the BASIC programs can't be LOADed, LISTed or RUN on the PET.

A Few Comments On Program Variables

L9 is the length of a line, normally 40 or 80; Q is quotes-mode; it also notes REM statements; A$(J) is a table of cursor-control names, and A(J) is the corresponding character designations; K$(J) is similarly a list of BASIC keywords; C and Cl are flags to tell whether adjacent characters are alphanumeric, so that we will split PRINTX into PRINT X but not PRINT^"X";
B counts the number of repeated cursor movements; B1$ is the current keyword;
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FS is the character preceding a spelled-out cursor movement; it is either a left-square-bracket or a comma;

MS is the down-shift character for text mode printing, when needed;

PS is the print string; everything is assembled here before printing.

Copyright © 1982, Jim Butterfield.

```
90 REM LISTER   JIM BUTTERFIELD
100 DATA 19,147,17,145,29,157,18,146,20,148,141,32
110 REM 80-COLUMN CURSOR STUFF
120 DATA 7,21,149,22,150,14,142,25,153
130 DATA 15,143
140 REM VIC STUFF
150 DATA 144,5,28,159,156,30,31,158
160 DATA 8,9,133,137,134,138,135,139,140
170 DATA HOME,CLEAR,DOWN,UP,RIGHT,LEFT,RVS,RVOFF,DEL,INST,RET
180 DATA HOME,CLEAR,DOWN,UP,RIGHT,LEFT,RVS,RVOFF,DEL,INST,RET
190 DATA BELL,D.LINE,I.LINE,ER.BEGIN,ER.END,TEXT,GRAPHIC,SCROLL.UP,SCROLL.DOWN
200 DATA TOP,BOTTOM
210 DATA BLACK,WHITE,RED,CYAN,MAGENTA,GREEN,BLUE,YELLOW
220 DIMA(40),A$(40),K$(90)
230 FORJ=0TO40:READA(J):NEXTJ
240 FORJ=0TO40:READA$(J):NEXTJ
250 DATA END,FOR,NEXT,DATA,INPUT#,INPUT,DIM,READ,LET,GOTO,RUN,IF,RESTORE,GOSUB
260 DATA RETURN,REM,STOP,ON,WAIT,LOCAD,SAVE,VERIFY,DEF,POKE,PRINT#,PRINT,CONT
270 DATA LIST,CLR,CMD,SYS,OPEN,CLOSE,GET,NEW,TAB(,),TO,PN,SPC(,),THEN,NOT,STEP
280 DATA $,-,*,/,,^,AND,OR,>,=,<,SGN
290 DATA INT,ABS,USR,FRE,POS,SQR,ND,LOG,EXP,COS
300 DATA SIN,TAN,ATN,PEEK,LEN,STRS,VAL,ASC,CHR$(,),LEFT$(,),RIGHT$(,),MIDS,GO,CONCAT
310 DATA DOPEN,DCLOSE,RECORD,HEADER,COLLECT,UPLOAD,COPY,APPEND,D,SAVE,CATALOG
320 FORJ=0TO89:READK$(J):NEXTJ
400 CLOSE:INPUT"NAME OF PROGRAM FILE";GS
                   
410 OPEN 1,8,3,G$","P,R"
420 GET#1,A$,B$
430 IFA$<>CHR$(1)ANDA$<>""GOTO400"
440 IFA$=""THENA$=CHR$(1):GET#1,X$
450 INPUT"LINE NUMBER RANGE -{}3 L LEFT";Z$
460 L0=0:L1=0:L2=1E9
470 FORJ=1TOLEN(Z$):YS=MIDS(Z$,J,1)
480 Y=ASC(YS):IFY>=48ANDY<=57GOTO10
490 IFY=32GOTO510
500 L0=J:IFY<>45GOTO600
510 NEXTJ
520 IFLO<LEN(Z$)THENL2=VAL(MIDS(Z$,L0+1)):IFL2=0THENL2=1E9
530 IFLO>1THENL1=VAL(Z$)
540 IFL0=0THENL1=L2
550 P3$="[":P4$="]":INPUT"LIST TOP INTERN{03LEFT}";Z$
560 P$="["P3$="]":INPUT"GRAPHICS OR TEXT G{03LEFT}";Z$
570 POKE59468,12:IFASC(Z$)=84THENPOKE59468,14:M$=L$:P1$=P3$:P2$=P4$
580 P$="["P2$="]":INPUT"TRANSLATE CURSOMOVES N{03 LEFT}";Z$
590 P$="["P3$="]":INPUT"LIST TO PRINTER N[03 LEFT]";Z$
600 P$="["P4$="]":INPUT"LIST TO PRINTER N{03 LEFT}";Z$
610 P3$="[":P4$="]":INPUT"LIST TO PRINTER N{}{03 LEFT}";Z$
620 P$="["P3$="]":INPUT"GRAPHICS OR TEXT G{03 LEFT}";Z$
630 POKE59468,12:IFASC(Z$)=84THENPOKE59468,14:M$=L$:P1$=P3$:P2$=P4$
640 PRINT"NAME OF PROGRAM FILE";GS
                   
650 IFASC(Z$)=89THEN7=1
660 OPEN4,P:$=P1$
670 J=80:IFPO3GOTO690
680 PRINT"CLEAR";PRINT"+++++++;++":FORJ=1TO81:IFPEEK(32768+J)=32THENNEXTJ
690 L9=J:PRINT#4,"PROGRAM:";G$
700 REM NEW LINE
710 GOSUB2010:Q=0:T1=1:C1=-1:GET#1,A$,B$:IFSTO0GOTO3000
720 IFB$=""GOTO3000
730 GET#1,A$,B$
740 L=ASC(A$)+ASC(B$)*256
750 IFL<LEN(A$)+ASC(B$)GOTO3000
760 IFB$=""GOTO3000
770 IFL<LEN(A$)+ASC(B$)GOTO3000
780 IFB$=""GOTO3000
790 IFB$=""GOTO3000
800 REM START TEXT HERE
810 GET#1,A$:IFA$=""GOTO710"
820 T=0:A=ASC(A$):IFA$=32ANDF$="","GOTO840"
830 IFQ=0OR(AAND127)>31ORT7=0GOTO90
840 FORJ=1TO40:IFA$=A(J)THENB$=A$(J):GOT0860
850 NEXTJ:GOT0100
860 IFB$=B1THENB$=B1:GOT0810
870 IFB$=B1THENB$=B1:GOT0810
880 IFB$=B1THENB$=B1:GOT0810
890 IFB$=B1THENB$=B1:GOT0810
900 IFB$=B1THENB$=B1:GOT0810
910 IFB$=B1THENB$=B1:GOT0810
920 IFB$=B1THENB$=B1:GOT0810
930 IFB$=B1THENB$=B1:GOT0810
940 IFB$=B1THENB$=B1:GOT0810
950 IFB$=B1THENB$=B1:GOT0810
960 IFB$=B1THENB$=B1:GOT0810
970 IFB$=B1THENB$=B1:GOT0810
980 IFB$=B1THENB$=B1:GOT0810
990 IFB$=B1THENB$=B1:GOT0810
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<tr>
<td>VIC 20 Computer, 5K</td>
<td>$199</td>
</tr>
<tr>
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<td>60</td>
</tr>
<tr>
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<td>VIC MODEM (for CBM 64)</td>
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<td>VIC 1525 Graphic Printer (for CBM 64)</td>
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CBM 4040, 340K Dual Drive 919
CBM 2031, 170K Single Drive 489

PRINTERS — LETTER QUALITY

<table>
<thead>
<tr>
<th>Printer</th>
<th>Price</th>
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<tbody>
<tr>
<td>CBM 3300, 40cps</td>
<td>$1450</td>
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<tr>
<td>Diablo 820, 25cps</td>
<td>1350</td>
</tr>
<tr>
<td>Nec Spinwriter 7700, 55cps</td>
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<tr>
<td>Nec Spinwriter $500, 35cps</td>
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PRINTERS — DOT MATRIX

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<tr>
<td>CBM 6022, 80cps/graphics</td>
<td>$395</td>
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<tr>
<td>CBM 8023, 150cps/graphics</td>
<td>599</td>
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<td>Okidata 82A, 120cps/serial or par</td>
<td>449</td>
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INTERFACES

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<td>ADA-1450 Serial</td>
<td>$149</td>
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<td>ADA-1600 Parallel</td>
<td>149</td>
</tr>
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</tr>
<tr>
<td>Video/Audio cable for 64 &amp; monitor</td>
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</tr>
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MONITORS — Great resolution for the CBM 64 or VIC

<table>
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<th>Monitor</th>
<th>Price</th>
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<tr>
<td>Panasonic, 13&quot; Color</td>
<td>$375</td>
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<tr>
<td>Amdek Color I</td>
<td>330</td>
</tr>
<tr>
<td>NEC JB 1201M, 12&quot; Color</td>
<td>330</td>
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<td>NEC JB 1201, 12&quot; green phosphor</td>
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</tr>
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<td>Amdek Video 300UL, green phosphor</td>
<td>175</td>
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BUSINESS SOFTWARE

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<thead>
<tr>
<th>Software</th>
<th>Price</th>
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</thead>
<tbody>
<tr>
<td>Spellmaster Dictionary (great for WordPro)</td>
<td>$199</td>
</tr>
<tr>
<td>OZ2 Data Base System (8050)</td>
<td>240</td>
</tr>
<tr>
<td>Silicon Office (database, wp)</td>
<td>995 (New)</td>
</tr>
<tr>
<td>Wordcraft 80</td>
<td>289</td>
</tr>
<tr>
<td>VisiCalc (new expanded)</td>
<td>199</td>
</tr>
<tr>
<td>Dow Jones Portfolio Management System (RS232)</td>
<td>120</td>
</tr>
<tr>
<td>WordPro 4+ or 5+</td>
<td>299</td>
</tr>
<tr>
<td>The Manager</td>
<td>199</td>
</tr>
<tr>
<td>Legal Time Accounting</td>
<td>425</td>
</tr>
<tr>
<td>I.R.M.A. A.</td>
<td>235</td>
</tr>
</tbody>
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RENUMBER
(And a Brief Exploration Of BASIC)

Manny Juan
Dale City, CA

Type this program as is into your Atari—the first three lines must be entered exactly as shown—and save it on a cassette with the LIST"C" command. This command saves the program as ASCII text instead of as tokenized statements (as when a program is saved with CSAVE). A program saved this way may be reentered later to merge with another program already in memory, as described below.

Now type NEW to clear memory and CLOAD your favorite program. Make sure that the highest line number is less than 32100 and that it is an END statement. After the load is finished, place the tape containing RENUM (the renumbering program) into the cassette drive and type ENTER"C". This will make the Atari think that program statements (which are normally entered at the keyboard) are now being ENTERed from the cassette drive. After you have done this, RENUM becomes a part of your program, occupying the last 48 lines of it and ready to be invoked.

To renumber your program, simply type GOTO 32100. The program displays "FROM,BY?" and awaits your response. Type the line number you want your program to start with, followed by the increment value you desire. Please make sure that the potential line numbers will not extend beyond 32100. Sit back and wait for a couple of minutes. (The time varies according to the size of the program and the number of line number references RENUM has to resolve.)

This utility will renumber your program according to the starting number and increment value you supply. It also resolves all line number references in the following statement types: GOTO, GOSUB, IF...THEN, ON...GOTO, ON...GOSUB, TRAP, and RESTORE. It can recognize references to non-existent line numbers (e.g., TRAP 40000), and it attempts to recognize symbolic references (e.g., GOTO LABEL).

Whenever it encounters any of these conditions, RENUM will display, on the screen, the new line number of the current line being scanned, followed by "NF" if the referenced line was Not Found, or "SR" if a Symbolic Reference was encountered.

I suggest that you note these messages on paper so that you may investigate them later. Statements flagged with "NF" (other than some TRAP statements which may reference line numbers above 32768) usually imply that those statements are unexecutable. The presence of "SR" messages should tell you to look for those places in the program where the offending symbolic reference is assigned a value, so it can be adjusted according to the new numbering sequence.

When the renumbering process is completed, this utility displays the number of lines in your program, followed by this message:

LIST"C:";bbbb,eeeee

where bbbb is the beginning number and eeee is the ending number of your program. You may position the cursor over this line and press the RETURN key if you are ready to save your program in ASCII format on cassette. (Note that a CSAVE command issued at this point would have saved your program and this utility on cassette in tokenized form.) Just remember to use the ENTER"C" command to reload your program next time, though. After that, you then CSAVE it again in a more compact form.

If you are doing program development, RENUM becomes a very handy tool to use to "open up" crowded line numbers to allow easy insertion of new lines. And if you are an author, RENUM adds a slight touch of professionalism to your articles with neatly renumbered program listings.

Program Logic
The logic of RENUM is very simple. Starting from the first line, it scans each statement and considers only those that may refer to a line number (GOTO,
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IF...THEN, etc.). If the line number reference extracted is less than the line number of the current line being scanned, it searches forward from the beginning of the program; otherwise, it begins its search from the current line.

While performing its search, it also keeps track of the future line number for each line encountered. When it finds a match, it replaces the line number reference by the future line number of the matching line. After it has resolved all such line number references, it starts over from the top; this time, it steps through all the lines of the program, a line at a time, and actually renumbers them. That's all there is to it.

Let me advise you at this point that the remainder of the article will discuss some internal mechanisms of the BASIC interpreter and will be more technical. If you are satisfied with the utility of RENUM, skip the rest of the article. But, if you're a system programmer, read on!

How does RENUM know where to start? The address of the first line in a program is always pointed to by a two-byte register at locations 136 and 137. (The value of a two-byte register is always computed as the left byte + 256 * right byte.) Before we discuss how RENUM steps through the program, resolves line number references and renumbers lines, we need some background information on how BASIC works.

**BASIC Tokens**

As everyone probably knows by now, a BASIC program is always stored in RAM in a “tokenized” format. Keywords (PRINT, LET, GOTO, etc.) are replaced by single bytes whose values identify the keyword. Variables are also stored as single bytes whose value is 128 + N, where N is the position of the variable in the variable table (the first variable occupying position zero).

Numeric literals (like those found in expressions or in statements like A = 123 or GOTO 32700) are replaced by seven bytes. The first byte is always 14, which stands for “numeric literal follows,” and the last six bytes make up the BCD (Binary Coded Decimal) representation of the literal. Line numbers are encoded into a two-byte representation so that the right byte multiplied by 256 plus the left byte equals the value of the line number.

Each BASIC line (except REM and DATA), whether it is made up of one statement or multiple statements, is always stored as a string of one-byte tokens in this format:

\[ N1, N2, PL, (LL, TK, ... other tokens..., DM)... \]

where the portion enclosed in parentheses may occur one or more times. N1 and N2 make up the line number so that \( LN = N1 + 256 \times N2 \). PL is the length of the whole tokenized string, including N1 and N2. If PL is added to the address of N1, we get the address of the next line. LL is the offset, relative to the address of N1, of the next statement within the string.

The value of LL is never greater than PL, but it is equal to PL at the last or only statement within the line. TK is the token representing the keyword, and it may be followed by other tokens. Finally, DM is an end-of-statement delimiter. It contains a value of 22 if the statement is the last or only statement in the line; otherwise, it contains a value of 20.

For example, consider this line in BASIC:

\[ 356 \text{ ?@GOTO 12345} \]

The resulting token string that represents it is fully annotated below:

<table>
<thead>
<tr>
<th>Relative Address</th>
<th>Token Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>100</td>
<td>356 MOD 256</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>INT(356/256)</td>
</tr>
<tr>
<td>2</td>
<td>17</td>
<td>offset to next line</td>
</tr>
<tr>
<td>3</td>
<td>7</td>
<td>offset to next statement</td>
</tr>
<tr>
<td>4</td>
<td>40</td>
<td>token for ?</td>
</tr>
<tr>
<td>5</td>
<td>128</td>
<td>variable number + 128</td>
</tr>
<tr>
<td>6</td>
<td>20</td>
<td>end of first statement</td>
</tr>
<tr>
<td>7</td>
<td>17</td>
<td>offset to next line</td>
</tr>
<tr>
<td>8</td>
<td>10</td>
<td>token for GOTO</td>
</tr>
<tr>
<td>9</td>
<td>14</td>
<td>“number follows”</td>
</tr>
<tr>
<td>10</td>
<td>66</td>
<td>exponent byte of literal</td>
</tr>
<tr>
<td>11</td>
<td>1</td>
<td>1, of 12345 (0 * 16 + 1)</td>
</tr>
<tr>
<td>12</td>
<td>35</td>
<td>23, of 12345 (2 * 16 + 3)</td>
</tr>
<tr>
<td>13</td>
<td>69</td>
<td>45, of 12345 (4 * 16 + 5)</td>
</tr>
<tr>
<td>14</td>
<td>0</td>
<td>other digits, if any</td>
</tr>
<tr>
<td>15</td>
<td>0</td>
<td>same as above</td>
</tr>
<tr>
<td>16</td>
<td>22</td>
<td>end of statement and line</td>
</tr>
<tr>
<td>17</td>
<td>(start of next line)</td>
<td></td>
</tr>
</tbody>
</table>

A tokenized statement is not necessarily compressed, as you can see above. Compression is more readily apparent in a program where long, meaningful variable names are used generously, and literals sparingly.

The syntax for GOTO, “GO TO”, GOSUB, TRAP, and RESTORE (tokens 10, 11, 12, 13, and 35, respectively) requires a line reference immediately following the keyword. (RESTORE sometimes requires none.) For these statement types, RENUM immediately resolves the line number references, if any. Both ON...GOTO (tokenized format 30,...,23) and ON...GOSUB (format 30,...,24) are followed by a list of line number references which are separated internally by the token 18. You may say that token 18 stands for the commas separating the numbers.

Finally, IF...THEN is recognized as the token string (7,...,27). When a line number reference immediately follows THEN, that number becomes a part of the IF...THEN token string. In all other cases (as in IF...THEN A = 0, or IF...THEN GOTO
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100), the whole statement is broken into two token strings so that it now reads (internally) as
"IF...THEN <null statement> : next statement." I urge you to investigate these statement types, and others, by RUNning the short program below:

```
10 DIM A$(1)
20 X=PEEK(136)+PEEK(137)*256
30 LN=PEEK(X)+PEEK(X+1)*256:PL=PEEK(X+2)
40 IF LN=32768 THEN STOP
50 IF LN<=90 THEN 90
60 LIST LN: ? "ADDR=";X
70 FOR I=1 TO PL
80 ? PEEK(X+I-1);",";:NEXT I: ? INPUT A$
90 X=X+PL: GOTO 30
```

Just add the BASIC statements you want to examine after line 90 and type RUN. Line 40 checks for end of program. A "phantom" line (numbered 32768) is always present as the last statement of any program to tell the BASIC interpreter where the program ends. It cannot be listed, deleted, or referenced. But it is there.

If you also want to see all the valid keywords in BASIC, and their tokenized values as well, type this program in:

```
5 DIM A$(10)
10 I=42161: K=0: ? CHR$(125)
20 A$="": J=0
30 C=PEEK(1): IF C>128 THEN 100
40 J=J+1: A$(J)=CHR$(C)
50 I=I+1: GOTO 30
100 C=C-128: J=J+1: A$(J)=CHR$(C)
110 PRINT K, A$
120 K=K+1: IF K>53 THEN STOP
130 I=I+3: GOTO 20
```

You will notice that there are 54 (0 through 53) keywords. BASIC looks up this table when translating a statement into a token string. If it finds no match, BASIC assumes that the statement has an implied LET keyword, and it assigns a token value of 54 for the keyword portion of the resulting token string.

**BCD To Decimal, And Back**

As I said earlier, all numeric literals used in BASIC statements (including line number references) are expressed in BCD (Binary Coded Decimal) format internally. When I discovered this, while I was investigating tokens, I realized that I needed the capability of converting a line number reference from BCD to decimal, and back, in order to make RENUM work.

The process takes many steps, including normalization of a number to even powers, "chunking" of digits by two's, and merging nybbles [a piece of information that's four bits long] to bytes [one that's eight bits]. In fact, a whole article could be devoted to BCD to decimal conversion. Suffice it to say that I did not have to write a lengthy routine to do the conversion – I simply took advantage of BASIC's built-in conversion routines.

**BASIC Variable Table**

BASIC maintains a variable table (addressed by locations 134 and 135) where all variables are stored. Each entry in the table is eight bytes long; the first byte specifies the variable type, and the second byte identifies the variable number, which starts with zero. For scalar variables (not DIMensioned), the first byte is always zero, and the segment defined by bytes three through eight contains the BCD representation of the variable's value.

Let's define a variable, say WM, to be our work area for doing the conversion. To convert a BCD number to decimal, we just POKE the six bytes representing the number into the BCD segment of the entry corresponding to WM. *Voilà!* WM now contains the decimal value of the number (as would be proved by PRINTing it).

To convert the other way (as when we are replacing a line number reference by a future line number), we simply equate WM to the desired decimal value, extract the last six bytes of WM's entry in the variable table, and POKE them into the token string to replace the old BCD number.

**BASIC Symbol Table**

But how do we know where WM resides in the variable table? When RENUM is first loaded (or ENTERed from cassette), dozens of variables would have already been added to the variable table. All variables defined and used in the program (or even in direct mode) get stored in the table. But before each one is added, the variable's NAME is first added to the end of another table – the symbol table. (It starts at location 2048 on a cassette-based system, and it seems to start at 7676 when DOS II is present.)

This table is actually a character string which is a concatenation of all variable names – in the sequence they are first defined. And this sequence is followed by the variable table. The last character of each name is flagged (bit seven turned on) to serve as a terminator. Type in this short program to see what the symbol table looks like:

```
10 X=2048
20 I=0
30 C=PEEK(X+1)
40 IF C=0 THEN STOP
50 PRINT CHR$(C);
60 I=I+1
70 GOTO 30
```

Before RUNning it, enter a few variables with long names (RUMPLESTILTSKIN = 0, etc.) in direct mode so you can recognize them. The characters appearing in reverse video mark the ends of
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the variable names.

With this information, it is possible to resolve the question posed above by extracting the variable name string segments, one at a time, until one of them matches "WM," at which point the variable number for WM would be obtained. However, this method requires a slow and lengthy routine to perform string extraction and matching. There has to be a better way.

**Current Line Pointer**

A new register comes into play. Locations 138 and 139, I discovered, always point to the current line being executed. With this new knowledge, I was able to define WM and pinpoint its location in the variable table in a single line of BASIC! I refer you now to line 32120 in the listing. The first statement defines the variable WM. Keep in mind that when this whole statement was tokenized, an entry for WM was added to the variable table, and its variable number now appears in the tokenized string.

The second statement determines the address of this very same line as it is being executed. At this point, X points to the beginning of the line. Let us dissect the third statement. The expression "(X+5)" positions us to the token for WM in the statement "WM = 0". "PEEK(X+5)-128" looks at that byte and converts it to the true variable number assigned to WM. Multiplying it by eight computes the offset from the beginning of the variable table (defined by the first two terms of the statement). Finally, adding two to the result positions us to the BCD segment of WM's entry in the variable table. With this address saved in Y, BCD to decimal conversion (and back) becomes a breeze (as shown respectively by the one-liners 32470 and 32530).

**RENUM, Line By Line**

With all that background information out of the way, we can now talk about the other significant lines in RENUM. Lines 32100 through 32210 are the main loop of the program, which positions the variable C to the keyword token of every statement encountered before it enters the "analyze-keyword" subroutine at line 32280. The next loop, 32220 through 32270, performs the actual renumbering of the lines.

Line 32290 checks for GOTO, GOTO, GOSUB, TRAP, and RESTORE. Lines 32300 through 32370 check for the statements ON...GOTO and ON...GOSUB. Line 32330 skips numeric literals that the program might come across following the keyword ON, but before the words GOSUB (token 24) or GOTO (token 23). Lines 32380 through 32440 handle the IF statement, and line 32410 similarly skips insignificant numbers until it encounters the word THEN (token 27). The reason for skipping over these numeric literals is to preclude RENUM from misinterpreting BCD segments as valid tokens. Line 32430 handles the case where IF...THEN is immediately followed by a line number.

The subroutine starting at 32450 performs the search and replace operation. Line 32450 itself checks for end of statement (as when RESTORE is not followed by a number). When a line number reference is found, line 32470 converts it (now expressed as six bytes in BCD format) into decimal for comparison with the current line, which is performed at 32480.

At this point, it is determined whether searching is to start from the top or from the current position. Lines 32500 and 32510 search for a matching line number. When a match is found, line 32530 converts the future line number of that matching line to BCD as described previously and replaces the original reference. Finally, control is transferred to 32550 when the actual renumbering process is completed.

The program itself can be further reduced in size by merging statements into single lines, but that is up to you. The most obvious features missing from the program are sound and graphics, and that can be easily remedied.

```
32100 REM RENUMBER BY MANNY JUAN
32110 TB=256: I=1: Z=32100
32120 WM=0: X=PEEK(138)+PEEK(139)*TB: Y
   =PEEK(134)+PEEK(135)*TB+8*(PEEK
   (X+5)-128)+2
32130 ? "FROM,BY": INPUT FR,BY:? CHR$(
   125)
32140 B=PEEK(136)+PEEK(137)*TB: X=9:M=
   FR
32150 LN=PEEK(X)+PEEK(X+1)*TB: SOUND 0
   ,LN,10,B
32160 IF LN=Z THEN 32220
32170 PL=PEEK(X+2): C=X+3
32180 LL=PEEK(C): C=C+I
32190 GOSUB 32280
32200 IF LL<PL THEN C=X+LL: GOTO 32180
32210 X=X+PL: M=M+BY: GOTO 32150
32220 M=FR: X=B: SOUND 1,0,0,0
32230 LN=PEEK(X)+PEEK(X+1)*TB: SOUND 0
   ,32768-LN,10,B
32240 IF LN=Z THEN 32350
32250 MH=INT(M/TB): ML=M-MH*TB
32260 POKE X,ML: POKE X+1, MH
32270 M=M+BY: X=X+PEEK(X+2): GOTO 32230
32280 TK=PEEK(C)
32290 IF TK=10 OR TK=11 OR TK=12 OR T
   K=13 OR TK=35 THEN C=C+1: GOSUB 3
   2450: RETURN
32300 IF TK<35 THEN 32380
32310 C=C+1: D=PEEK(C)
32320 IF D=23 OR D=24 THEN 32350
32330 IF D=14 THEN C=C+6
32340 GOTO 32310
32350 C=C+1: GOSUB 32450: D=PEEK(C)
32360 IF D<20 AND D>22 THEN 32350
32370 RETURN
```

(continued on p. 206)
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If you've ever used the VIC's data file functions to do tape saves and loads of machine code, hex tables, or graphics, you'll appreciate the speed, ease, and flexibility with which this program, Dump/Recover, accomplishes those tasks. You'll also learn a bit about using BASIC's internal machine language routines.

**VIC Block SAVE And LOAD**

Sheila Thornton  
New York, NY

This program is built around four of the kernal routines, the self-contained machine language software modules in VIC's operating system which can be accessed through a group of JMP instructions located at the top of memory.

These routines—SETLFS, SETNAM, SAVE, and LOAD—are subroutines of the SAVE and LOAD functions in BASIC, but can be used individually to save any size memory block up to location 32766 ($7FFE) and to load the saved matter into its original position or a new one.

To discourage casual copying of their proprietary software, Commodore has inserted code in the SAVE routine which aborts attempted tape saves above 32766 ($7FFE hex). However, a VIC owner who boasts a 1540 disk has informed me that, curiously, this prohibition doesn't extend to disk saves.

Dump/Recover (Program 1) combines 43 bytes of machine code and ten lines of BASIC to connect you to the kernal routines and to allow specification of start and end address and name via an INPUT statement.

**Understanding The Method**

Program 2 is a commented disassembly of the machine code that Dump/Recover must POKE into memory. In the first four instructions, the logical file number, device, and secondary address are selected, and then the SETLFS routine which makes it all happen is called. The second four instructions specify the length of the file name and its location in memory, and then jump to SETNAM, which will expect to find the file name immediately above the end of the array variables (as pointed to by zero page locations 49 and 50) and the name length at address 0.

At this point, the SAVE or LOAD routines can be called, but the usual tape messages (other than the PRESS... instructions) will not be displayed. Some sleuthing inside VIC's Operating System disclosed that SAVE and LOAD require that bit seven at address 157 ($9D) be set for the messages to be printed. The two instructions following the jump to SETNAM accomplish this.

While these messages are not required for a successful save or load, I find it comforting to see that VIC is indeed SAVING/SEARCHING FOR/LOADING the file I've specified. This feedback also serves as a check for typing errors, and helps to spare VIC from doggedly searching through an entire cassette for, say, "OPCODE TABEL" while I've excused myself to make tea. Unfortunately, I wasn't able to find how to turn on the "LOAD ERROR" message, so this is handled in BASIC.

After completing these preparatory routines, the program returns to BASIC, which checks whether a save or load has been chosen and jumps to the appropriate machine code. LOAD will look at addresses 251 and 252 ($FB, $F8) to find the start address, and SAVE will additionally use 253 and 254 for the end address.

Since Dump/Recover's purpose is to save and load any permitted section of memory, I decided that the "safer" place to put the machine code was in the BASIC input buffer (512 to 600 — $0200—$0258), making it necessary to re-POKE the code every time the program is run. While this doubles the permanent program length (to 487 bytes), it does add flexibility.

Returning to Program 1, you can see that Dump/Recover's first job is to accept the start and end addresses (in decimal) and the file name, so the input buffer can be freed up for the machine code. The end address entered for a save must be one higher than that of the last byte to be saved. For a load, a "0" must be entered as the end address.

Line 1003 places the name length in location 0 and turns the end-of-arrays pointer, plus the name length, into a decimal number. Because all of the program's variables must be set up before the latter step is taken, "U" is first set equal to "1." In line 1004, the program puts the file name above the BASIC variables, jumps to the SETLFS and SETNAM routines, POKEs the start address pointer, and tests whether a dump or recovery has been selected. If a dump, line 1005 places the end address in memory, jumps to the appropriate machine code, and ends the program.

Since a side effect of the LOAD routine is that the numeric and array variable pointers are set to the end address of the loaded material, line 1006 saves the pointers in the input buffer before LOAD is called, and restores them afterward. Line 1007 checks the I/O STATUS word, and prints a load error message if STATUS reports either an unrecoverable load error or any mismatch.
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**WARNING!** These games cause high panic levels!
If the END statements in lines 1005 and 1008 are changed to RETURNS, Dump/Recover can be used as a subroutine: but don’t forget that, while RUN restores the DATA pointer, GOSUB does not. I have fashioned short, unique versions of Dump/Recover to include in programs which need to load in binary data and to preface frequently used machine code tapes so they will load in without making BASIC forget where it’s put its variables.

Material saved with Dump/Recover can be verified from BASIC using the format, VERIFY “FILENAME”,1,1. BASIC will also load these tapes, but the adjustment made to the variable pointers may make it necessary to execute a NEW after the load. You’ll often find it necessary to protect the loaded file from BASIC by lowering the string and end-of-memory pointers.

The kernel routines are pretty thoroughly documented in the Programmer’s Reference Guide (pp. 182-211), but I’d like to share with you some omissions and errors I discovered there while writing this program. First, the Guide neglects to say what the valid secondary addresses are for the SAVE function. I wasn’t surprised to discover that (hey are the same as used in BASIC:

0 = Relocatable save  
1 = Non-relocatable save  
2 = Relocatable save with end-of-tape marker  
3 = Non-relocatable save with E-O-T marker

The discussion of the SETLFS routine indicates that 255 (SFF) should be used if no secondary address is desired. While this may be true for other I/O operations, a 255 function exactly like a 3 for a tape save. The Guide also gives incorrect secondary addresses for a load. In fact, a “0” will permit a relocating load, and a “1” will inescapably send the file back to its origin.

With just a few bytes of simple “straightline” code, even inexperienced machine language programmers can tap significant programming power and speed from the 36 kernel routines. I’ve found other documentation errors in the Guide, though, so I suggest you thoroughly test out a routine before incorporating it in a program.

Program 1: BASIC Version

999 REM "DUMP/RECOVER" FOR VIC-20
1000 PRINT "START, END, NAME": INPUT V, W, VS: R = 540: FO RJ = 17043: READT, POKER+J+5, T: NEXT: GOTO 1
003 1001 DATA 169, 1, 162, 1, 160, 0, 32, 186, 255, 165, 0, 166, 99, 164, 58, 32, 189, 255, 169, 128, 133, 157, 96
1002 DATA 169, 0, 166, 251, 164, 252, 32, 213, 255, 96, 16, 9, 251, 166, 253, 164, 254, 32, 216, 255, 96
1003 T = LEN(VS): POKER, T: U = 1: S = 256 * PEEK(58) + PEEK(49) + T
1004 FOR J = 1 TO POKES - J, ASC(RIGHTS(VS, J)): NEXT: S YS546: U = V: T = 252: GOSUB 1009: IF W = 0 THEN 1006
1006 FOR J = 0 TO 5: POKER+J, PEEK(45+J): NEXT: SYS569: FOR J = 0 TO 5: POKER+J, PEEK(R+J): NEXT
1007 IF STATUS AND 48 THEN PRINT: PRINT "LOAD": PRINT "ERROR";
1008 END
1009 POKET, INT(U/256): POKET - 1, U - 256 * PEEK(T): RETURN

Program 2: Machine language subroutines

<table>
<thead>
<tr>
<th>Address</th>
<th>Machine Code</th>
<th>Description</th>
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<tr>
<td>0222-0224</td>
<td>A9 A2 A6 A0</td>
<td>LDA A1, A2, A6, A0</td>
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<td>0225</td>
<td>80</td>
<td>JSR FBA</td>
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<tr>
<td>0226-0229</td>
<td>A5 A6 A7 A4</td>
<td>LDY # 0, A6, A7, A4</td>
</tr>
<tr>
<td>0230-0234</td>
<td>60 A9 A6</td>
<td>RTS A9, A6</td>
</tr>
<tr>
<td>0235-0236</td>
<td>95 STA 9D</td>
<td>STA 9D</td>
</tr>
<tr>
<td>0237-0238</td>
<td>60 RTS</td>
<td>RTS</td>
</tr>
<tr>
<td>0239-0241</td>
<td>A9 LDA # 80</td>
<td>LDA # 80</td>
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<td>0242-0246</td>
<td>60 A6 LDX</td>
<td>RTS A6, LDX</td>
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<td>0247-0248</td>
<td>60 LDX</td>
<td>RTS LDX</td>
</tr>
<tr>
<td>0249-0250</td>
<td>60 A6 LSY</td>
<td>RTS A6, LSY</td>
</tr>
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<td>0251-0255</td>
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<td>RTS LSY</td>
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TextPlot II

Mark Grebe
York, NE

When "TextPlot" (COMPUTE!, November 1981, #18) was published, I thought that it would probably be limited to such uses as labeling graphs. At the time, I was busy writing games for the Atari, so I overlooked this valuable routine. However, when David Plotkin's article, "Using TextPlot for Animated Games" (COMPUTE!, April 1982, #23), appeared, it caught my eye immediately. I had been toying with the idea of writing a machine language routine similar to Apple's shape tables, so I decided to see if TextPlot would work.

I soon found that TextPlot had a limitation. It can place the character only at horizontal positions that are divisible by four. In the four color modes, the Atari stores information for four pixels in one byte. When you attempt to move the object horizontally, it jumps four pixels instead of moving smoothly.

After many hours of writing, I finished a revision. The command to invoke TextPlot II is almost identical to the one used in TextPlot:

A = USR(ADR($A),chr,color,horiz,vert)

There must be four parameters in the command. Unlike TextPlot, if you don't have four, the program returns an ERROR -22. TextPlot merely used the system bell. (I would like to suggest that machine language programmers use this error number as a standard for the wrong number of parameters in a USR statement.) The meanings of the parameters are:

chr - ASCII value of the character you wish to plot.

color - The color of the character (1-3).

horiz & vert - these are the same as the X and Y values used for PLOT and DRAWTO in the graphics mode you are in.

TextPlot II is a BASIC loader program. Since the program is too large to fit in page six, it is broken into two parts. The portion in the variable A$ is completely relocatable, as the only call used is JSR $0600. This is a call to the other portion of the program.

Well, that's it, short and simple. If you come up with any amazing games using TextPlot II, please let me know. If you don't want to type in all those data statements, I'll be happy to make you a copy. Just send a cassette or diskette, an SASE mailer, and $8 to:

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Eight sprites are available for screen display in a 24 horizontal by 21 vertical pixel format. Each sprite has a different "display hierarchy" when crossing over another sprite. Sprite 0 would move in front of Sprite 1; Sprite 1 and Sprite 0 would move in front of Sprite 2, and so on up to Sprite 7. All other sprites would move in front of Sprite 7. Also, you can tell each sprite whether it moves in front of or behind the normal text graphics.

Each sprite can be expanded to twice its size, horizontally, vertically, or both. Automatic collision detection tells you when sprites have hit each other or when a sprite has hit the background text graphics.

Commodore's manual gives the register number in the graphics IC chip which gives access to the collision information. First of all, the sprite-to-sprite collision is register 30 decimal. When sprites collide, the graphics chip sets their bits in this register. Second, the sprite to background graphics collision is register 31 decimal. When a sprite collides with the background, its bit is set.

Creating a Sprite
To make a sprite, you must first draw it on a 24x21 grid. Then you convert the set dots in each row into three separate bytes of data, using binary code. For each byte, add up the number according to its bit. The numbers for each bit in a byte are 128, 64, 32, 16, 8, 4, 2, 1.

Example of converting the grid:

Row 1  +  .  .  .  .  .  +  .  .  .  .  .  +  +  +  +  +  +  +  +  +  +
Row 2  +  .  .  +  .  +  .  +  +  +  +  +  +  +  +  +  +  +  +
Row 3  .  .  +  .  .  +  +  +  +  +  +  +  +  +  +  +  +  +  +

101 DATA 129,1,255:REMDATAFORROW1
102 DATA 145,1,255:REMDATAFORROW2
103 DATA 17,1,199:REMDATAFORROW3
104 DATA

Next, POKE into memory the 63 bytes of data to describe the sprite to the computer. The conversion of the grid into 63 bytes is not hard, but it is very time consuming. This is the reason for the Sprite Editor.

The Easy Way
The sprite editor gives many easy single-key commands to edit the sprite, display it, and save it. When the program is executed, commands are printed along the left side of the screen. On the right side of the screen is a 24x21 grid which is used to edit a sprite. To move the cursor, use the cursor keys. If you want a pixel set on the sprite, push the 1, 2, or 3 keys. If you want the pixel erased, push the "←" key. Any time you want to see the actual sprite, push the "=" key and it will compute the grid into the byte form and display the sprite in the lower left corner of the screen.

If you make any updates on the grid, they will not be displayed in the corner until the "=" key is pushed again. Once the sprite has been displayed, it can be enlarged horizontally or vertically by pressing "X" or "Y". Also, you can display the data for using this sprite in a program by pushing "B".

On all four of the following commands, the computer will ask if it is the correct command to be executed. The four commands are "N" for erasing the grid and the sprite to edit a new sprite; "S" for saving sprite data to cassette; "L" for loading a sprite from cassette; and "Q" for quitting the program.

To change colors while creating a sprite, use the "F1," "F3," "F5," and "F7" keys.
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10

COMPUTE!

POKE53281,6:DIM A(21,24),B(63),A$(15}:X=0:
Y=0:R=0:C=0:S=10 39:S1=55311

LI V=53 248:POKEV+21,0:POKEV+23,0:POKEV+29,0:R
ESTORE:FORX=0TO15:READA5{X):NEXT

12

PRINT"{CLEAR}":FORR=1T021:FORC=1TO24:A(R,C
)=4 6:NEXT:NEXT:FORX=lTO63:B(X)=0:NEXT

14

POKEV+4,60:POKEV+5,200:POKE2042,13:POKEV+3
7,0:POKEV+41,14:POKEV+38,1

16

20

FORX=1TO63:POKE831 + X,B(X):NEXT:POKEV+21,4 :
POKEV+28,4

PRINT"{CLEAR}{DOWNlMC SPRITE

EDITOR{DOWN}"

22 PRINT"_ ERASE"
23 PRINT"1 MC 0-BLACK"
24 PRINT"2 SC
-LT BLUE"
25 PRINT"3 MC 1-WHITE"
32 PRINT"= COMPUTE SPRITE"
33 PRINT"X SCALE 'X' "
34 PRINT"V SCALE 'V"
35 PRINT"B BASIC DATA"
36 PRINT"N NEW SCREEN"
37 PRINT"S SAVE SPRITE"
38 PRINT"L LOAD SPRITE"

IFA$="L"THENOPEN1,1,0,N$:GOTO3 00
CLOSE1:GOTO16

300

FORX=1TO63:INPUT#1,B(X):NEXT:CLOSE1:PRINT"

{DOWN}COMPUTING SPRITE MATRIX"
310 Y=0:FORR=1TO21:FOHX=0TO2:Y=Y+1:FORC=2T08ST
EP2:Q=X*8+C:P=2"(8-C)

312

S=B(Y}AND(P*3):A(R,Q)=46:A(R,Q-1}=46

314

IFS>0THENA{R,Q}=S/P+48:A(R,Q-l)=S/P+48

330
500

NEXT:NEXT:NEXT:S=1039:GOTO16
DATA BLACK,WHITE,RED,CYAN,PURPLE,GREEN,BLU
E,YELLOW

DATA

ORANGE,BROWN,LT

N,LT BLUE,GRAY3

RED,GRAY1,GRAY2,LT GR

(Q

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inferior imitations This is the original one as featured in the New Products section ot
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PRINT"Q

50

Y=0:FORR=lTO21:FORC=lTO24:Y=Y+l:POKES+YfA(

QUIT"

R,C):POKES1+Y,14:NEXT:Y=Y+16:NEXT

55 X=1:Y=1:GOTO79
60 GETA$:IFA$=""THEN60
61

R=S+X+(Y-1)*40:C=A(Y,X):POKER,C:POKER+1,C

62

IFA$="{D0WN}"THENY=Y+l:IFY>21THENY=l

64
65

IFAS="{RIGHT}"THENX=X+2:IFX>24THENX=1
IFA$="{LEFT}"THENX=X-2:IFX<1THENX=23

66
67

IFAS="_"THENA(Y,X)=46:A(Y,X+1)=46
IFA$>"0"ANDA$<"4"THENR=48+VAL(A$):A(Y,X)=R

68

:A(Y,X+1)=R
IFA$="=nTHENl00

69
7 0

IFA$="X"THENPOKEV+29,ABS(PEEK{V+29)-4)
IFAS="Y"THENPOKEV+2 3,ABS{PEEK(V+23)~4)

71
72

IFA$="B"THEN120
IFAS = tlLnORA$ = "S"ORA$ = nN"ORA$ = nQ"THEN190

73

IFAS="{F1}"THENR=33:GOSUB130

76

IFA$="{F4}"THENR=38:GOSUB130

79

R=S+X+(Y-1)*4 0:C=A(Y,X)+128:POKER,C:POKER+

6 3 IFAS="{UP}"THENY=Y-1:IFY<1THENY=21

100

196

200 OPEN1,1,1,N$:FORX=1TO63:PRINT#1,B(X):NEXT:

510

39

74
75

December 1982. Issue 31

IFA$="{F2}"THENR=37:GOSUB130
IFAS="{F3}"THENR=41:GOSUB130

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B{Y)=B(Y)+2~(7-C)*Q:NEXT:NEXT:NEXT:FORX=1T

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This unit will interface your VIC-20 or CBM-64 to

6 pin DIN -J

102

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------ CBM-64/VIC-20 PRINTER INTERFACE

1,C:GOTO60

104

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NEW CBM-64 AND VIC-20 PRODUCTS

Y=0:FORR=1TO21:FORX=0TO2:Y=Y+1:B(Y)=0:FORC

=lTO7STEP2:Q=A{R,X*8+C)-48

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O63:POKE831+X,B(X):NEXT:GOTO55

110

PRINT"{REV}"A$":

111

FORX=1TO10:GETN$:NEXT

YES OR NO"

112

GETN$:IFN$=""THEN112

Switches to select device addresses 4 through 7. Also

select ASCII or PET ASCII and bit 8 output.

114 PRINT"{UP}

{UP}":RETURN

115

PRINT"{REV}CONTINUE":G0T0111

119

REM

120

PRINT"{CLEAR}":FORX=1TO7:PRINT"DATAM ; :FORY
=1TO9:PRINTB((X-1J*9+Y}"{LEFT}, ";:NEXT

122

PRINT"{LEFT}

130

C=PEEK(V+R}AND15:C=C+1:IFO15THENC=0

132

POKEV+R,C:PRINT"{HOME}{03 DOWN}";:IFR=33TH

":NEXT:PRINT:GOSUB115:GOTO20

EN136

133

PRINT"{DOWN}";:IFR=37THEN136

134
135

PRINT"{DOWN}";:IFR=41THEN136
PRINT"{DOWN}";

136

PRINT"{07

190

GOSUBU0:IFN$O"Y"THEN79

191

GETN$:GETN$:IFA$="N"THEN11

192

IFA$="Q"THENPOKEV+21/0:POKEV+28,0:PRINT"{0
4 DOWN}":END

194

RIGHT}"A$(C)"

":RETURN

PRINT"{CLEAR}":POKEV+21,0:INPUT"NAME OF SP
RITE";NS:PRINT

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Add five invaluable commands to VIC BASIC: renumber, delete, find, change, and kill. This enhancement to BASIC automatically locates itself, protects itself, and becomes "part of the computer." It requires 1200 bytes of RAM, a little more than 1K. The article describes the step-by-step process of entering this program (it's machine language, but you can enter and use it without knowing machine language). Alternatively, the author offers to make tape copies—see instructions below.

Tiny Aid For VIC-20

David A. Hook
Barrie, Ontario

Since the early days of the PET, various enhancements for BASIC have been available. Bill Seiler, then of Commodore, produced the first public-domain version, called "BASIC-Aid."

Many updates and improvements have been made over the past couple of years. The PET/CBM program has ballooned to a 4K package for almost every possible PET/CBM equipment configuration.

As has been customary in the Commodore community, Jim Butterfield developed a version of the BASIC-Aid. He called this Tinyaid2 (or Tinyaid4, for BASIC 4.0). This offered the six most useful commands from the full-fledged program.

Following is my modification of that work, designed to provide VIC users with the same benefits. After using this for a while, I think you will find the added commands nearly indispensable.

Features

VIC Tiny Aid is a machine language program which consumes about 1200 bytes of your RAM memory. After you have loaded the program, type "RUN" and hit "RETURN". The program repacks itself into high memory. The appropriate pointers are set so that BASIC will not clobber it. VIC Tiny Aid is now alive.

Once activated, five commands become attached to BASIC. They will function only in "direct" mode; i.e., don't include them in a program.

(1) NUMBER 1000,5 'RETURN'
NUMBER 100,10

Renumber a BASIC program with a given starting line number and given increment between line numbers. The maximum increment is 255.

All references after GOTO, THEN, GOSUB, and RUN are automatically corrected. A display of these lines is presented on the screen as it works. If a GOTO refers to a non-existent line number, then it is changed to 65535. This is an illegal line number, and must be corrected before the BASIC program is used.

(2) DELETE 100-200 'RETURN'
DELETE -1500
DELETE 5199 -

Deletes a range of lines from a BASIC program. Uses the same syntax as the LIST command, so any line range may be specified for removal. DELETE with no range will perform like a NEW command, so be careful.

(3) FIND /PRINT/ 'RETURN'
FIND /AS/, 150-670
FIND "PRINT", 2000 -

Will locate any occurrences of the characters between the "/" marks. Almost any character may mark the start/end of the string to be found, so long as both are the same. The first example will find all the PRINT instructions in the program.

If you are looking for a string of text which contains a BASIC keyword, you must use the quote characters as markers. This will prevent the search string from being "tokenized."

If a limited line-range is desired, use the same syntax as for LIST. Note that a comma (",") must separate the line-range from the end marker.

All lines containing the string are printed to the screen. If a line has more than one of them, each occurrence will cause a repetition of that line.

(4) CHANGE -PRINT-PRINT/#4,- 'RETURN'
CHANGE /ABC/XYZ/, 6000 -
CHANGE /DSS/D15/-, -5000

Using the same syntax as FIND, you may change any string to any other string in a BASIC program. This command is very powerful and was
not part of the early versions of BASIC-Aid or Toolkit.

As before, you may indicate a line-range. As the changes are made, the revised lines are displayed on the screen.

Watch out for the difference between BASIC keywords and strings of text within quotes. You may use the quote characters to differentiate, as with FIND.

(5) KILL 'RETURN'

This command disables VIC Tiny Aid and its associated commands. A syntax error will be the result if any of the above commands are now tried.

Since the routine is safe from interference from BASIC, you may leave it active for as long as your machine stays on. It is possible that VIC Tiny Aid may interfere with other programs that modify BASIC's internal "CHRGOT" routine. The KILL command allows you to avoid this conflict.

Procedure

The VIC contains no internal machine language monitor, which is really the only practical way to enter this program. So follow one of the three methods below to perform the task.

(1) Borrow an Upgrade or BASIC 4.0 PET/CBM, with its internal ML monitor. This will be the easiest method to enter the program.

(2) Use your VIC-20, but you must have a machine language monitor:
   — Jim Butterfield's Tinymon For VIC (COMPUTE!, January 1982, #20).
   — my adaptation of Supermon For VIC (The Transactor, Volume 3, Issue #5).
   — VICMON cartridge from Commodore.

(3) The easy way:
   Send $3, a blank cassette or 1540/2031/4040 diskette in a stamped, self-addressed mailer to me at:
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   Barrie, Ontario, Canada
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Be sure it's packaged securely. Diskettes will be returned in DOS 2.0 format. Only 2040 (DOS 1.0) owners need take extra care. (The programs need to be copied to a DOS 1.0 formatted disk. Don't SAVE or otherwise WRITE to the disk you get).

If you are using a VIC, and have a 3K RAM or SUPEREXPANDER cartridge, plug this in. It will be somewhat easier to follow, since programs are then "PET-compatible" without further juggling. However, don't use the 8K or 16K expansion for this job.

If you are familiar with the operation of the ML monitor, please skip ahead to the specifics below.

You are about to type in almost 2500 characters worth of hexadecimal numbers. In addition to the digits from zero to nine, the alphabetic characters from A-F represent numbers from ten to fifteen. These characters, and three instructions, will be all that are used to enter our program. You don't have to understand the process – just type in the characters exactly. It's not very exciting, but don't be too intimidated by the "funny" display.

Believe it or not, this is the most efficient way to enter the information. The program will use only 1200 characters of memory. Using a "BASIC loader" (with DATA statements), the program wouldn't fit in a 5K VIC!

Enter the machine language monitor program using a:

TINYMON/SUPERMCN FOR VIC – LOAD and RUN the program.

PET/CBM — Type "SYS1024" and hit "RETURN".

VICMON Cartridge — "SYS 6*4096" or "SYS 10*4096" (this depends on the version you have), then type "RETURN".

Note: If you are working on the unexpanded VIC, you will need to follow the alternate instructions in parentheses below.

The cursor will be flashing next to a period character ("."). Type the entry starting at the current cursor position:

.M 0580 05C0 'RETURN'  (M 1180 11C0)

Several lines should appear on the screen, much like the "memory-dump" which accompanies this article. A four-digit quantity called an "address" leads off a line, and either eight or five columns of two-digit values appear alongside.

Look at the tables of values in the article. They show eight rows of these addresses. Note that the first "block" has the address "0580," which matches the first address just above. The first row of the next table shows "05C0," which is the second (or ending) address just above.

Your mission is to type in the matching values from the article, in place of the two-digit values you see on the screen. If you're using your VIC for this job, you will have to be on your toes. The tables show eight bytes per row, whereas the various VIC monitors present only five bytes at a time. You could mark off the values in groups of five before you start.

Remember to hit "RETURN" at the end of each screen line, or the changes won't be made.

Double check the values you've typed. It's not easy to find an error later on.

Look at the next block of values. Type in the
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start/end addresses to display:

.M 05C0 0600 ‘RETURN’ (M 11C0 1200)

Type in the values required and go on with the rest of the blocks.

You will use addresses ranging from:

05xx-06xx-07xx-08xx-09xx-0Axx

as shown in the tables. The “x” characters stand for the other two digits of the address in the leftmost column.

If you are working on the unexpanded VIC, the sequence of addresses is:

11xx-12xx-13xx-14xx-15xx-16xx

You will have to type these pairs of characters in place of the leading two shown just above.

With that task complete, we are ready to pre-service this work on tape. So type:

.S “VIC AID.ML”,01,0580,0AB6 ‘RETURN’
(or: .S “VIC AID.ML”,01,1180,16B6 ‘RETURN’)

Mount a blank tape, and follow the instructions. Save a second copy, for safety.

Exit the ML monitor, with:

.X ‘RETURN’

VERIFY the program normally before going any further.

Now comes the easy part. Type “NEW”, then the BASIC listing. Enter this exactly, without including any extra text. Save this as “VIC AID.BAS” and VERIFY it.

Leave this program in memory for the next stage.

Finally, LOAD the “VIC AID.ML” and SAVE “VIC AID.REL” on another blank tape. Both the BASIC part and the machine language part have been SAVEd together.

Check-Out

We are going to check out the machine language using a “checksum” method. Type in “NEW” before proceeding. Now enter the following program:

10 I=0 (or: I=3072 for unexpanded VIC)
20 T=0: FOR J=1408+I TO 2741+I
30 T=T+PEEK(J)
40 NEXT J
50 PRINT T

After a few seconds, if the value 161705 appears, you’ve likely got it perfectly. Go to the next section.

If not, there’s at least one incorrect entry. Change the two values in line 20, using the table below. Re-RUN the program and compare against the value in the third column.

Repeat the process for each row, noting any that don’t match. Each row corresponds to two “blocks” from the last section. You will have to re-enter the ML monitor to re-check those sections that differ. Re-SAVE the ML part!

Operation

The final acid test. RELOAD the program from tape and RUN it. The screen will clear and a brief summary of the added commands will be displayed. The cursor should return almost instantly, under the “READY.” message.

If the cursor does not come back, there is something still amiss. All the numbers appearing in the listing in this article were produced from a working copy of the program (Honest!). You still have option (3) from the procedure section available. If you do send a tape/disk at this point, include your non-functioning version. I can then do a compare, to see where the error(s) were.

This has been a massive exercise, and mistakes can easily creep in. Your comments are welcome.

Program 1: Memory Dump of Tiny Aid

<table>
<thead>
<tr>
<th>Block #</th>
<th>Value 1</th>
<th>Value 2</th>
<th>Checksum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-2</td>
<td>1408</td>
<td>1535</td>
<td>15201</td>
</tr>
<tr>
<td>3-4</td>
<td>1536</td>
<td>1663</td>
<td>17221</td>
</tr>
<tr>
<td>5-6</td>
<td>1664</td>
<td>1791</td>
<td>15925</td>
</tr>
<tr>
<td>7-8</td>
<td>1792</td>
<td>1919</td>
<td>15117</td>
</tr>
<tr>
<td>9-10</td>
<td>1920</td>
<td>2047</td>
<td>15565</td>
</tr>
<tr>
<td>11-12</td>
<td>2048</td>
<td>2175</td>
<td>14141</td>
</tr>
<tr>
<td>13-14</td>
<td>2176</td>
<td>2303</td>
<td>15840</td>
</tr>
<tr>
<td>15-16</td>
<td>2304</td>
<td>2431</td>
<td>16276</td>
</tr>
<tr>
<td>17-18</td>
<td>2432</td>
<td>2559</td>
<td>15152</td>
</tr>
<tr>
<td>19-20</td>
<td>2560</td>
<td>2687</td>
<td>15194</td>
</tr>
<tr>
<td>21</td>
<td>2688</td>
<td>2741</td>
<td>6073</td>
</tr>
</tbody>
</table>

Memory Dump of Tiny Aid

Aid

Program 1: Memory Dump of Tiny Aid

0580 A5 2D 85 22 A5 2E 85 23
0588 A5 37 85 24 A5 38 85 25
0590 A0 00 A5 22 D0 02 C6 23
0598 C6 22 B1 22 D0 02 C6 23
05A0 D0 02 C6 23 B1 22 C6 23
05A8 F0 21 85 26 A5 22 D0 02
05B0 C6 23 C6 22 B1 22 18 65
05B8 24 AA A5 26 65 25 48 A5

05C0 37 D0 02 C6 38 C6 37 68
05C8 91 37 8A 48 A5 37 D0 02
05D0 C6 38 C6 37 68 91 37 18
05D8 90 B6 C9 DF D0 ED A5 37
05E0 85 33 A5 38 85 34 6C 37
05E8 00 AA AA AA AA AA AA AA
05F0 AA AA AA AA AA AA AA AA
05F8 AA AA AA AA AA AA AA AA

0600 DF AD FE FF 00 85 37 AD
0608 FF FF 00 85 38 A9 4C 85
0610 7C AD D9 FB 00 85 7D AD
0618 DA FB 00 85 7E 4C 8F FC
0620 00 F0 03 4C 08 CF A9 C9
0628 85 7C A9 3A 85 7D A9 B0
0630 85 7E 60 DB FB 00 85 8B
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3 PRINT " DAVID A. HOOK
4 PRINT " FROM 'TINY AID' BY:
5 PRINT " JIM BUTTERFIELD
6 PRINT " AND 'BASIC AID' BY:
7 PRINT " BILL SEILER
8 PRINT " [REV] SAMPLE COMMANDS:
9 PRINT " [DOWN] CHANGE ?/PRINT#4,/
10 PRINT " FIND .GOSUB., 200-
11 PRINT " DELETE 130-625
12 PRINT " NUMBER 100, 5
13 PRINT " KILL (VIC AID)
14 SYS(PEEK(43)+PEEK(44)*256+383)

Program 2: BASIC section of Tiny Aid
1 PRINT"{CLEAR} {REV} VIC TINY AID "
2 PRINT"{DOWN} ADAPTED FOR VIC BY:

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This tutorial shows a quick and easy way to select random numbers using PEEK and POKE to increase speed. The technique is also demonstrated as an alternative to the SOUND command.

### Atari PEEK And POKE Alternatives

Jerry White
Levittown, NY

When writing a BASIC program, it is often necessary to find the fastest possible method to achieve a desired result. When speed is important, an assembler subroutine is usually the best alternative. In many cases, however, using PEEK and POKE instructions instead of conventional routines can significantly increase the speed.

In each of the four example routines below, RAM location 540 is used as a timer. The term "jiffy" is used to denote 1/60 of a second. Location 540 counts backwards until it reaches zero. When the number 255 is POKEd into this location, it will take four and one quarter seconds to count back to zero.

Each routine begins with a Graphics 0 command to clear the screen. You might want to try Mode 2 later on to see how the elapsed time of each routine is affected. Standard text mode was chosen so the routines could be listed on the screen and the elapsed time displayed.

Time tests 1 and 2 show two ways to select a random number between zero and 255. The first method is the conventional way. For demonstration purposes, the random number was selected ten times.

The second listing provides an alternative method which is four times faster. Our number is selected with a PEEK at location 20. This is also a jiffy counter, but unlike location 540, this one counts forward until it reaches 255. It is then reset to zero and continues counting normally. This method of selection is only useful when a single random number is required. For example, to return a decision on a 50 percent probability, check location 20 for less than, or for equal to, 127. This method would not be effective if more than one number is needed within a short period of time. It is, however, an excellent alternative in most cases, and is much faster than the conventional method because the multiplication is eliminated.

Time test routines 3 and 4 loop through the 256 pitches of Atari’s undistorted sound. Test 3 uses the conventional SOUND command. The execution time was 123 jiffies, or just over two seconds. Test 4 uses the POKE command. The difference was 17/60ths of a second.

There are many situations where the PEEK and POKE commands can be used to speed up your BASIC programs. There are also things that could not be done at all in Atari BASIC were it not for PEEK and POKE. I will continue to explore this subject in future COMPUTE! tutorials.

---

**Atari BASIC Time Test 1**

```
5 GRAPHICS 0:LIST
10 POKE 540,255:FOR TEST=1 TO 10:X=RND(0)*256:NEXT TEST:TIME=PEEK(540)
20 ? ; "TIME=";255-TIME;" 60ths of a second."
```

TIME=16 60ths of a second.

**Atari BASIC Time Test 2**

```
5 GRAPHICS 0:LIST
10 POKE 540,255:FOR TEST=1 TO 10:X=PEEK(20):NEXT TEST:TIME=PEEK(540)
20 ? ; "TIME=";255-TIME;" 60ths of a second."
```

TIME=4 60ths of a second

**Atari BASIC Time Test 3**

```
5 GRAPHICS 0:LIST
10 POKE 540,255:FOR TEST=0 TO 255:80.0,TEST,10,2:NEXT TEST:TIME=PEEK(540)
20 ? ; "TIME=";255-TIME;" 60ths of a second."
```

TIME=123 60ths of a second

**Atari BASIC Time Test 4**

```
5 GRAPHICS 0:LIST
10 POKE 540,255:FOR TEST=0 TO 255:POKE 53760,TEST:NEXT TEST:TIME=PEEK(540)
20 ? ; "TIME=";255-TIME;" 60ths of a second."
```

TIME=106 60ths of a second
For Commodore 2022 and 2024 printers, add an automatic shut-off to stop the machine when the paper has run out.

Paper Monitor Switch For 2022 Printer

Rev. Jack Weaver
Homestead, FL

Dire warnings are always posted for the users of dot-matrix printers. The warning DO NOT OPERATE UNLESS PAPER IS IN THE MACHINE is justified!

It is somewhat surprising, then, that Commodore did not see fit to include a Paper Monitor Switch in its 2022 and 2024 printers.

We use large amounts of fan-fold paper and have found, to our dismay, that not every stack of fan-fold paper is truly a continuous stack. For some reason, the stack may be separated, and this might not be obvious until it is too late. The paper runs out, the tractor runs on, and the printer continues to print — all without paper. This prompts visions of those tiny wires that make up the print head beating themselves flat against the platen and then ruining the guides through which they run.

The solution offered here works perfectly and has saved our print head more than once when we have had to leave the room during a printing run.

Our solution is twofold. First, the hardware fix.

The principle used is very simple. We discovered that if we grounded the PA-2 pin (Pin ID character E) on the Parallel User Port, a value of 251 is produced when location 59471 is PEEKed. (This method naturally assumes that the PA-2 pin is not being used for any other peripheral.) If the PA-2 is not grounded, when we PEEK location 59471, the value is 255. Our method grounds PA-2 when the paper runs out and isolates PA-2 when paper is in the printer.

We used the tractor feed carriage (which is isolated from ground) as the bracket to which we attached a three-inch long, stainless steel fishing leader, properly bent to touch the paper entry guide when no paper is in the machine.

This stainless steel “whisker” is attached to the PA-2 pin by a 28-gauge stranded wire which we coiled for flexibility. (The wire is soldered to an appropriate edge card connector which matches the Parallel Port.) When the paper is properly in the machine, the steel “whisker” is isolated from the paper guide by the paper itself. This gives us the two circumstances needed for our PEEKing program. The attached drawings should be self-explanatory.

The Software Fix

You may call the subroutine with a GOSUB before and just after paging — or preferably just before every PRINT # command to the printer. After the bottom edge of the last sheet of paper has passed the “whisker,” the program will stop until the up-arrow key (↑) is pressed (which should be done only after new paper has been introduced).

The Subroutine

Line 4000 returns you to the program if the value of PEEK(59471) is equal to anything other than 251. This means that there is still paper in the printer.

If PEEK(59471) is equal to 251, then the paper is out, and line 4010 fills the screen with the warning that the paper has run out.

Line 4015 clears the keyboard buffer in the event that the up-arrow has been pressed during the run.

Lines 4016-4027 give an audible signal if you have installed a CB-2 line amplifier for sound.

Line 4029 goes back for more sound continuously until the up-arrow is pressed.

Line 4030 turns off sound after up-arrow is pressed and returns from the subroutine to the main program.

Included is a short program for testing the proper grounding of the PA-2 line. After the line is properly connected, run this short program and manually ground and un-ground the “whisker”; you will see the value of PEEK(59471) change as you do it. If it does not change back and forth from 251 to 255 as you manually operate the “whisker,” then there is some error in your construction. Use extreme care that only the PA-2 pin is selected for grounding. Consult your PET manual or see attached diagram of the Parallel User Port.

This arrangement has no effect on any of our peripheral operations (such as our 2040 disk or the 2040 printer).

Program 1: Monitor/Indicator For 2022 Printer

```
4000 IF PEEK(59471)<>251 THEN RETURN
4010 FOR J=1 TO 10:PRINT "PAPER IS OUT - XXX PUT IN NEW PAPER":PRINT:NEXT J
4012 PRINT "TYPE """":WHEN READY TO - CONTINUE"
4015 GET WQ$:IF WQ$<>"":THEN 4015
4016 POKE 59467,16:POKE 59466,15:J=1
```
4020 GET WQS: FOR X=255 TO 1 STEP -J:
-POKE 59464,X
4025 IF PEEK(151)=59 THEN 4030
4027 NEXT X: J=J+1: IF J=10 THEN J=1
4029 IF WQS<>"" THEN 4020
4030 GET WQS: POKE 59467,0: RETURN

READY.

Test Program: Grounding
10 PRINT PEEK(59471)
20 GOTO 10

READY.

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“Change Disk” changes the device number of any Commodore disk: 2040, 4040, 8050 or 2031. It is an adaptation of a Commodore utility program.

A Floppy With A Strange Device

Jim Butterfield, Associate Editor

Why would you want to change a device number logically? You can dig into the innards and restrap the disk to a new device number if you wish. “Logical” changes are temporary and vanish when power is removed from the unit.

The most usual reason is a temporary hookup. In order to make copies or do some similar job, you want to hook together two or more units. Maybe you've borrowed an 8050 from a friend for the afternoon; he wouldn't be pleased to find the unit restrapped when you return it.

The trick is to have the program search out the right place to do the disk unit change. There are three different sets of locations which are used on various disks: 12/13 on the early 2040 and 3040 units; 119/120 on 2031 units; and 50/51 on 4040s and 8050s. We find out which one is correct by PEEKing the innards of the disk and seeing which set of locations contains the correct (old) numbers. When we find the right one, we make the change.

For those users interested in “innards”: the disk units check the device strapping once only at power up. It stores the computed “listen” and “talk” addresses in RAM memory, and from then on will use only the computed values. So we can change RAM, and the device number will be operational until we cut the power.

99 DATA 12,50,119,0
100 INPUT "OLD DEVICE NUMBER"; DO
110 IF DO<8 OR DO>15 THEN100
150 INPUT "NEW DEVICE NUMBER"; DN
160 IF DN<8 OR DN>15 THEN150
200 OPEN15,DO,15: REM COMMAND CHANNEL
210 A$=CHR$(DO+32): B$=CHR$(DO+64)
220 READA: IFA=0 THEN PRINT "DISK NOT RECOGNIZED!"; GOTO310
230 PRINT#15,"M-R"CHR$(A)CHR$(0): GET#15,X$;
240 PRINT#15,"M-R"CHR$(A+1)CHR$(0):
250 GET15,XX: IF X$=A$ GOTO 220
300 PRINT#15,"M-W"CHR$(A)CHR$(2)CHR$(DN+32)CHR$(DN+64)
310 CLOSE15

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DELETE - Deletes any portion of the running program between specified line numbers, under program control, with COMMON function, and continues execution. All deleted memory is reclaimed, and all variables/arrays are retained.

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**VIC File Clerk**

Dennis Surek  
Welland, Ontario

This program is designed to save you some space around the house – space perhaps presently occupied by large filing cabinets or old cardboard storage boxes. You will be able to file and at any time read back quickly 60 pages of information stored on one side of a 60-minute cassette.

Whether it is recipes, or budgets, or utility bills, the computer stores them efficiently and accurately. This program should be saved at the beginning of every tape that is to be converted into a filing cabinet.

The program first displays the file numbers and names and then asks which one you wish to access, and whether you wish to read or write to that file. If you are writing, the instructions will appear. Whether you are writing or reading, you will “Fast Find” to the proper file. [See Home and Educational Computing!, Fall 1981, p. 15.]

If you are writing, you can write as many pages as the file maximum allows. If you are reading, you can switch to writing subsequent pages, or you can continue reading through following pages and files.

Line 10 sets the number of files (NF) at 15 and the number of pages per file (NP) at 4. Changing either or both of these to lower values is easily done and requires no further changes to the program. The product NF x NP should be kept to 60 or less. With this in mind, it is just as easy to decrease NF and increase NP. But note that the program only fast finds to each file, and that increasing the number of pages per file defeats this fast find feature.

Increasing NF to more than 15 creates some minor problems. You will have to put additional data statements for file names between lines 100 and 240. Secondly, to keep the menu from scrolling up when the program is run, insert the following four lines:

81 IF INT(NF/2) THEN 90  
82 PRINT "PRESS ANY KEY TO": PRINT  
"CONTINUE”  
83 GETB$: IF B$ = " THEN 83  
84 PRINT "(CLEAR)"

These lines allow you to see half of the file names first and then to call for the rest when you are ready.

**Three Naming Choices**

Lines 100 to 240 are reserved for file names. There are three methods for dealing with file names. If you know all of the file names ahead of time, you could enter them when you key in this program. Conversely, you might not bother with file names at all, but use only the file numbers, writing descriptions of the files on the cassette box.

The system that I use is to save the program at the exact beginning of the magnetic portion of each tape. I then simply edit any of these lines to the title I want and reSAVE the program starting at the same position on the tape. The new program has not changed in length and therefore will still fast find to the proper file headers.

Lines 250 to 290 determine which file you want and whether you wish to read or write. If you are reading file #1, then line 300 branches to the read file routine beginning on line 660. This is possible because the PLAY key is already down from loading the program and no fast forward is required. In all other cases, some cassette key instructions will be needed. Line 310 determines if any keys are down and instructs you to press STOP in order to bring all keys up. Line 320 temporarily halts the program until this is done. If you are writing file #1, then line 330 branches to the write routine on line 420. Again, no fast forward is required for this file.

For all other files the cassette must be put into fast forward. Line 340 gives this instruction, and line 350 halts the program until the fast forward key is depressed. Line 360 begins the timer, and line 370 halts the program until an elapsed time of 90 jiffies per page per file is reached. At that instant, line 380 stops the cassette motor. Lines 390 and 400 get all keys up in a manner described previously. Line 410 branches to the read routine, and lines 420 to 500 are the instructions for writing a file.
Line 510 opens the file for writing and increments the page count. In the command OPEN1.1,1.1 the first “1” is the logical file number or reference number for our data file. The second specifies cassette drive #1, and the third indicates that the file is being opened for writing with no end of tape marker. It is the absence of this marker that allows the reading of consecutive pages later. For convenience, all files are assigned logical file #1. The program keeps track of the actual file number with the variable F.

Lines 520 to 590 input from the keyboard up to 20 message lines that make up one page. If a message line containing more than 22 characters is entered, it is edited to that length by line 540. Line 550 displays the last five characters of the message line as accepted so that you know how to begin your next message line.

If you are writing fewer than 20 message lines and have signaled this with the input message STOP, then line 580 will fill the rest of the page with blank message lines. This keeps all the pages the same length and therefore at a specific location on the tape. This enables you to later change any page simply by writing over the old one without having to rewrite the following pages in that file. Lines 600 to 650 determine if you wish to write the next page. If the answer is no, the program terminates.

Lines 660 to 740 are the read file routine. The zero in the command OPEN1,1,0 indicates a read operation. Line 720 moves the cursor up one line if the message line is 22 characters so that no blank lines will be displayed between message lines.

Lines 750 to 780 are for inputting and branching on commands to read or write subsequent pages. Lines 790 to 810 are the usual instructions to get all cassette keys up when changing from reading one page to writing the next page.

This program has been kept reasonably short so that load time is at a minimum. For that reason, there is no programming of special color or sound commands.

```basic
10 NF=15:NP=4:DIMA$(NF),O$(20)
20 PRINT"[CLEAR] ***VIC FILE CLERK***"
30 REMY DENNIS SUREK
40 REM 555 LLOYD AVE
50 REM WELLENDONT
60 PRINT"THIS PROGRAM WILL"
70 PRINT"READ OR WRITE TO FILE:"
80 FORI=1TONF
90 READ A$(I):PRINTI;TAB(5);A$(I):NEXTI
100 DATA UNNAMED
110 DATA UNNAMED
120 DATA UNNAMED
130 DATA UNNAMED
140 DATA UNNAMED
150 DATA UNNAMED
160 DATA UNNAMED
170 DATA UNNAMED
180 DATA UNNAMED
190 DATA UNNAMED
200 DATA UNNAMED
210 DATA UNNAMED
220 DATA UNNAMED
230 DATA UNNAMED
240 DATA UNNAMED
250 INPUT"FILE SELECTED";F
260 IFF<1ORF>NFTHEN250
270 INPUT"R-READ/W-WRITE";CS
280 IFCS="W"ORCS="R"THEN300
290 GOTO270
300 IFF=1ANDCS="R"THEN660
310 PRINT"[CLEAR]";:IF(PEEK(37151)AND64)=0THEN
320 PRINT"PRESS STOP ON TAPE"
330 IF(PEEK(37151)AND64)=0THEN320
340 IFF=1THEN420
350 PRINT"PRESS FAST FORWARD"
360 IF(PEEK(37151)AND64)=64THEN400
370 IFCS="R"THEN660
380 PRINT"[CLEAR]";
390 PRINT"INSTRUCTIONS TO"
400 PRINT"[REV]WRITE FILE"
410 PRINT"[UP]DOWM";MAXIMUMS:";
420 PRINT"*****"
430 PRINT"DOWM";20 LINES PER PAGE"
440 PRINT"TYPE STOP IF LESS"
450 PRINT"-NP;"PAGES PER FILE"
460 PRINT"DOWM";REV]WAIT[OFF] FOR PROMPT.FIRST"
470 OPEN1,1,1:PC=PC+1
480 PRINT"[CLEAR] [REV]WRITE FILE";F,"PAGE";PC
500 FORK=1TO20:INPUTO$(K):IFLEN(O$(K))<=22THEN
510 PRINT"[CLEAR] [REV]WRITE FILE";F,"PAGE";PC
520 FORK=1TO20:INPUTO$(K):IFLEN(O$(K))<=22THEN
530 PRINT"[CLEAR] [REV]WRITE FILE";F,"PAGE";PC
540 FORK=1TO20:INPUTO$(K):IFLEN(O$(K))<=22THEN
550 PRINT"[CLEAR] [REV]WRITE FILE";F,"PAGE";PC
560 FORK=1TO20:INPUTO$(K):IFLEN(O$(K))<=22THEN
570 FORK=1TO20:INPUTO$(K):IFLEN(O$(K))<=22THEN
580 FORK=1TO20:INPUTO$(K):IFLEN(O$(K))<=22THEN
590 FORK=1TO20:INPUTO$(K):IFLEN(O$(K))<=22THEN
600 FORK=1TO20:INPUTO$(K):IFLEN(O$(K))<=22THEN
610 PRINT"[CLEAR] [REV]READ FILE";F,"PAGE";PC
620 IF(PEEK(37151)AND64)=0THEN800
630 IF(PEEK(37151)AND64)=0THEN800
640 IF(PEEK(37151)AND64)=0THEN800
650 IF(PEEK(37151)AND64)=0THEN800
660 IF(PEEK(37151)AND64)=0THEN800
670 IF(PEEK(37151)AND64)=0THEN800
680 IF(PEEK(37151)AND64)=0THEN800
690 IF(PEEK(37151)AND64)=0THEN800
700 IF(PEEK(37151)AND64)=0THEN800
710 IF(PEEK(37151)AND64)=0THEN800
720 IF(PEEK(37151)AND64)=0THEN800
730 NEXTK
740 CLOSE1
750 PRINT"READ NEXT PAGE?":INPUT"Y/N";WS
760 IFWS="N"THEN800
770 IFWS="Y"THEN800
780 IFWS="Y"ANDPCP=NPTHEN510
790 IFPC=NPTHENPRINT"MAX";NP,"PAGES REACHED";
800 GOTO820
810 GOTO510
820 END
```
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These three short Applesoft programs show you how to change line numbers in order to delete and create undeletable lines.

**Undeletable Lines, Revisited**

P. Kenneth Morse  
Augusta, GA

Michael P. Antonovich described (COMPUTE!, October 1981, #17) a method of using the Apple's monitor to enter Applesoft program statements that could not be easily deleted using the Applesoft DEL command. He indicated that a way to get rid of such lines was to change the end-of-program pointer in S69-6A (115-116, decimal).

There are, however, at least two other general approaches to deleting "undeletable" lines:

1. Change the line number back to a deletable number. This may be done by using the monitor (or POKE statements) to modify the number of a specific line, or by simply running Apple's Re-number program. Once a deletable line number has been achieved, DEL will complete the job. Readers may find the program text file Deletable (see Program 1) helpful in quickly gaining control of undeletable lines.

2. LIST the deletable portion of the program to a new text file, clear memory with a NEW command, and then EXEC the text file. The undeletable lines will have vanished!

Mr. Antonovich's approach (changing the end-of-program pointer) and the text file approach (#2 above) will work only when the undeletable lines are at the end of the program. However, undeletable lines may also be placed at the beginning of the program (where they inhibit LISTings beginning at specific line numbers) or in mid-program. For example:

```
10 PRINT "THIS IS" ;
20 PRINT "A TEST"
```

may be converted to

```
65535 PRINT "THIS IS" ;
20 PRINT "A TEST"
```

by entering

```
POKE 2051,255:POKE 2052,255
```

in immediate execution mode, and the program will RUN and LIST, but you cannot RUN, LIST or GOTO either 20 or 65535 as specific line numbers. However, it is not practical to make the opening lines undeletable, since the program would then work only for the trivial case of a program with no GOTOs or GOSUBs! To test this, enter:

```
NEW
10 PRINT "THIS IS" ;
20 PRINT "A TEST"
30 GOTO 50
40 STOP
50 PRINT "IT WAS A SUCCESS"
```

and change line 10 to line 65535 as above. The program will not be able to find line 50!

Secondly, it is not necessary to key in an entire line through the monitor to achieve an undeletable line number. Programs 2 and 3 below provide Applesoft and Integer BASIC programs that will change specified line numbers to the undeletable value of 65535.

**Deletable (Lines 1-8 In Program 1)**

RUNning Program 1 creates a program text file, Deletable, which may be EXECed to convert undeletable Applesoft lines to a deletable range (63000-63999). Deletable will renumber up to 1000 undeletable lines per run. Once the line numbers are in the deletable range, DEL will finish the job.

Line 0 is a temporary line, used to create the text file Deletable by LISTing to the file lines 1-8. When Deletable is RUN, line 2 sets the value of the high and low bytes to be POKE'd as the new deletable line number. Line 3 initializes L1, the line address, as the start-of-program address stored in bytes 105-104 (decimal). Line 4 calculates CL, the line number being tested, and determines if it is undeletable (i.e., at least 64000). If the value of CL (line 4) is undeletable, deletable values are POKE'd (line 5), the POKE values are incremented, and control is passed to line 6. When all line numbers have been tested (or 1000 lines have been made deletable), Deletable deletes itself!

Deletable may also come in handy in case of a bombed Applesoft program caused by an inadvertent POKE which created an illegal line number. However, if the pointer to the next line was bombed, Deletable will not be able to help.

To use Deletable:

- Key in (and SAVE) Program 1
- RUN (this will create Deletable)
- LOAD the program containing the undeletable lines
- EXEC Deletable
- RUN
Applesoft (Lines 61800-61970 in Program 2)

The program will renumber as 65535 all lines between 62000-63999 and then delete itself. Here's how it works.

Beginning with the first line currently in memory, the program calculates CL, the current line number (line 61920). If CL is less than 62000, then the address (L1) of the next line number is calculated in line 61940, and the program recycles to 61920. If the number is at least 62000, the address of the line number is saved in the L() array, and a test is made to determine if the end of the lines to be renumbered has been reached.

If not, the program returns to 61920 to test the next line number. If it is the final line, it then renumbers each line referenced in the L() array to 65535, and DELETes Applesoft Permanent Notice. If you expect to renumber more than ten lines, you will need to DIM L(), either as a direct command or by inserting a DIM statement in the program.

To use Applesoft Permanent Notice:

- Key in and SAVE Program 2
- RUN (this creates Applesoft Permanent Notice)
- NEW or LOAD a program
- Enter lines numbered 62000-63999 which you want to be made permanent
- EXEC Applesoft Permanent Notice
- RUN 61800

Integer (Lines 31000-31170 in Program 3)

Integer Permanent Notice operates in somewhat similar fashion, but the lines to be renumbered should be in the range 32000-32767 (remember: Integer BASIC doesn't like numbers greater than 32767). Lines 31070-31090 determine L1, the address of the line number to be tested. CL, the line number itself, is calculated in 31110 and tested in 31110. If CL is 32000 or greater (line 31120), then L1 is tested (line 31130) to see if the final line has been tested. If not, the address L1 is stored in the array ADD(L). L is incremented, and control shifts to line 31120. When all line numbers have been tested, the value 255 (line 31160) is POKEed into both bytes of each address stored in ADD(). ADD() is currently DIMensioned at 10; this may be changed to renumber more than ten lines to undeletable status.

To use Integer Permanent Notice:

- Key in and SAVE Program 3
- RUN
- NEW or LOAD a program file
- Enter lines to be made permanent. Number them between 32000 and 32767
- EXEC Integer Permanent Notice
- RUN 31000

Program 1: Deletable

```
0 D$ = CHR$(4) PRINT D$"OPEN DELETABLE": PRINT D$"WRITE DELETABLE": LIST 1 - 81 PRINT D$"CLOSE DELETABLE": END
1 REM
2 SAVE 'DELETABLE' BEFORE RUNNING!
3 HI = 246 LO = 24: REM VALUE IS 63000
4 L1 = PEEK (103) + 256 * PEEK (104): L1 = 0
5 CL = PEEK (L1 + 2) + 256 * PEEK (L1 + 3): IF CL < 64000 THEN 6
6 POKE L1 + 2, LO: POKE L1 + 3, HI
7 LO = HI = 1
8 IF 256 * HI + LO < 64000 THEN 4
9 DEL 18
```

Program 2: Applesoft Undeletable

```
1 D$ = CHR$(4): FS = "APPLESOFT PERMANENT NOTICE": PRINT D$"OPEN": PRINT D$"WRITE": LIST 61800, 61970: PRINT D$"CLOSE": END
1800 REM ...........................
1810 REM 'PERMANENT NOTICE'
1820 REM BY KEN MORSE
1870 REM ...........................
1875 TEXT: HOME: PRINT "REM" REM LINES FOR PERMANENT NOTICE SHOULD BE NUMBERED 62000 OR HIGHER, AND SHOULD BE THE HIGHEST NUMBERED LINES IN THE PROGRAM"
1880 PRINT : INPUT "MAKE PROGRAM LINES PERMANENT BEGINNING AT 62000 THROUGH": LL
1890 IF LL < 62000 THEN 1830
1900 FL = 62000
1910 L1 = PEEK (103) + 256 * PEEK (104): L1 = 0
1920 CL = PEEK (L1 + 2) + 256 * PEEK (L1 + 3): IF CL = FL THEN 1950
1940 L1 = PEEK (L1 + 256 * PEEK (L1)): IF L1 = GOTO 61920
1950 L1 = L1 + 2, L1 = PEEK (L1 + 256 * PEEK (L1 + 3)): IF L1 > 0 THEN L = L + 1: GOTO 61950
1960 FOR J = L TO 0 STEP -1: POKE L(J), 255: POKE L(J) + 1, 255: NEXT J
1970 DEL 61300, 61970: END
```

Program 3: Integer BASIC Undeletable

```
1 D$ = CHR$(4): FS = "INTEGER PERMANENT NOTICE": PRINT D$"OPEN": PRINT D$"WRITE": PRINT D$"CLOSE": END
3100 REM ...........................
3101 REM 'PERMANENT NOTICE'
3102 REM FOR INTEGER BASIC
3103 REM BY KEN MORSE
3104 REM ...........................
3105 REM DIM ADD(10)
3106 REM ...........................
3107 REM ...........................
3108 REM ...........................
3109 REM ...........................
3110 REM ...........................
3111 REM ...........................
3112 REM ...........................
3113 REM ...........................
3114 ADD(L) = L1
3115 REM ...........................
3116 REM ...........................
3117 END
```
Atari Moving Message Utility

Michael A. Ivins
Cheyenne, WY

“Ticker Tape Atari Messages,” COMPUTE!, February 1981, struck me as being an excellent way for dealers and others to present promotional and other kinds of messages. However, the message I tried to type in was one of several hundred characters and occupied many lines of text on the screen.

When I tried to run the message, I found that nothing was being displayed beyond the third screen line of my original text. This coincides with the limit placed on a logical line of program code.

I then set out to expand the program. The program which accompanies this article is the result. It is a menu-driven program with four options. The first option is the entering of a long message in shorter segments (I call them “phrases”) and concatenating these into the main message string. The load and save routines allow choice of disk or tape and include error traps in case you forgot to turn on your tape recorder. These two options eliminate the need to type a new message every time the program is run. For an explanation of the actual message movement, I refer you to the original article.

In the preparation of this program, I ran into something which I have not seen documented anywhere. When you want to change the DIM of a variable, you will encounter an ERROR 9 unless you use the CLR command, as I did in lines 100 and 200. The BASIC Reference states, “This command clears the memory of all previously dimensioned strings, arrays, and matrices so the memory and variable names can be used for other purposes. It also clears the values stored in undimensioned variables.”

It also does something not mentioned in the manual. When I first attempted to use the command, I wanted to put it in a subroutine. However, every time I did this I was presented with an “ERROR 16”, which means a RETURN was en- countered without a matching GOSUB. It is now apparent to me that the CLR command not only clears variables, but also clears the “stack” similar to the way the “POP” command does. This means that a CLR command must never be used as part of a subroutine or in a FOR-NEXT loop.

Some Few Hints
The way the program is written, you can enter a message of up to 2000 characters. This is a pretty long message, but if you should like an even longer one it is only necessary to change the DIM statements in the enter and load routines. If you would like your message to be more colorful, mix upper- and lowercase letters and inverse. They will still be displayed as uppercase letters, but in as many as four different colors (a similar trick gives us the colored stars in the message border).

A control comma (graphics heart) will show as a blank space, and it is sometimes wise to add it at the end of a phrase to insure separation from the start of the next one. Finally, although this program will accept phrases up to three lines long, I advise entering shorter phrases to avoid any chance of losing something.

Ticker Tape Update

```
1 REM MOVING MESSAGE UTILITY
10 OPEN #1,4,0,"K:";GOTO 20
15 ? CHR$(125);"YOU MUST ENTER OR LOAD A MESSAGE FIRST";GOTO 25
20 ? CHR$(125)
25 ? "MOVING MESSAGE UTILITY"
30 ? :? "ENTER NEW MESSAGE" :? :? "LOAD AN OLD MESSAGE" :? :? "SAVE CURRENT MESSAGE" :? :? "RUN CURRENT MESSAGE"
35 GET #1,A;IF A<69 AND A>76 AND A<
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The usual RESTORE statement in Applesoft simply resets the data list pointer to the first occurrence of a DATA statement in an Applesoft program, though in some applications it would be necessary to READ from a distinct DATA line. With a small machine language program, it is rather easy to build a RESTORE with a parameter.

This is done with the ampersand (&) command. This symbol, when executed as an instruction, causes an unconditional jump to memory location $03F5. At location $03F5 there must be a JMP instruction to your machine language program, which is then terminated with an RTS instruction to pass control back to Applesoft.

The syntax of RESTORE(N) with the ampersand is &N where N is an integer in the range 0-65535. If there is no line number N, the data list pointer will be set to the next DATA line in the program. If there are no more DATA lines, an OUT OF DATA error message will be displayed. Before the first use, the machine language must be linked with CALL768.

The ML routine can now be saved either on disk with BSAVE RESTORE(N),A$300,L$22 or on tape with 300.321W.

A simple example for the use of &N:

```basic
10 PRINT CHR$(4)"BRUN RESTORE(N)"
20 INPUT"LINENUMBER:";LN
40 &LN
50 READ L
60 PRINT"HEREISLINE#"L
80 GOTO20
```

The ML routine can now be saved either on disk with BSAVE RESTORE(N),A$300,L$22 or on tape with 300.321W.

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```

The ML routine can now be saved either on disk with BSAVE RESTORE(N),A$300,L$22 or on tape with 300.321W.
Have you ever created a great machine code utility only to realize that the area of memory in which it resides is needed by another program? Maybe you have wanted to make a copy of Supermon (a high memory monitor utility) for a friend's 8K machine. “Codemover” will move machine code to a new location rapidly and accurately.

Machine language consists of codes that the 6502 executes. The code may process or transfer data, test and branch, and control input and output. All of these instructions use different addressing techniques, and the principal concern of our code-moving program is to translate the proper address along with some jump and other instructions. The instructions can be broken into three groups.

The first group requires the most attention. These are the three-byte codes using absolute, absolute indexed, and absolute indirect addressing. Some examples would be LDA $40FC, JMP $4095, EOR $033A,Y, JMP($033A). Each of the instructions in this group is followed by two bytes containing the address in the normal low, high format. If these two bytes point to an address within the machine language program itself, they will need to be changed to reflect the new location of the program. If they point to an address outside the target program (i.e., a routine in ROM), a new address need not be computed.

The second group contains instructions which require two bytes. Some examples are LDA SFF, CMP #$FF, STA($40,X), ROL $28,X, and BEQ $0352. The branch instructions are relative, a displacement from their address. As a result, they will point to the correct offset address after they are moved. Branches can simply be moved without any worry.

The last group consists of instructions only one-byte long. They are also just moved with no adjustments necessary because they do not point to an address. Some examples are CLD, PHA, ROL, and ASL.

The Program
The program is relatively self-explanatory, although a few comments may be helpful. It is written in PET BASIC and should be easy to transfer to other machines; it requires about 4K. The lines that do the actual moving are 1325 to 1560. Two subroutines at 100 and 200 convert from hex to decimal and vice versa. At line 300 are stored the opcodes, which are three and two bytes long.

At line 1410 Codemover PEEKs the current memory location and compares it with the three-byte opcodes stored in C3%() array. If a match is found, the program then computes the address from the following two bytes to see if it is within the boundaries of the original machine code. If it is, a new address is computed, using the displacement, and POKEd into the new code. Otherwise, no displacement is calculated.

If the code is not a three-byte opcode, it is then checked against the array of two-byte opcodes. If a match is found, the program then moves two bytes of code. Otherwise, the computer moves only one byte before PEEKing the next machine code instruction.

The program has another mode of moving machine code besides translation of the JMP addresses. You may want to move a lookup table verbatim so that the copy is exactly like the original. Failure to do this may cause the table to be changed slightly.

Now the next time that a machine utility is in an unfortunate or busy location, simply move it, letting the computer do all the work. After all, isn’t that what these machines are for?

30 DIS="0123456789ABCDEF"
40 DIM C3%(47),C2%(73)
50 REM*********VARIABLES***********
52 REM
54 REM 00 --BEGIN OF ORIGINAL CODE
56 REM 00 --LAST OF ORIGINAL CODE
58 REM 00 --BEGIN OF COPY CODE
60 REM 00 --LAST OF COPY CODE
62 REM 00 --DISPLACEMENT OF CODE
64 REM 00 --BEGIN OF SECTION
66 REM 00 --END OF SECTION
68 REM C3%(47) --1 BYTE OPCODES
70 REM C2%(73) --2 BYTE OPCODES
72 REM ADD --FORMER ADDRESS
74 REM NADD --COMPUTED ADDRESS
76 REM
78 REM***************
99 GOTO 900
100 REM SUB TO TRANSATE DECIMAL TO HEX:ENTER
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REM /*TRANSLATE ADDRESS'S AND MOVE*/
1405 II=II+1:A%=PEEK(II):POKE(II-D),A%:GOTO 1400
1410 IF II>15 THEN GOTO 1400
1420 REM ADD=PEEK(II+2)*256+PEEK(II+1)
1425 IF ADD>LO OR ADD<BO THEN II=II+1:A%=PEEK(II+1):GOTO 1400
1430 NADD=ADD-D
1435 POKE(I1+2-D),INT(NADD/256)
1440 POKE(I1+1-D),NADD-INT(NADD/256)*256
1450 II=II+2:GOTO 1410
1460 PRINT"/UP":POKEiA%:
1470 PRINT"/UP":POKEiiA%:
1480 PRINT"/UP":POKEiiA%:
1490 PRINT"/UP":POKEiiA%:
1500 PRINT"/UP":POKEiiA%:
1510 PRINT"/UP":POKEiiA%:
1520 PRINT"/UP":POKEiiA%:
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1710 PRINT"/UP":POKEiiA%:
1720 PRINT"/UP":POKEiiA%:
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Insight: Atari

Bill Wilkinson
Optimized Systems Software
Cupertino, CA

This month, I will follow through with at least one of my promises for some heavier assembly language stuff: the discussion and source for the fix to the 850 handler LOMEM problem. Unfortunately, I did not manage to complete the other promised project, the BASIC Cassette Verify program.

That program has proven more difficult to write than I had suspected it would, primarily because it's hard to get the debugger and BASIC to cooperate. With some luck I will have the problem fixed very shortly.

In any case, I've also got a few little tidbits to share with you, so let's tackle them first.

Atari-CP/M Revisited
First, I would like to clear up a misunderstanding (on my part) about the Vincent Cate (US Enterprises) Atari-to-CP/M connection, mentioned a couple of issues ago. I stated that one problem with the system was that you would not be able to use standard Atari diskettes. Not totally true. If you have (or have access to) an Atari compatible 810 drive, you can copy programs from the 810 to the CP/M host. (Vincent claims that the system is even capable of properly simulating self-booting disk games, etc., though I would imagine that some of the heftier protection schemes might defy his standard system.)

Anyway, the address for USS Enterprises is 6708 Landerwood Lane, San Jose, CA 95120. I hope this doesn't seem too much like an ad or endorsement: I have not used the system. I have, however, heard from people who have and who say it does what it claims to do.

In the same column, I mentioned a new product to be introduced soon which would function either as an Atari disk controller (810 emulator) and/or as a CP/M system in which the Atari console was a smart terminal. That project is apparently at the reality stage, so I guess in fairness I should now mention it by name.

The company producing the product is Software Publishers, Inc., of Arlington, Texas. (I know. Software publishers?) The base price of the controller, I have been told, is about $500 without disk drive. The CP/M add-on will be (is?) about $250. Perhaps someone will soon give us a review of the viability of this concept.

Double No-Trouble
Speaking of viability: We have been using our Percom drives (one double density, one double sided and double density) for about three months now. We are more than satisfied with their reliability. And, of course, the new OS/A+ we produced for use on the larger drives allows considerable flexibility. Perhaps the Atari can be used as a business machine after all.

And to be sure that we don't slight anyone, I need to mention that our MPC double density system has been here about a month now and also seems to be working fine.

So far, all the things we've tried seem better for most purposes than the 810 drives, though all of them seem to have trouble with some heavily protected diskettes. Moral: buy the drive, forget the diskettes. (Side issue and pet peeve: If it's that heavily protected, it will have trouble even on a slightly out of speed Atari 810. So far, I have plunked down my scarce dollar only three times for copy-protected disks. I think I will try to be thriftier in the future.)

Percom DOS
By now it should be general knowledge that the "new and improved DOS" that Percom has been publicizing is none other than OS/A+. But it is a significant change from our "old" OS/A+, which is really just a CP/M-like keyboard interface hooked to the Atari DOS 2.08 File manager. Thanks to the efforts of Mark Rose, our youngest associate and junior at Stanford University, we have managed to produce an all new, random access DOS designed to interface to any and all disk drives from 128 kilobytes to 16 megabytes. The "random access" description implies that you are not tied to the tyranny of NOTE any more (and POINT is now reasonable: you POINT to a byte position within a file, just like on the big guys' systems, and better than CP/M).

This may sound like an advertisement for OSS and Percom, but it really isn't. First of all, our profits aren't really tied to the sales of this new DOS, so it isn't really an ad for us. And second, it appears that OS/A+ will be used by all the other Atari-compatible drive manufacturers, so Percom is offering it first but not alone. Anyway, the real reason I brought this up (aside from wanting to pat Mark Rose on the back in public) is to pass on a few of the things that you should watch out for if you are thinking of moving to either more or larger
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LOMEM On The Tot-Mem Poll

I am sadly dismayed to see so many Atari-produced and Atari-compatible products being introduced nowadays which violate one of the prime rules for running on an Atari: don't put anything lower in memory than LOMEM.

After all, the operating system provides these nice, convenient locations LOMEM and HIMEM, which contain the addresses of the bottom and top of usable memory. Why not use them?

But no, let us assume that we will run under Atari DOS 2.0S, with two single density drives, with our blinders on (so that we cannot see the future). Phooey. How about a little table to show the values of LOMEM under various DOS configurations, with various numbers of drives and files available?

### LOMEM With Various DOS's

<table>
<thead>
<tr>
<th>Dos Used</th>
<th>Number Of Drives</th>
<th>Number Of Files</th>
<th>Contents Of LOMEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atari DOS 2.0S</td>
<td>2-S</td>
<td>3</td>
<td>$1C00</td>
</tr>
<tr>
<td>Atari DOS 2.0S</td>
<td>4-S</td>
<td>7</td>
<td>$1F00</td>
</tr>
<tr>
<td>Atari DOS 2.0S</td>
<td>2-D</td>
<td>3</td>
<td>$1E80</td>
</tr>
<tr>
<td>Atari DOS 2.0S</td>
<td>2-S, 2-D</td>
<td>5</td>
<td>$2180</td>
</tr>
<tr>
<td>Atari DOS 2.0S</td>
<td>4-D</td>
<td>7</td>
<td>$2380</td>
</tr>
<tr>
<td>OS/A + ver 2.0</td>
<td>2-S</td>
<td>3</td>
<td>$1F00</td>
</tr>
<tr>
<td>OS/A + ver 2.0</td>
<td>4-S</td>
<td>7</td>
<td>$2100</td>
</tr>
<tr>
<td>OS/A + ver 2.0</td>
<td>4-D</td>
<td>7</td>
<td>$2680</td>
</tr>
<tr>
<td>OS/A + ver 4.0</td>
<td>2-D</td>
<td>3</td>
<td>$2C00</td>
</tr>
<tr>
<td>OS/A + ver 4.0</td>
<td>4-DD</td>
<td>7</td>
<td>$3300</td>
</tr>
</tbody>
</table>

**legend:** -S means single density drives  
-D means double density drives  
-DD means double sided, double density

Surprised? It gets worse: if you load the RS-232 handler for the 850 Interface Module, you must add almost $700 to all the table figures! (And I left out K-DOS simply because I don’t know the correct figures there, but I understand that they are all over $3000.)

“But,” you say, “how come you show Atari DOS with double density drives?” Aha! You didn’t know that Atari DOS will handle double density drives for most user programs? (The menu can get confused, especially for duplicating disks, but BASIC – for example – runs just fine.)

We agonized a long time over coming out with OS/A + version 4, the Percem (et al.) random access DOS, with its much higher LOMEM values. But then we realized that, given that you will use double density and larger disks, there is simply no way to stay completely compatible. So, if you’re going to do it, do it right.

Incidentally, Percem’s initial patches to Atari DOS 2.0S solved the problem in a different way: they moved the disk buffers to the top of memory and dropped HIMEM. Of course, then they ran into trouble with the programs that ignore HIMEM. Like BASIC A +? Welllll, I guess we have to take our lumps, too. Sigh. But we’re working on it, honest.

So this has gone on long enough. The moral: if you’re writing assembly language programs, pay attention to the rules. If you’re stuck with an interpreter or compiler that does it wrong, go yell at the company that palmed it off on you.

### Mishandler

Since I am ranting on about LOMEM anyway, let’s tackle the problem I presented last month: the Atari RS-232 handler for the 850 Interface Module does not handle the RESET key properly when the disk device (or other previously loaded handlers) is present.

The result is that LOMEM will be reset to what the disk handler thinks it is, rather than above the 850’s driver. And, of course, this means that any program which uses LOMEM properly will zap the RS-232 (Rn:) drivers. Which might not be so bad except that the Rn: name will still be recognized by CIO. Which might be a real disaster.

Why did all this come about? Because Atari didn’t follow their own advice. When you steal DOSINI from DOS, in order to link yourself into the RESET chain, the first thing you should do is call the old DOSINI. Instead, the 850 handler does all its initializing, resets LOMEM to above itself, and then calls the old DOSINI! (And, of course, poor old FMS doesn’t know that R: exists, so it moves LOMEM to just above itself. And, admittedly, you could fix the problem by having DOS change LOMEM only if the change is upward. This is left as an exercise to the reader.)

So what do we do about this bug? If you are using BASIC (or BASIC A +), forget about it. BASIC maintains its own LOMEM pointer, which is initialized only at BASIC coldstart time (e.g., at power-up). In fact, many system programs either do similar things or have been purposely assembled in higher memory to avoid all possible drivers. (Except see that good old table. Maybe they aren’t all high enough?)

However, if you need to fix this problem, chances are you need to fix it quickly and thoroughly. The machine language program below seems to do a reasonably good job of patching the mess. But, of course:

**Caveats:** (1) This program works as shown with my 850 Interface Module. I know for a fact that Atari has made more than one version of this beast, so I can not guarantee it will work on yours. (2) This program works by patching the AUTORUN.SYS (also known as AUTORUN.232 or
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RS232.OBJ or RS232.COM) file. If you are not using Atari DOS (or OS/A+, for RS232.OBJ or RS232.COM), then this will work only if you can load and execute this routine at the addresses shown in the listing.

So how does this program work? To understand it, we must first understand how the Rn: handler is loaded from the 850.

Here I Am

When the Atari computer is powered up, it finds out if a disk drive is attached by sending out a status request command (via SIO). If, indeed, disk drive number one is alive and well, then the disk boot proceeds. But if the 850 is alive and well, it is also sitting on the serial bus, looking at SIO sending status request command(s) to the disk. SIO will try 13 times to boot the disk before giving up. But here is where the 850 gets sneaky: if the disk doesn’t answer after about ten of those tries, the 850 jumps on the bus and says “Here I am! I’m the disk drive! Boot me!”

And, of course, the computer indeed “boots” the disk – whether it actually is the drive’s controller chip responding or whether it is an 850 in chip’s clothing. And that’s how those 1800 or so bytes of code get into the computer when all you have is an 850.

But how does that code get pseudo-booted when you do have a disk? Well, one way would have been to distribute the handler on the disk. But why waste all that good code sitting out in the 850, just waiting to be executed? So AUTORUN.SYS (in any of its aliases) is a very small routine that performs just the right operations to load the 850’s serial handlers.

In building the program presented here, I have cheated. Quite frankly, I have not investigated why and how the code used in AUTORUN.SYS works. And quite frankly, I don’t care. What I have done is simply build my program around that code. And here’s what my program does.

First, I get the current contents of DOSINI (presumably the address of the FMS initialization routine) and save them for later use. Then I fall through and let the 850’s code be loaded and initialized. If this process is successful, I then find the new contents of DOSINI (the Rn: driver’s initialization routine address) and save them also. And where do I save the two initialization addresses? In the middle of the patch to be applied to the 850 driver.

Then all I need do is move the patch into the middle of the driver and re-link DOSINI to point to the patch. Now, the cute part of all this is: where do we put the patch? Why, righ: on top of the erroneous call to the FMS initialization. (The one that occurs after the 850 init, remember?)

Ummuh, but I’m patching a JSR to the FMS init followed by a JMP to the 850 init. How does all that fit into the space of one (previous) JSR? And what about the code immediately preceding the patch? Here it comes, the kludge. The code we are replacing includes a check of the warmstart location, since the handler does not bother to call the FMS initialization if it doesn’t need to. Well, with our code patch, the FMS always gets called to init itself. But so what? It doesn’t hurt anything, just slows the loading of this 850 interface code an unnoticeable amount.

Anyway, if you can follow the code, you will note where the patch is being applied. The byte immediately before the patch location must be a CLC instruction. (Check it out by loading the RS232 handlers and then using a debugger to list the code.) If it is not, then your 850 differs too much from mine to use this routine as is. (And if you figure out where to patch it, why not tell all of us.)

Last but not least, notice that the patch is intrinsically relocatable, just as is the 850 handler. It should work in virtually any memory and/or disk drive and/or DOS configuration.

Whew! That was lengthy and heavy, right? Well, cheer up, there’s more to come next month. Like how to add a default drivespecifier to Atari DOS and OS/A+. If you have two drives, wouldn’t it be convenient to be able to specify that “D:...” meant “D2:...” once in a while? Watch this space.

Atari 850 Fixer Upper
or: when in doubt, punt.

0000 1010 PAGE " or: when in doubt, punt."
1020 ;
1030 ; Some equates
1040 ;
1050 0043 1050 FIXOFFSET = 543 ; read the text
1060 000C 1060 DOSINI = 50C ; the cause of all this
1070 ;
1080 1090 ; This first code is simply to save the original
1090 ; contents of DOSINI for later use, like the
1091 ; 850 code should have done in the first
1100 ; place. High.
1110 1130 ;
1140 1150 LOAD $3800-10
1160 377F A50C 1160 LDA DOSINI ; presumably, we are saving
1170 377F BD77B8 1170 STA PRIORITY1 ; the FMS init vector for
1180 377F A50D 1180 LDA DOSINI+1 ; later use, but the beauty
1190 37FD BD78B8 1190 STA PATCH2+2 ; this: it works w/o FMS also
1200 ;
1210 ;
1220 ; Now we begin the original Atari loader code.
1230 ;
1240 ; If your code doesn’t agree with this, it
1250 ; is possible that your 850’s internal
1260 ; is different also. If so, apply the
1270 ; patches with caution. Read the text.
1280 ;
1290 ; CAUTION: this code is uncommented, simply
1300 ; because I’m not sure exactly what it
1310 ; is doing. But who cares...it works.
1320 ;
1330 3800 1330 *= $3800 ; where the Atari code was found
1340 3800 A900 1350 LDA $550
1350 3802 B00003 1360 STA $0300
1360 3805 A901 1370 LDA $501
1370 3807 BD0003 1380 STA $0301
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such patch!.

...the 850's code.

This patch areahas

This is just to make it a LOAD AND GO file

You might wish to use $282 instead of $280.

understand the implications thereof.

This patch area has two addresses placed

in it and then it is moved en masse

The 850 code has patched

its init entry point into

we will jump

to it at the end of our patch

we move our patch code into the 850's code

We move our patch code into the 850's code.

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Here's what a father and his eleven-year-old son came up with when they first brought their VIC home.

Checkbook

Harvey B. Herman
Associate Editor

Harvey Gets A Computer

For many months I had been hearing about a wonderful new personal computer which Commodore markets. After using it for several days, I came to believe that the hyperbole put out about it was justified and Commodore has a best seller, possibly the first gold microcomputer. It surely will rival their earlier PET model (er, sorry, CBM), but it is intended for a different clientele (everybody).

If it is true that millions of consumers are buying VIC and other machines, it follows that not all of them can be experienced computer hobbyists. It would be a shame if someone brought one home, without a plug-in cartridge or other program (software), and did not know what to do with it, even after reading the manual. This article is intended to illustrate one application for a personal computer. The program, checkbook balancer (called Checkbook), can be used to demonstrate to friends, neighbors, and spouses the hidden potential in our e.t. (expensive toys). We don't want them to ever get the idea that its only use is for playing games. Later you can show off a fun program if you have one. VIC and a color TV play some great games. However, in a demo, applications programs first is the rule.

The Kids Take Over

My kids kicked me off the VIC shortly after I brought it home and set it up (super easy to do, set up—not kick me off, as I scream and carry on a lot). The eleven year old, Mark, typed in a program he had seen demonstrated on a PET at his elementary school. This program and mine, discussed below, do not make use of the color features of the VIC. I am still a novice in that area. However, our experience with PET BASIC transferred easily to the new machine as the commands are identical. When it is given your age in years, Mark's program calculates how many days old you are. The program is not perfect. For example, leap years are not allowed for. However, he was very cocky after it worked. I mention this experience because I feel the reader is probably over 11 years old and should not allow a kid to show him up. Teach yourself VIC BASIC, if you have not already done so, and learn to be a better computer programmer than my eleven year old son. It really is not difficult.

Harvey Regains Control

At this point I asserted my authority (such as it is) and took over command of the VIC. On paper I composed a checkbook balancing program, typed it in, and, after correcting a few mistakes, had a working program. The whole process took about two hours, which I would guess is probably about average for an experienced BASIC programmer like myself (no brag). The Checkbook program (like any other) can be divided logically into three sections: input, calculations, and output. First, the previous month's balance is asked for. Then queries about the number and amount of deposits and checks follow. Calculations are done after each input operation. The only result, the new checkbook balance, is output at the end, along with a reprise of the input data for checking purposes.

You Can Do It Better

If the program is unintelligible to you because you have not learned VIC BASIC, you can still type it in and show it to your friends. (Make sure you know how to SAVE and LOAD short programs on tape before typing in a program as long as this one.) Of course the Checkbook program could be improved and even customized. Part of the allure of personal computers is that we can make them do what we want rather than vice versa. For example, if you feel that it is important to save the data on tape for future reference, read the manual on tape files and add this feature to the program.

Checkbook has now become, in part, your program of which you can be proud. The fact that you have added even more practical utility makes it
that much sweeter. Tell your friends about “your program,” but please try not to be too cocky. Happy computing on your VIC!

VIC Technical Notes

1. RETURN as a sole response to INPUT does not stop program as in previous Microsoft BASICs. Program continues using old value of variable.

2. INPUT with prompt in quotes has a restriction. Length of prompt should be 20 characters or less (not counting cursor control characters). Otherwise, prompt message is included in response string.

3. All programs on tape begin loading at hex 1001. PET tapes made with 2.0 (Upgrade) ROMs load into VIC normally. PET tapes made with 1.0 (Original) ROMs have first line garbled.

4. VIC tapes can be loaded into PET if an append procedure is used. First NEW, then append (with tool kit or similar program), and VIC tapes will load normally.

5. As with PET, the STOP key does not work when the program is waiting for input. Instead, press RUN/STOP and RESTORE. VIC will stop without losing your program. This method should get you out of many other awkward spots, but will not work if certain critical pointers are lost (say by an errant machine language program).

6. It helps to keep a list of the color graphics symbols handy (and for that matter, cursor control also) when typing programs from a printed list. This will save much frustration caused by trial and error pecking during program entry.

Program 1.

10 REM CHECK BOOK BALANCE PROGRAM
20 REM HARVEY B. HERMAN
30 REM
40 DIM D(20), C(50): REM 20 DEPOSITS, 50 CHECKS
50 PRINT "{CLEAR} {REV} CHECK BOOK": PRINT
60 INPUT "DO YOU WANT [12 RIGHT] INSTRUCTIONS"; A$;
70 GOSUB 710
80 ON J GOTO 370, 310, 300
90 PRINT "WHAT?": PRINT: GOTO 260
100 PRINT "HOW MANY"; M
110 PRINT
120 INPUT "PREV. BAL."; PB: NB = PB
130 PRINT
140 INPUT "ANY DEPOSITS"; A$
150 GOSUB 710
160 ON J GOTO 250, 180, 170
170 PRINT "WHAT?": PRINT: GOTO 140
180 PRINT
190 INPUT "HOW MANY"; N

200 PRINT
210 FOR I = 1 TO N
220 INPUT "DEPOSIT"; D(I): PRINT
230 NB = NB + D(I)
240 NEXT I
250 PRINT
260 INPUT "ANY CHECKS"; A$
270 PRINT
280 GOSUB 710
290 ON J GOTO 370, 310, 300
300 PRINT "WHAT?": PRINT: GOTO 260
310 INPUT "HOW MANY"; M
320 PRINT
330 FOR I = 1 TO M
340 INPUT "CHECK"; C(I): PRINT
350 NB = NB - C(I)
360 NEXT I
370 PRINT "HIT A KEY WHEN READY"
380 GET A$: IF A$ = "" THEN 380
390 PRINT
400 PRINT "{CLEAR} {REV} DATA SUMMARY"
410 PRINT
420 PRINT "PREV. BAL.", " NEW BAL."
430 PRINT PB, NB
440 PRINT
450 PRINT "HIT A KEY WHEN READY"
460 GET A$: IF A$ = "" THEN 460
470 IF N = 0 THEN 580
480 PRINT "{CLEAR} {REV} DATA SUMMARY"
490 PRINT
500 PRINT
510 PRINT "DEPOSITS"
520 FOR I = 1 TO N
530 PRINT "DEPOSIT"; I, "$"; D(I)
540 NEXT I
550 PRINT
560 PRINT "CHECKS"
570 FOR I = 1 TO M
580 PRINT "CHECK"; I, "$"; C(I)
590 NEXT I
600 PRINT
610 PRINT
620 PRINT "HIT A KEY WHEN READY"
630 GET A$: IF A$ = "" THEN 630
640 PRINT "{CLEAR} PRINT {REV} SEE YOU NEXT MONTH"
650 PRINT
660 PRINT
670 PRINT "HIT A KEY WHEN READY"
680 GET A$: IF A$ = "" THEN 680
690 PRINT "{CLEAR}": PRINT {REV} SEE YOU NEXT MONTH"
700 END
710 IF LEFT$(A$, 1) = "Y" THEN J = 2: RETURN
720 IF LEFT$(A$, 1) = "N" THEN J = 1: RETURN
730 J = 3: RETURN

Program 2. Mark’s Program

10 PRINT "{CLEAR}"
20 PRINT "THIS IS A GAME THAT SHOWS HOW MANY DAYS OLD YOU ARE."
30 PRINT "ENTER YOUR AGE SO YOU WILL LEARN N."
40 INPUT A
50 PRINT "YOU ARE"; A * 365; "DAYS OLD"
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A Monthly Column

Machine Language:

Hexed!

Jim Butterfield
Associate Editor

You often find nonsense printed about hexadecimal numbering systems. For example, one source says, “We use hexadecimal numbers when programming in machine language, since that’s what the computer uses.” Balderdash! There is no such thing as a hexadecimal computer—they’re all binary.

It may seem hard to believe at first, but hexadecimal numbers are for human convenience. The computer is happy with binary—in fact, binary is all it’s got—but we are not likely to wax enthusiastic if we are asked to place a value of 00001100 into location 1110100001001100. To make it easier for people, we like to condense binary.

Binary

The computer is made up of circuits and wires. Each wire carries either of two kinds of electrical signal—full voltage or no voltage. There’s no volume control needed here: it’s all or nothing. This two-condition situation is called binary, for its two states: voltage or no voltage, on or off, yes or no, up or down, one or zero.

The one/zero name for the two conditions is handy: it allows us to describe a group of logic signals by a stream of digits. If the computer has a group of eight wires, three of which are carrying full voltage while the others have no voltage, we can describe these wires’ states concisely and accurately with the expression 00101100.

Now, there’s a very important group of 16 wires called the address bus. These wires “call up” a certain part of memory. We might write out such an address as 1110100001001100, giving the condition of each wire of the address bus. The contents of each memory location is delivered on a group of eight wires, called a data bus; we might store 00001100 into a location. A group of eight “bits” of information is called a “byte”.

But it seems unwieldy to write the individual bits out, one by one.

Enter Hexadecimal

We can shorten these values by grouping the bits together, four at a time. Thus, the address 1110100001001100 may be broken up into 1110-1000-0100-1100. Further, we can give a name to each of the 16 combinations that four bits can have. For example, 0000 can be written as digit 0; 0001 as digit 1; 0010 as digit 2; and so forth. The weighting of the four bits is 8-4-2-1, so that we can quickly see that 0101 can be represented as 4 + 1 or 5.

This works well for the first ten combinations: 0000 is written as 0 and 1001 as 9. But there are six combinations that total ten or more. Our objective is to write one digit to represent the four bits, so we can’t write binary 1010 as 10 for ten; that’s two digits. We pick a new scheme for these values: 10 is written as a letter A, 11 as a B, and so on, until we reach 15, which is written as F. The whole table becomes:

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</tr>
<tr>
<td>13</td>
<td>D</td>
</tr>
<tr>
<td>14</td>
<td>E</td>
</tr>
<tr>
<td>15</td>
<td>F</td>
</tr>
</tbody>
</table>

Now we can write address 1110100001001100 as hexadecimal E84C, which is more compact and easier to remember. We can go the other way easily, too: if we see a value of hex 85 we can write it immediately as binary 10000101 if we need to. Note: this is not the same as the decimal value eighty-five, and we tend to say “eight-five” to keep the two number systems clear.

So we can view hexadecimal notation as a compact way of writing the computer’s binary numbers. Hexadecimal, by the way, means “based on 16”. You can see that there are 16 combinations, 16 different digits.

Converting To Decimal

If we have a hexadecimal number like 85, we sometimes would like to know its equivalent value in decimal. For example, if we PEEK the number in BASIC, we would see a value of 133 stored in the same location—that’s the decimal value. We often need to do conversion. Even to PEEK, we’d need to change the hexadecimal address into decimal so that we could tell BASIC where to look.

In the early days (remember?) we used to be told that a number like 263 means “two hundreds, and six tens, and three units.” Same rules for
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<td>830 Phone Modulator</td>
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<td>850 Interface</td>
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<td>CX8483 Programmer</td>
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**PRINTERS : In Stock**

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<td>LeStick</td>
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**DISKETTES : In Stock**

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**COMMODORE**

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hexadecimal, except that we use powers of 16 instead of powers of 10. So 85 is "eight sixteens, and five units"; or, to put it mathematically, $8 \times 16 + 5$. This works out to 133, as mentioned before. An address like E84C works out as $14 \times 4096 + 8 \times 254 + 4 \times 16 + 12$. The 14 is the value of the E digit, and 4096 is the third power of 16. The whole thing works out to 59468.

You can do this quickly on your computer (don’t forget to use the asterisk for multiplication). If you have a pocket calculator, there’s an easier method. Type the value of the first digit. If there are any more digits, multiply by 16 and add the value of the new digit. Repeat until you run out of digits.

Let’s try this with E84C. Type in 14 (that’s the E). Multiply by 16 and add the 8. Multiply by 16 and add the 4. Multiply by 16 and add 12 (for C).

That’s it: you should get 59468 as before.

Decimal To Hexadecimal

You will often have a decimal number that you would like to convert to hexadecimal. There are several different methods of doing this.

An easy manual method is to divide repeatedly by 16: the remainder is the next hexadecimal digit, going from right to left. If we started with 133, dividing by 16 gives 8 with a remainder of 5. The 5 is the right-hand digit. Now divide the 8 by 16: you get zero with a remainder of 8. This goes to the left of the 5 to give a result of 85 hex.

Remainders are hard to do on calculators and computers. Here’s a method I prefer that works easily on either:

If the number is less than 256, divide by 16; otherwise divide by 4096. You’ll get a number which has a whole and fractional part. The whole value is your first digit; make a note of it and then subtract it. Now multiply by 16 and repeat the whole procedure: you’ll get two digits for numbers less than 256, and four for greater numbers.

Suppose we have 59468 on our hand calculator. Divide by 4096; you’ll get a number like 14.51855. The 14 is your first digit, E: write it down and then subtract the 14. Multiply the remaining .51855 by 16 and you get 8.2968. Note the 8 behind the E, subtract 8, and you’re ready for the next multiplication by 16. Keep going and you’ll get the 4, and finally the last digit will be 12 (it may be 11.99, but we can stretch a point), for which we write down C. Result: hexadecimal E84C.

Hexadecimal numbers are for our convenience. They are very close to the computer’s internal notation — binary — but a little more compact and easier for us.

We’ve talked about simple conversion methods from hexadecimal to decimal and back. They are useful for small computers. If you are a numbers freak, there’s lots more for you to dig into: negative numbers, fractions, and even floating point hexadecimal. But the basics will take you a long way.

Some beginners wonder if machine language programmers know secret spells and incantations to make their programs work. I tell them that it’s purely logical — no special secrets are required. But it’s nice to know how to deal with a hex... number.

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Speed Limit For Your Atari

Mike Steinberg
Brooklyn Park, MN

Speed is a virtue when you're running a program, but when you enter the command to LIST, and watch your work fly by...the virtue turns to vengeance! Having to enter line numbers and commas to create a section-by-section list is a real time waster...and what's the computer for if not to help you save time rather than waste it?

Line Pacer, will make listing and editing more effective and enjoyable, without the need of a printer, disk drive or assembler-editor. It's so simple to enter and use, you can have it up and running even if you've only read chapter one of the Atari BASIC Manual.

A few notes are helpful before you put Line Pacer to work. The program occupies lines zero through nine. This is necessary since most other programs begin on line ten or higher. This enables Line Pacer to co-exist with any program starting at line ten or higher.

Another handy feature is the ability to determine the speed at which your listing will progress. In order for Line Pacer to work, it must be recorded on tape (or disk) using the LIST rather than the SAVE command.

When you're ready to use Line Pacer, entering your main program first – making sure it starts at line ten or higher. Next, call up Line Pacer from the cassette or disk where you've stored it. Use the ENTER rather than the LOAD command.

Since Line Pacer is a program itself, when you hit RUN and return, Line Pacer will take over with its "read" mode. Once you've determined the number of lines, the SELECT button will control the forward movement and the OPTION button will allow you to backtrack.

The "edit" mode can be entered by pressing the BREAK key. Once you've made your edit, you can go back to Line Pacer by typing CONT and hitting the return key.

When you're done editing or reading and want to run your program, just type GOTO and the number of the first line of your actual program, hit RETURN, and you're off and running.

0 ? : "(13 SPACES) LINE PACER
(14 SPACES):? : "(14 SPACES)AN M.J.
S.A. PROGRAM (C) 1981": ? :
1 PRINT " TO ADVANCE PRESS 'SELECT':
" : ? " TO BACKUP PRESS 'OPTION':
"
2 PRINT "PRESS BREAK FOR EDIT MODE":?
" TYPE 'CONT' AND PRESS RETURN WHEN YOU HAVE FINISHED YOUR EDIT"
3 ? : "HOW MANY LINES PER SELECT";: I
INPUT LIN: : ? :
4 FOR LST=9 TO 50000 STEP LIN
5 LIST LST+1,LST+LIN
6 IF PEEK(53279) = 5 THEN GOTO 9
7 IF PEEK(53279) = 3 THEN LST=LST-LIN: GOTO 5
8 GOTO 6
9 NEXT LST:GOTO 5:REM ** SHOULD BE CODED ON TAPE OR DISK WITH 'LIST' AND CALLED WITH 'ENTER'
A Graphics Plot For The Epson MX-80 Printer

William L Osburn
Wyoming, DE

For those Atari owners with an Epson MX-80 printer and the Macrotronics Parallel Printer Interface, here is a short BASIC routine which will copy a graphics mode 7 display onto the printer.

Before running this routine, XS must be DIMensioned to 80 characters. The graphics you want copied must already be displayed on the screen.

5200 REM SET UP GRAPH PRINTER PLOT
5210 LPRINT CHR$(27);CHR$(65);CHR$(131);CHR$(27);CHR$(50);CHR$(15)
5230 FOR I = 0 TO 159
5240 FOR J = 0 TO 79: POSITION I,J: GET #6, A
5250 IF A = 0 THEN X$(79-J+1,79-J+1) = "": GOTO 5270
5255 IF A = 1 THEN X$(79-J+1,79-J+1) = ".": GOTO 5270
5260 X$(79-J+1,79-J+1) = "*"
5270 NEXT J
5280 LPRINT X$
5290 NEXT I
5300 END

Line 5210 sets up the vertical and horizontal spacing of the Epson MX-80. The commands CHR$(27); CHR$(65); CHR$(131); CHR$(27); CHR$(50) set the vertical line spacing to 3/72 of an inch. The line spacing can be set to any 1/72 of an inch. CHR$(15) sets the horizontal printing to 132 characters per line. Lines 5230 and 5240 direct the pixel scan of the screen. The command LOCATE I,J,A can be used in place of POSITION I,J; GET #6, A in line 5240. The returned value of variable A will be either 0, 1, 2, or 3, depending on the COLOR exp used for that pixel. Lines 5250, 5255 and 5260 set the X$ array for printing depending on the value returned for A. In this case I used ",," for the border and "*" for the curve. The border and the curve were in different colors. Line 5280 prints the string array X$ (x = 1, y = 0 to 79). Line 5295 rings the MX-80 buzzer after the printing is done. The plot takes about nine minutes to complete and this allows me to do something else.

The result is a copy of the screen onto paper. The routine rotates the plot 90° clockwise in order to print.
This handy input routine makes a program crash-proof. See the substitution in Program 2 for VIC.

Flash Prompt For VIC And PET

Glenn Murray
Fredericton, N.B.

Displaying longer passages of information on the screen means choosing how to pause at an appropriate point to let the user digest one section, and then move along to the next. This is especially important in CAI programs for schools, or any time you're relating instructions or outputting a lengthy report.

A computer novice, I began to use a CBM 8032 for word processing last year, and was soon lured into writing simple programs to convey information on local history and astrology via the microcomputer. This usually involves long passages of text and graphics, needing more than one screenful for display.

Earlier Versions

At first, I used simple INPUT statements to create a pause, such as: "Type 'C' to continue", but this required pressing both the C-key and RETURN to move forward. Also, the possibility always existed of simply striking RETURN and falling out of the program altogether. To avoid this, I tried ending each passage with a time-delay (FOR I = 1 TO 20000: NEXT to allow 20 seconds for reading that segment, for instance). I soon discovered that people read at widely differing speeds, and are sometimes interrupted long enough for an important passage to whiz past unread. Obviously, this was not the answer.

Reverting to INPUT statements, I tried inserting default values at the response-point, so that most users would find the appropriate response already in place and could simply press RETURN to continue. Using cursor-controls, I had the cursor pause and flash right on the default value, like so:

100 INPUT "ANOTHER ROUND?...";Y'
105 OR'N'...
110 {02 RIGHT}"Y"{03 LEFT}"N";R$
115 IF"Y"AND"N"THEN100

This was better than anything I'd tried earlier, but it still wasn't appropriate when the program simply needed a cue to continue. I then discovered the value and immediacy of the GET statement. Using GET instead of INPUT means that, even without default values, the user has to touch only a single key to register his response. Now, when the prompt said "PRESS 'C' TO CONTINUE..." that was really all that was required. How wonderful!

The trouble now was that no single letter-key on the PET/CBM keyboard is quite so noticeable or quite so familiar (even to the casual user) as the large RETURN key. I still felt the most sensible and completely comfortable suggestion was:

PRESS 'RETURN' TO CONTINUE...

The other problem was that I'd become fond of the flashing cursor with its self-contained default value as an attention getting device at the end of a passage of text. Obviously, then, the "ideal" prompt would be to see the above cue (PRESS RETURN TO CONTINUE) appear at the bottom of the screen and flash slowly until the response was entered.

The Blinking Prompt

The enclosed subroutine accomplishes this in a very simple fashion. It can be loaded before writing a program or added to already existing programs, and accessed by simply using "GOSUB 10000" where you might otherwise use an INPUT, GET, or time-delay to hold a screenful of text before moving on. The words "PRESS RETURN TO CONTINUE" will flash on the bottom line of your screen (line 23 – hence cursor-down 22 times in line 10110) until the RETURN key is pressed, and then the program continues.

The short demo-program illustrates the use of this device to beginning-programmers and has plenty of REM statements to make its simplicity obvious. It should work on most micros, although the position of the flashing prompt might need adjustment to appear at the bottom-center of your monitor screen. This version is for the 40-column PET, but adding 20 extra spaces to the TAB indicators (that goes for line 10110 in the subroutine too!) makes it look fine on the 80-column machine as well.

If you don't want the flashing to begin instantly when the screenful of information changes, insert a simple time-delay of several seconds immediately before your "GOSUB 10000" (as seen in line 260 of the demo-program). This will give the user time to digest most of your information before the blinking prompt appears at the bottom of the screen.
Program 1: Subroutine and Demonstration

10 REM BLINKING PROMPT SUBROUTINE DEMONSTRATION
100 PRINT "{CLEAR}"""
200 PRINTTAB(7)"{8 DOWN} THIS WILL "
210 PRINTTAB(7)"DEMONSTRATE THE USE"""
220 PRINTTAB(7)"OF A BLINKING PROMPT TO CREATE""
230 PRINTTAB(7)"A PAUSE, AND "
240 PRINTTAB(7)"THEN QUICKLY RESUME""
250 PRINTTAB(7)"ANY PROGRAM WHEN THE USER IS"
260 PRINTTAB(7)"READY TO PROCEED..."
260 FOR I = 1 TO 3000: NEXT: REM WAIT TO START FLASHING
270 GOSUB10000
300 PRINT "{CLEAR}"""
310 PRINT "LIST THE PROGRAM & SEE HOW IT WORKS.""
320 PRINT "{2 DOWN}""THE SUBROUTINE IS AT LINE 10000.""
330 PRINT "{2 DOWN}""USE IT ANYTIME YOU GOSUB STATEMENTS.""
500 END
10000 AS = "{REV}"""
10010 FOR L = 1 TO 1000
10100 PRINT "{HOME}""
10110 PRINTTAB(2)"HIT RETURN TO CONT"
10120 GETRS: IF R$ = CHR$(13) THEN RETURN
10130 IF A$ = "{REV}" THEN A$ = "{OFF}": GOTO 10010
10150 IF AS = "{OFF}" THEN AS = "{REV}"
10160 IF AS = "{REV}" THEN AS = "{OFF}"
10170 NEXT L
10180 IF A$ = "{REV}" THEN A$ = "{OFF}"
10190 IF AS = "{OFF}" THEN AS = "{REV}"
10200 IF AS = "{REV}" THEN AS = "{OFF}"
10210 IF AS = "{OFF}" THEN AS = "{REV}"
10220 IF AS = "{REV}" THEN AS = "{OFF}"
10230 IF AS = "{OFF}" THEN AS = "{REV}"
10240 IF AS = "{REV}" THEN AS = "{OFF}"
10250 IF AS = "{OFF}" THEN AS = "{REV}"
10260 IF AS = "{REV}" THEN AS = "{OFF}"
10270 IF AS = "{OFF}" THEN AS = "{REV}"
10280 IF AS = "{REV}" THEN AS = "{OFF}"
10290 IF AS = "{OFF}" THEN AS = "{REV}"
10300 NEXT L

Program 2: Make this substitution to use this technique on the VIC.

10110 PRINTTAB(2)"AS;"{20 DOWN}HIT RETURN TO CONT"""
SOFTWARE IN BASIC FOR ATARI

Invoice Writing for Small Business

This program makes writing invoices easy. Store your products in DATA statements with order-number, description, and price. The program later retrieves the description and price matching to the entered order-number. The shipping cost and the discount may be calculated automatically depending on the quantity ordered or entered manually. The description to the program tells you how to change the program and adapt it to your own needs. Comes with a couple of invoice forms to write your first invoices on to.

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- Microline 84 Printer
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- Versa Writer Graphics Tablet
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**American Peripherals**

- Snakeman
- Astroblast
- City Bomber & Minifield
- Apple Pong
- Choplifter
- Serpentine

**Creative Software**

- Black Hole
- Trashman
- Astrobuzz
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- Meteors Run
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light sensitive pen barrel connected to electronic circuitry by a three foot lightweight cable. Since the electronics circuit is on a board, the pen barrel is thinner. The circuit board plugs into the VIC's user port and is ready to use with only minor "tuning."

A free demonstration program accompanies the unit, as well as complete documentation on installation, operation, and programming. The Touch-n-Light Pen retails for $75. Also available is educational and recreational software which retails for $9.95 to $14.95.

Sunshine Peripherals Inc.
1229 East 28th Street
Brooklyn, NY 11210

CyberLOGO Turtle For The Apple

Cybertronics has released the CyberLOGO Turtle, an open-ended computer literacy learning environment. It runs on any Apple II in 48K (no language card is required). The CyberLOGO Turtle provides these LOGO features:

- Turtle graphics
- Full screen editor
- Filing system for saving both programs and pictures
- Sound
- Color pictures and backgrounds
- Global and local variables
- The CyberLOGO Turtle also includes a STEP mode for easy debugging. This facility allows a student to execute a program one line at a time to locate programming errors.

A CyberLOGO Turtle SKETCH mode is included for the exploring student. In SKETCH, students can move the CyberLOGO Turtle and draw pictures by pressing single keys.

Unlike any other LOGO product, the CyberLOGO Turtle offers on-line HELP. HELP provides guidance for the first-time user, a complete description of the CyberLOGO Turtle language, and quick solutions to students' most frequent problems.

The CyberLOGO Turtle manual, written in friendly, jargon-free language by Dr. Pamela Sharp of the Stanford University Psychology Department, is designed specifically for the novice user.

The CyberLOGO Turtle is priced at $99.95. To order, write or call:

Cybertronics International, Inc.
Software Publishing Division
999 Mount Kemble Avenue
Morristown, NJ 07960
(201)766-7681

A Financial Wizard From Computari

Computari has released A Financial Wizard, version 1.5, which supersedes their Personal Finance for the Atari.

A Financial Wizard is capable of storing 100 checks per month (220 checks with the two drive option) and allows 26 major and 36 sub-expense categories. Available core programs include Check Entry, Budget Entry, Check Search, Tabulations, Bargraph, Check Balancer, Checkwriter, and Utilities (which includes an audit program).

All data is entered through the Check Entry program, which allows users to scan and correct previous entries with ease. Colorful graphics using a custom display list format and defined data fields makes data entry easy. All data resides on the program disk, so there is no disk switching.

Household budgets are created with Budget Entry. The COPY MONT and COPY CATEGORY features allow rapid creation of a year's budget.

Check Search allows single or multiple (up to seven) parameter searches at one time.
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Tabulations lists expenses by month, year to date, or by category over a twelve month span, while Bargraph provides the same data in bargraph form. With an 80-column printer with graphics capability, the user can reproduce the bargraph on paper.

Check Balancer offers a fast way to balance the computerized checkbook and includes a correction mode. Checkwriter will print checks which are obtained through Abacus Software.

Those who have the earlier Personal Finance package may update to the new version by sending $10 and their PF disk to: On-Line Computer Center, 10944 N. May Avenue, Oklahoma City, OK 73120.

The new Financial Wizard costs $34.95. A clear plastic disk case, for storing up to ten FW diskettes, is available for an additional $4.

Check Balancer offers a fast way to balance the computerized checkbook and includes a correction mode. Checkwriter will print checks which are obtained through Abacus Software.

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Software Development Associates

Software for Timex and Sinclair

Software for Timex and Sinclair

Software for Timex and Sinclair has cassette-based software for the Sinclair ZX-81 and the Timex/Sinclair 1000. The software includes programs to entertain, educate, and assist in financial planning. An introductory cassette containing five games (SDA-Match23, SDA-BattleCard, SDA-Gunner, SDA-Mugwumps, and SDA-Snark) is available for $3.95. A free catalog is also available by sending a SASE to:

Software Development Associates
Dept. GI, 2240 W. McRae Way
Phoenix, AZ 85027

Joystick and Terminal Program for The Color Computer

Spectrum Projects has announced two new products, the Spectrum Stick and the Colorcom/E terminal program.

The Spectrum Stick is a new joystick for the Color Computer. Its features are:
- Hair trigger fire button.
- Swivel-ball type component.
- Extra long cable.
- Brush aluminum knob.
- Sturdy construction.
- A red LED indicator.

The Spectrum Stick costs $39.95 plus $2 for shipping and handling.

The Colorcom/E, a terminal program for the Color Computer, comes in a ROM Cartridge ready to plug in and run. Colorcom/E's features and capabilities include:
- On-line and off-line scrolling.
- Off-line printing of data.
- Receiving and sending cassette files.
- Support of any serial printer.
- Full and half duplex.
- An optional word mode to eliminate word wrap.

Data can be easily edited before printing or writing to cassette.

The price is $49.95.

Spectrum Projects
95-15 86 Drive
Woodhaven, NY 11421
(212)441-2807

SuperPET Upgrade Board for CBM 8032

Commodore Business Machines has announced the availability of a single board upgrade that converts the CBM 8032 microcomputer into a SuperPET.

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**BOLDFACE**
This program utilizes three specially designed letter types that you can use to create on your VIC printer personalized headlines and messages in a variety of sizes. A plethora of applications. Program requires 8K memory expansion for VIC-20.

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**MAILING LIST**
Turn your computer into an electronic agenda! Enter names, addresses, phone nos. and comments. Use one-key-stroke command to sort by name or state, modify, delete or add new entries; print your mailing labels.

For VIC-20 (8K, printer optional)
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**CHARACTER GENERATOR**
Design your own special characters for any application (games, math, etc). Enhance your programs with your own unique figures. Program comes on tape with two sample runs that create strange creatures for games and digital electronic symbols and a detailed manual. Program available for VIC-20 only.

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The standard CBM model 8032 contains 32K of RAM and includes Commodore BASIC. With the SuperPET board, the upgraded machine will feature an RS-232 interface, 64K additional RAM in 8K RAM chips, and a standard 6502 microprocessor as well as a pseudo 16 bit 6809 based processor. An external switch for processor selection also allows programs designed for the 8032 to operate without modification.

The upgrade board also provides six languages, including Waterloo Computing Systems Limited’s microBASIC, microPascal, microFORTRAN, microAPL, microCOBOL, and 6809 Assembler. Applications developed on the SuperPET can be up-loaded to a mainframe system, and executed without modification.

The upgrade board (part number 900003501) sells for $795.

Commodore Business Machines, Inc. Computer Systems Division The Meadows 487 Devon Park Drive Wayne, PA 19087 (215)687-9750

Printer Programming Manual For VIC And Epson MX-80

Robert E. Huffman, of Munster, Indiana, has written a 53-page booklet titled VIC-20: MX-80 Connection. It is a printer programming manual for making the VIC-20 work with the Epson MX-80 with Grafrac-Plus.

Written for beginners, the booklet carefully explains each program — line by line, step by step. The programs present techniques that can be used by anyone with an understanding of BASIC fundamentals.

The booklet costs $15. Copies may be obtained by writing to:
Robert E. Huffman
9607 Dogwood Lane
Munster, IN 46321

Personal Finance Records For The Atari

SCITOR has announced the Personal Finance and Record Keeping package for the Atari 800 computer with 40K RAM, 1 810 disk, and BASIC.

The SCITOR Personal Finance and Record Keeping package provides homes and small businesses with a complete yet simple automated records system. You can organize and keep track of expenses, checks, credit cards and other personal records. Reports, high resolution graphics, and color bar charts can be generated from the records, providing insight into expenses, budgets, and progress.

November

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Gold更新器
Pacific Coast Hyperspace
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S.C. A.M.
Seven Card Stud
101 Leading Simpson
Shellhead
Shadow at the S.O.K.
Snake Run
Sneakers
Software: S.A.R. 505: 413: 414
Space Age
Speedboat Blast — cart
Space War
Star Defender
Star Defender II
Star Battleship
Surprise! A Saturday Evening Post Game

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versus goals. The ledger is Visi-Calc compatible. The package costs $75.

SCITOR Corporation
710 Lakeway, Suite 290
Sunnyvale, CA 94086
(408) 730-0400

Action Games For The VIC-20

Creative Software announces two new action games from Tom Griner, author of Black Hole and Astroblitz. The two ROM-based cartridges are: Videomania and Terraguard.

Videomania is an arcade-style action game pitting the player against the Evil Eyes, Walwokers, and the deadly Killer Box.

Terraguard, a multi-level arcade-style hi-resolution reflex game, constantly bombards the player with deadly space debris while he tries to gun down the Heeby-Jeeby, roving Eye and chomping Mouth. Even if he succeeds, he still must elude the enemy tractor beam.

Creative Software
201 San Antonio Circle
Mountain View, CA 94040
(415) 948-9595

Two Utility Packages For The Atari

Synergistic software has released two utility packages for Atari 400/800 computers. Both The Programmer’s Workshop and The Disk Workshop contain seven programs. One of the programs is Micro-DOS, a RAM resident program similar to Atari’s DUP.SYS. Since Micro-DOS is on-line and available any time, it provides quick and easy access to the DUP.SYS functions.

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The monitor contains 15 commands used to interact with the 6502. Some are display memory registers, disassemble, hunt, compare, hex/dec convert, transfer memory, and printer set/clear. Uses screen editing.

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Both packages require an Atari 400/800 computer with 32K and one disk drive. The price for each package is $34.95.

Synergistic Software
830 N. Riverside Dr., Suite 201
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PET Joystick Interface

J Systems Corp. announces the immediate availability of its new PET Joystick Interface. This versatile interface card adds joystick/paddle capabilities to all PET/CBM computers. The device enables the PET to accept inputs directly from two Apple joysticks, four Apple game paddles, or two Atari joysticks. Interface is complete and ready to plug into the user port.

All modes of operation are software selectable. The device features short access time (less than ten milliseconds/joystick) and high resolution digitization (greater than eight bits). This makes the interface ideal, not only for joysticks and paddles, but also for connecting any four resistive sensors to the PET/CBM. Fast machine language input routines, callable from a BASIC program, are included.

The price of the PET Joystick Interface is $49.95. This price includes the card, power supply, documentation, and sample software. The device can be ordered directly from:

J Systems Corp.
1 Edmund Place
Ann Arbor, MI 48103
(313) 662-4714

Skill/Action Game For Atari

PlatterMania, a ROM cartridge for the Atari 400/800, is a new action game from EPYX. The game can be played by one or up to four players.

A player begins with four spinning plates on top of four rods. He must be fast and accur-
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rate as he moves from rod to rod—making sure that no plate spins hard enough to fly off or slows enough to fall off. As the player's skill improves, the game increases in difficulty, providing up to 12 rods balancing plates.

PlatterMania is available on ROM cartridge for the Atari (with joystick or paddle controller). The suggested retail price is $39.95.

EPYX/Automated Simulations, Inc.
1043 Kiel Court
Sunnyvale, CA 94086

...room for additional equipment, working papers, manuals, etc. The cases can also be used for the Commodore VIC and related equipment.

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Games From Avalon Hill

New game releases from Avalon Hill are:

Legionnaire, a realtime war game for the Atari 400/800. The player assumes the role of Julius Caesar and commands ten legions against the barbarian tribes. The scrolling battlefield allows the player to inspect the entire ten square foot map stored in the computer's memory. The game features high-resolution graphics and sound effects and requires 16K. The cost for the cassette is $35.

Moon Patrol is an arcade-style game for the Atari. Players circle the moon, trying to touch down at the landing site, while dodging and destroying enemy invaders. Available on cassette, the game requires 16K and costs $25.

Telengard is for Apple II and TRS-80 Models I and III computers with 48K memory. It is a fantasy role-playing game that requires players to descend into a 50-level dungeon. Before his journey, a player may choose the character attributes he thinks will help him defeat the monsters within the dungeon and return with wealth and power. Telengard is a realtime game and emphasizes quick decision-making: if a player doesn’t make a decision in five seconds, the computer will make it for him. A manual of rules and suggestions is included. Available on diskette, the game costs $28.

G.F.S. Sorceress is a space adventure set in the year 2582. The player assumes the role of Joe Justin, wrongly accused and convicted of mutiny, and sentenced to drift in space for the rest of his life. The player’s goal is to vindicate Joe Justin. The game is available for the Atari 400/800, Apple II, and TRS-80 Models I and III. The cassette version is $30; the diskette, $35.
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ATARI is a trademark of ATARI, Inc.
Another strategy simulation game, Andromeda Conquest requires players to form and protect galactic empires. They must locate star systems with the highest resource values for colonization, but they also face opponents wanting the same star system. Cassette and disk versions are available ($18 and $23, respectively) for the Apple II+, Atari 400/800, TRS-80 Models I and III, and PET/CBM 2001 (no disk version for PET). The game requires 16K. There is also a 48K disk version for the IBM personal computer.

Memory Expansion For The Atari

Axlon Inc. has introduced a 48K memory expansion module for the Atari 400 home computer. Called the RAMCRAM Plus 48K, the new product provides 49,062 bytes of Random Access Memory in a single module.

This memory module allows Atari 400 owners to upgrade their computers to equal the computing power of its larger, more expensive brother, the Atari 800. With the RAMCRAM Plus 48K, Atari 400 users will have full access to software enjoyed by Atari 800 users.

The module requires no soldering modifications to the Atari 400 and can be easily installed with only a screwdriver in less than ten minutes. It offers gold plated contacts and a fully socketed board and is fully compatible with existing Read Only Memory (ROM) cartridges. The retail price is $229.95.

Axlon, Inc.
170 N. Wolfe Road
Sunnyvale, CA 94086
(408)730-0216

Adventure Game From Computerware

Computerware has introduced El Diablero, an adventure game for the Radio Shack Color Computer and TDP System 100.

The player is isolated in the middle of a desert in the Southwest. He has been a student of an aged sorcerer, but the sorcerer is missing. The player has apparently forgotten the sorcery techniques he’s been taught, but he has two clues to work with. He can remember that a “diablero” had become his teacher’s enemy, and he can recall a curious verse.

El Diablero costs $19.95 on cassette or $24.95 on disk (plus $2 for shipping and handling).

Communications Packages For VersaModem

Bizcomp has introduced two companion communications software packages for its Model 1080 VersaModem. Term Emulator II allows an Apple II Plus computer to communicate with The Source, Dow-Jones and University Computers, and mini-McTerm brings the same capabilities to Commodore PET/CBM.

Both communications packages eliminate the need for interface cards. A special low-cost cable plugs directly into the game jack on the Apple II. Modem operating parameters such as parity, duplex, and stopbits are conveniently changed from a setup menu. The RAM-copy feature permits the Apple to capture data from remote computers.

Using the mini-McTerm package, Commodore PET/CBM computers can be interfaced directly via the user port, bypassing the need for RS-232 conversion boxes. The user port interface also prevents excessive loading of the IEEE bus. Simul-
VIC-20® Hardware

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The VersaModem from Bizcomp

Simultaneous printing is a useful feature available on mini-McTerm. Bizcomp's VersaModem is a direct-connect modem intended for cost-sensitive personal computer applications. VersaModem is FCC registered and supplied with a modular plug for direct connection to the telephone network. It is packaged in a low profile enclosure which may be used as a base for a desk telephone.

Prices for the software packages on diskette, complete with interface cable and modular T-adapter, are: $29.95 for the Apple, $74.95 for the Commodore PET/CBM, and $24.95 for the Commodore VIC.

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**Winter Education Workshops**

Technical Education Research Centers, Inc. (TERC) is expanding its workshop series, Microcomputers in Education, to 14 sites throughout the country. The remaining sessions in the winter series will be held in the following locations:

1. St. Louis, MO – Dec. 7-9
3. Tallahassee, FL – Jan. 18-20

Workshops are designed for professional development of educators at all levels, elementary through college. Each workshop will emphasize hands-on experience with a variety of microcomputers. Extensive workshop reference materials will be given to participants. Special evening symposia will be held that address topics on current issues in microcomputer applications in education. Hotel accommodations will be available for participants who need them.

Workshop topics include:
1. BASIC and Graphics I
2. BASIC and Graphics II
3. LOGO I
4. LOGO II
5. Pascal I
6. Pascal II
7. Overview of Educational Applications of Microcomputers
8. Administrative Uses of Microcomputers
9. Microcomputers in Mathematics Instruction
10. Microcomputers in Science Instruction
11. Microcomputers as Laboratory Instruments
12. Microcomputers and the Education of Special Needs Students
13. Machine Language

For further information on these and upcoming workshops in other locations, write:

Ms. Sharon Woodruff
Conference Coordinator
TERC
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Space Adventure For The Atari

BRAM has released Attack at EP-CYG-4, an arcade-style game for the Atari 400/800.

The player orbits the fourth planet of Epsilon Cygnus. The enemy: the Tartillians, a machine race who destroyed their humanoid creators and have sworn to destroy all humans. The game offers a choice of missions and levels of difficulty. It may be played by one person or by two. A single player is in full control of his ship and its weapons and defenses. Two players — one acting as pilot, the other as gunnery officer — share the decisions of the mission.

Attack at EP-CYG-4 offers:

- 100% machine language; hi-res graphics with sound
- One player or cooperative two-player operation
- Two different missions on cassette (16K)
- Three different missions on diskette (24K)
- Three levels of difficulty
- Advanced joystick control capabilities
- Free poster

The price is $29.95 (cassette) or $32.95 (disk).

BRAM Inc.
18779 Kenlake Place NE
Seattle, WA 98155

Spread Sheet For VIC

Western New England Software announces an electronic spread sheet for the VIC-20. Short Sheet is a fully functional spread sheet which features: all the mathematic functions available on the VIC, full error handling, selectable dollars and cents mode, selectable manual recalculation.
TOTAL DEPARTMENT: G-8

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Farmers, Agribusiness Get Nationwide Electronic Information System

AgriStar, a new electronic business information, communications, and computing service for U.S. farmers, ranchers, and agribusinessmen, has been introduced by AgriData Resources, Inc., the Milwaukee-based publisher of Farm Futures magazine and a range of daily, weekly, and monthly farm business information services.

The AgriStar service will afford farmers, ranchers, and others in the business of agriculture, instantaneous electronic communications among themselves and equally instant access via any microcomputer terminal to the complete array of business, financial, marketing, weather, and news information. All information is continuously updated from several thousand electronically linked sources throughout the U.S. and the world.

AgriStar went into commercial operation in early November, following a nationwide test with 130 farmers.

Tandy Corporation is handling the nationwide retail distribution of the AgriStar service through some 5,000 of its Radio Shack stores and dealers in or near agricultural communities, beginning in January.

A major information source will be Commodity News Service, Inc. (CNS), a subsidiary of Knight-Ridder Newspapers. CNS will provide financial and commodity market information, which will be edited and formatted by Agri-Data for use by farmers and others engaged in agricultural production.

In addition to CNS, AgriData Resources has made information agreements with several major ag-industry publishers, meteorological services, commodity brokerage houses, and selected agricultural corporations, associations, and colleges. Market analysis and recommendations from a range of economists and analysts, including AgriData’s Top Farmer advisory service, will be available.

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AgriStar is compatible with virtually any microcomputer which is equipped to communicate over telephone lines. Either a microcomputer or a communicating terminal can be used. AgriData will provide, on a three-year lease/purchase basis, a communicating video display terminal for $32 per month, including a full three-year warranty. An optional printer for paper copies is available on the same basis for $32 per month.

Not including hardware costs, normal use of the service will cost less than $100 per month total. There is no telephone charge associated with use.

**Property Management For The Atari**

T & F Software has released P.M.P. 2000, a property management program for the Atari. It is designed as a template for VisiCalc.

For people who don’t have the time to pour over piles of bookkeeping and paper work, P.M.P. 2000 is the answer. P.M.P. 2000 provides various possibilities for property owners, from finance applications to monthly net returns on investments.

You enter the data for the known variables. P.M.P. 2000 does the rest, automatically identifying and solving for the unknown. Each program in the package – Apartment Status Report, Tenant Status Report, Cash Receipt Worksheet, Invoices, Distribution of Expenses/Bank Account Statement, and Income/Expense Schedules – helps you manage your property more efficiently, profitably, and effectively.

The retail price of P.M.P. 2000 is $199.95.

**Technical Sales**

New Product releases are selected from submissions for reasons of timeliness, available space, and general interest to our readers. We regret that we are unable to select all new product submissions for publication. Readers should be aware that we present here some edited version of material submitted by vendors and are unable to vouch for its accuracy at time of publication.
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PET Laser Gunner
The following line was missing from the PET/CBM version of this game, November 1982, p. 44:

8 PRINT"{CLEAR}";:GOTO85

PET Picture Files
Our thanks to author Liz Deal for pointing out that her screen save routine (November 1982, p. 202) will work on 40-column machines except for the Fat-40.

Commodore 64 Memory Map
Just checking to see if you’re on your toes. The Commodore 64 memory maps (October 1982, pp. 150-155) contained two minor errors which everybody noticed (and told me about). The “Tape error log” hex addresses should be 0100 to 013E and memory 0800 to 9FFF is of course BASIC RAM memory, not ROM. Good spotting, readers ... Jim Butterfield.

Atari Variable Table Refresh
On page 152 of the July 1982 issue, lines 32000 and 32040 should have a “D: following the first quotation mark (see line 32010 for the correct format).

Micros With The Handicapped
Lines 30 and 210 (October 1982, p. 125) require a backarrow where there is an underline.

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Many of the programs which are listed in COMPUTE! use special keys (cursor control keys, color keys, etc.). To make it easy to tell exactly what should be typed in when copying a program into the computer, we have established the following listing conventions.

### For The Atari
In order to make special characters, inverse video, and cursor characters easy to type in, COMPUTE! magazine's Atari listing conventions are used in all the program listings in this magazine.

Please refer to the following tables and explanations if you come across an unusual symbol in a program listing.

#### Atari Conventions
Characters in inverse video will appear like: `INVERSE`.

<table>
<thead>
<tr>
<th>When you see</th>
<th>Type</th>
<th>See</th>
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</thead>
<tbody>
<tr>
<td>(CLEAR)</td>
<td>ESC SHIFT &lt;</td>
<td>Clear Screen</td>
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<tr>
<td>(UP)</td>
<td>ESC CTRL -</td>
<td>Cursor Up</td>
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<td>(DOWN)</td>
<td>ESC CTRL +</td>
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<tr>
<td>(LEFT)</td>
<td>ESC DELETE</td>
<td>Cursor Left</td>
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<td>(DEL LINE)</td>
<td>ESC SHIFT DELETE</td>
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<td>(INS LINE)</td>
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<td>(TAB)</td>
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<td>(ESC)</td>
<td>ESC ESC</td>
<td>ESCAPE key</td>
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</table>

Graphics characters, such as CTRL-T, the ball character • will appear as the “normal” letter enclosed in braces, e.g., `T`.

A series of identical control characters, such as 10 spaces, three cursor-lefts, or 20 CTRL-R’s, will appear as (10 SPACES), (3 LEFT), (20 R), etc. If the character in braces is in inverse video, that character or characters should be entered with the Atari logo key. For example, `W` means to enter a reverse-field heart with CTRL-comma, 15 spaces, then five inverse-video CTRL-U’s.

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

To indicate that a key should be shifted (hold down the SHIFT key while pressing the other key), the key would be underlined in our listing. For example, `S` would mean to type the S key while holding the shift key. This would result in the “heart” graphics symbol appearing on your screen.

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

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

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

#### For The Apple
Programs listed as "Microsoft" are written for the PET/CBM, Apple, OSI, etc. Although the programs are general in nature, you may need to make a few changes for them to run correctly on your Apple. Microsoft BASIC programs written for the PET/CBM sometimes contain special cursor control characters. The following table shows equivalent Apple words. Notice that these Apple commands are outside quotations (and even separate from a PRINT statement). PRINT "[RVS]YOU WON" becomes INVERSE. PRINT "YOU WON":NORMAL

- CLEAR: (Clear Screen) HOME
- DOWN: (Cursor down)
- Apple II+: Call -922
- POKE37,PEEK(37)+(PEEK(37)<23)
- UP: (Cursor up)
- POKE37,PEEK(37)-(PEEK(37)>0)
- LEFT: (Cursor left)
- PRINT CHR$(8):
- RIGHT: (Cursor right)
- PRINT CHR$(9)
- RVS: (Inverse video on. Turns off automatically after a carriage return. To be safe, turn off inverse video after the print statement with NORMAL unless the print statement ends with a semicolon.)
- CLEAR: (Clear Screen)
- V: (Inverse video off)

#### VIC Conventions
- Set Color To Black: [BLK] Function Two: [F2]
- Set Color To White: [WH] Function Three: [F3]
- Set Color To Red: [RED] Function Four: [F4]
- Set Color To Cyan: [CY] Function Five: [F5]
- Set Color To Purple: [PUR] Function Six: [F6]
- Set Color To Green: [GR] Function Seven: [F7]
- Set Color To Blue: [BLU] Function Eight: [F8]
- Set Color To Yellow: [YEL] Any non-implemented: [NIM]
- Function One: [F1]

### All Commodore Machines
- Clear Screen: [CLEAR] Cursor Left: [LEFT]
- Home Cursor: [HOME] Insert Character: [INST]
- Cursor Up: [UP] Delete Character: [DEL]
- Cursor Down: [DOWN] Reverse Field On: [RVS]
- Cursor Right: [RIGHT] Reverse Field Off: [OFF]

### VIC Conventions
- Set Window Top: [SET TOP] Erase To Beginning: [ERASE BEG]
- Set Window Bottom: [SET BOT] Erase To End: [ERASE END]
- Scroll Up: [SCR UP] Toggle Tab: [TGL TAB]
- Scroll Down: [SCR DOWN] Tab: [TAB]
- Insert Line: [INST LINE] Escape Key: [ESC]
- Delete Line: [DEL LINE]

### 8032/Fat 40 Conventions
- Set Window Top: [SET TOP] Erase To Beginning: [ERASE BEG]
- Set Window Bottom: [SET BOT] Erase To End: [ERASE END]
- Scroll Up: [SCR UP] Toggle Tab: [TGL TAB]
- Scroll Down: [SCR DOWN] Tab: [TAB]
- Insert Line: [INST LINE] Escape Key: [ESC]
- Delete Line: [DEL LINE]
Here are some of the applications, tutorials, and games from available back issues of COMPUTE! Each issue contains much, much more than there's space here to list, but here are some highlights:

February 1981: Simulating PRINT USING, Using the Atari as a Terminal for Telecommunications, Attach a Printer to the Atari, Double Density Graphing on CIP, Commodore Disk Systems, PET Crash Prevention, A 25¢ Apple II Clock.

May 1981: Named GOSUB/GOTO in Applesoft, Generating Lower Case Text on Apple II, Copy Atari Screens to the Printer, Disk Directory Printer for Atari, Realtime Clock on Atari, PET BASIC Delete Utility, PET Calculated Bar Graphs, Running 40 Column Programs on a CBM 8032.

June 1981: Computer Using Educators (CUE) on Software Pricing, Apple II Hires Character Generator, Ever-expanding Apple Power, Color Burst for Atari, Mixing Apple Graphics Modes 0 and 8, Relocating PET BASIC Programs, An Assembler In BASIC for PET, QuadraPET: Multitasking?


October 1981: Automatic DATA Statements for CBM and Atari, VIC News, Undeletable Lines on Apple, PET, VIC, Budgeting on the Apple, Switching Cleverly from Text to Graphics on Apple, Atari Cassette Bootstrap-tapes, Atari Variable Name Utility, Atari Program Library, Train your PET to Run VIC Programs, Interface a BSR Remote Control System to PET, A General Purpose BCD to Binary Routine, Converting to Fat-40 PET.


February 1982: Insurance Inventory (multiple computers), Musical Transposition (multiple computers), Multitasking Emulator (multiple computers), Disassemble Apple Programs from BASIC, Plotting Polar Graphs on Apple, Apple P/M Graphics Made Easy, Apple PILOT, Put A Rainbow in your Atari, Marquee for PET, PET Disk Disassembler, VIC Paddles and Keyboard, VIC Timekeeping.

March 1982: Word Hunt Game (multiple computers), Infinite Precision Multiply (multiple computers), Atari Concentration Game, VIC Starfight Game, CBM BASIC 4.0 To Upgrade Conversion Kit, Apple Addresses, VIC Maps, EPROM Reliability, Atari Ghost Programming, Atari Machine Language Sort, Random Music Composition on PET, Comment Your Apple II Catalog.

April 1982: Track Down Those Memory Bugs (multiple computers), Shooting Stars Game (multiple computers), Intelligent Input Subroutines (multiple computers), Ultracube for Atari, Customizing Apple’s Copy Program, Using PET/CBM In The High School Physics Lab, Grading Exams on a Microcomputer (multiple computers), Atari Mailing List, Renumber VIC Programs The Easy Way, Browsing the VIC Chip, Disk Checkout for PET/CBM.

May 1982: VIC Meteor Maze Game, Atari Disk Drive Speed Check, Modifying Apple’s Floating Point BASIC, Fast Sort For PET/CBM, Extra Atari Colors Through Artfacticing, Life Insurance Estimator (multiple computers), PET Screen Input, Getting The Most Out Of VIC’s 5000 Bytes.


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