How To Select Your First Home Computer

COMPUTE!

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The Leading Magazine Of Home, Educational, And Recreational Computing

Special Home Applications Issue

How COMPUTE! Readers Use Their Computers

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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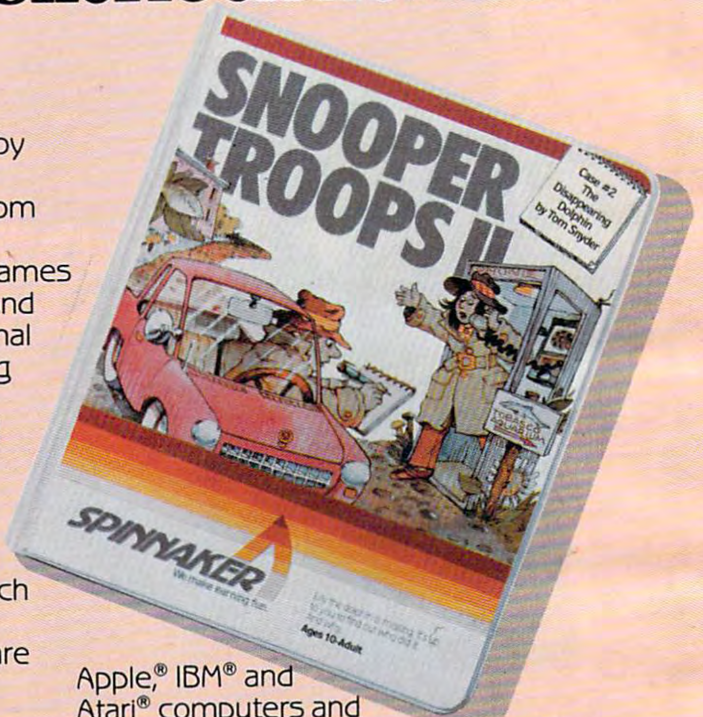

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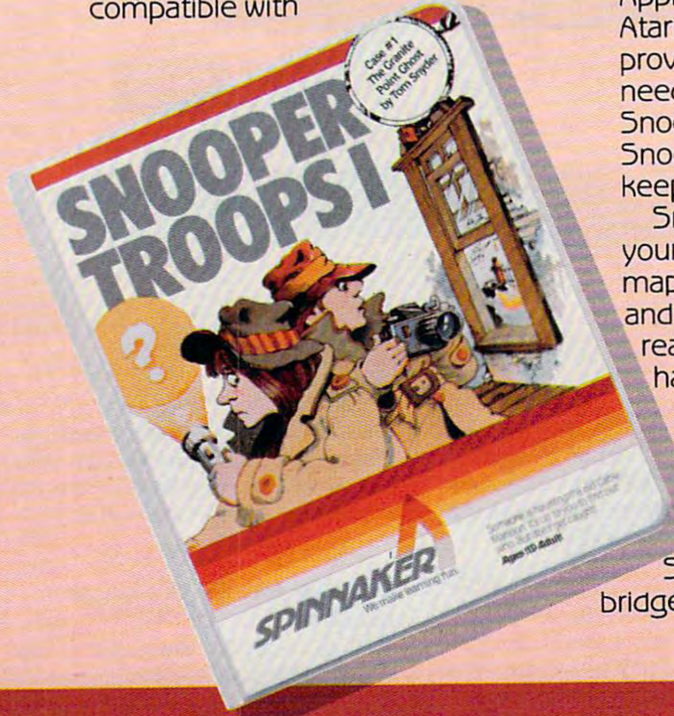

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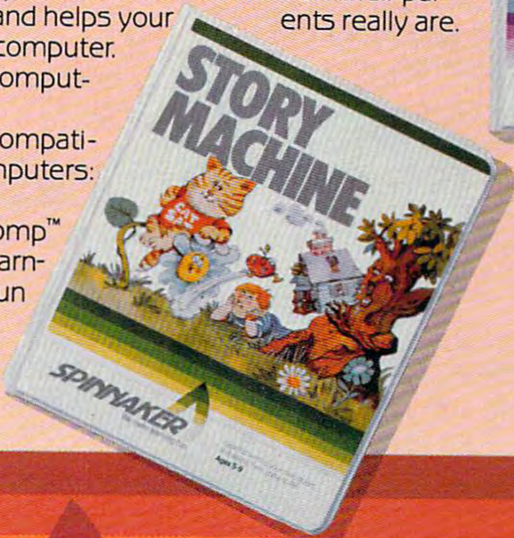

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December 1982 Vol. 4, No. 12

GUIDE TO ARTICLES AND PROGRAMS

AP Apple, **AT** Atari, **P** PET/CBM, **V** VIC-20, **O** OSI, **C** Radio Shack Color Computer, **64** Commodore 64, **ZX** Sinclair ZX-81, * All or several of the above.

NOTE: Consult Listing Conventions before typing in programs.

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The Editor's notes...

Robert Lock, Publisher/Editor-In-Chief

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.

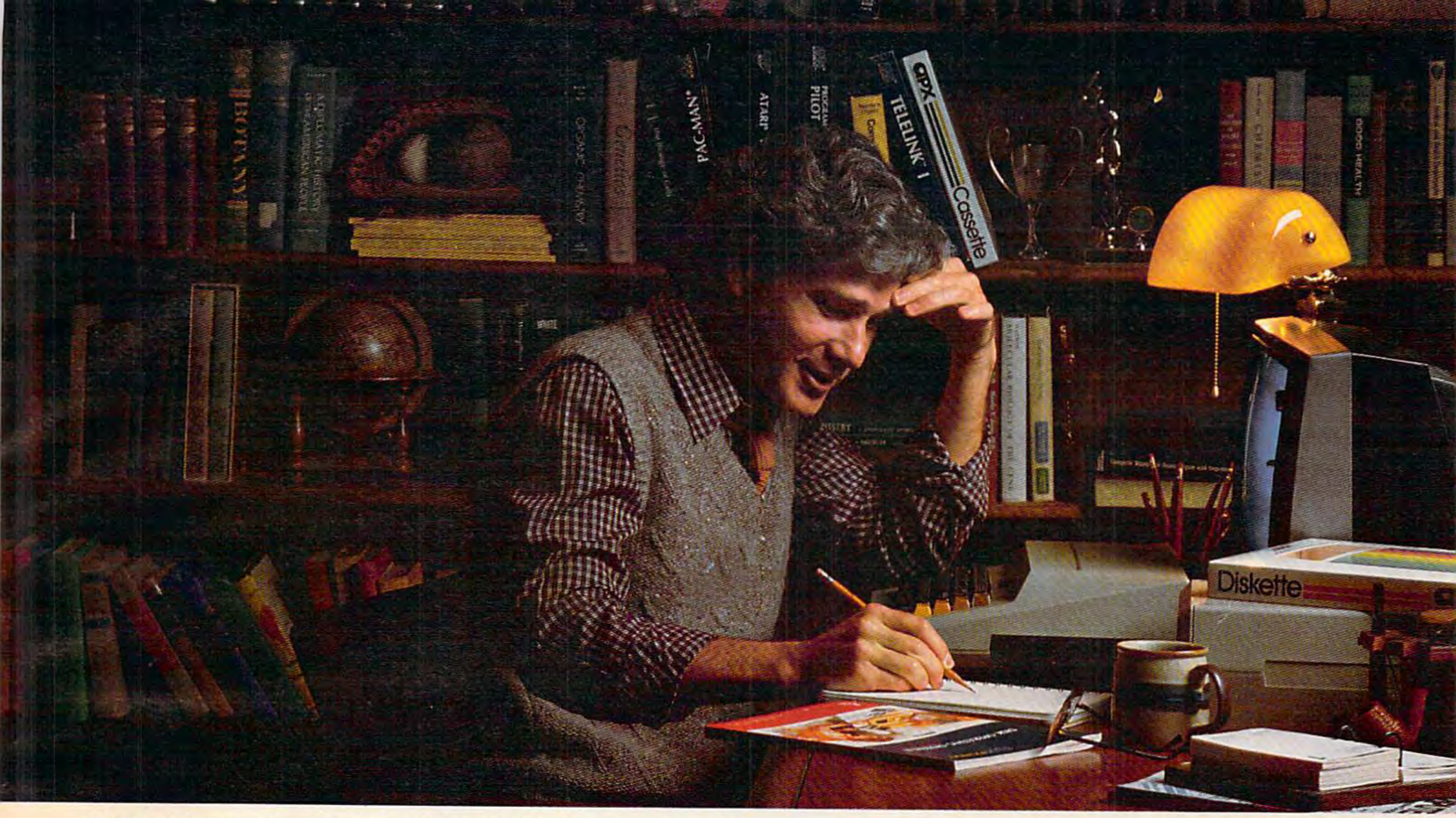
A Bang And A (Small) Whimper

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 issue 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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Mailing address: COMPUTE!
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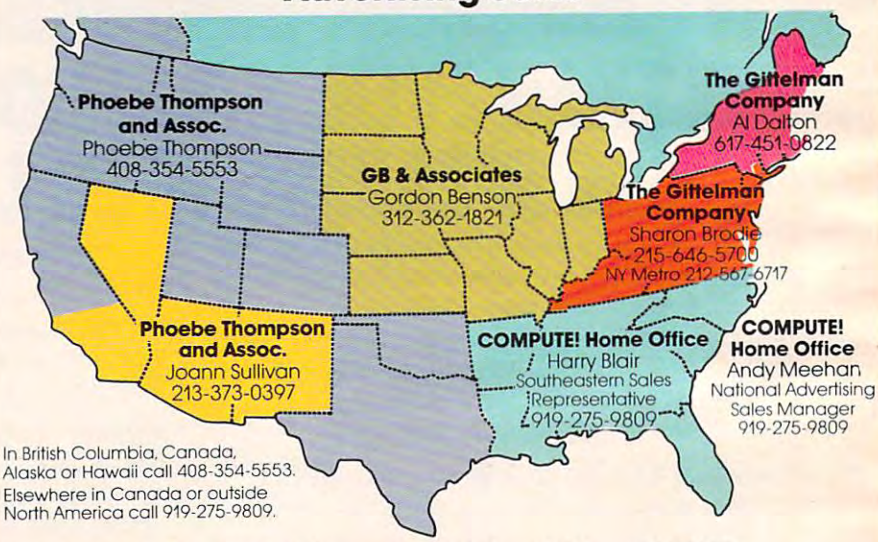

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Ask The Readers

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, p. 55, *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.

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

When a new computer comes out, it generally takes some time before a full map of its BASIC becomes available. **COMPUTE!** *has printed many such maps and will continue to be a source of these most useful guides. Because the Color Computer uses a version of the popular Microsoft BASIC, you can get an idea of what to expect by looking at a published map of Commodore or Apple Microsoft.*

Though the task of mapping BASIC is not for the novice or for the impatient, there are some BASIC programs which can assist in pointing to important subroutines and in identifying zero page usage. For a thorough discussion of these techniques, and the BASIC programs themselves, see "Mapping Machine Language," a two-part series, which began in the July 1982 issue of **COMPUTE!**.

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 article the 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!**.

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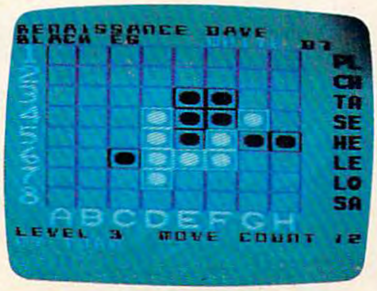

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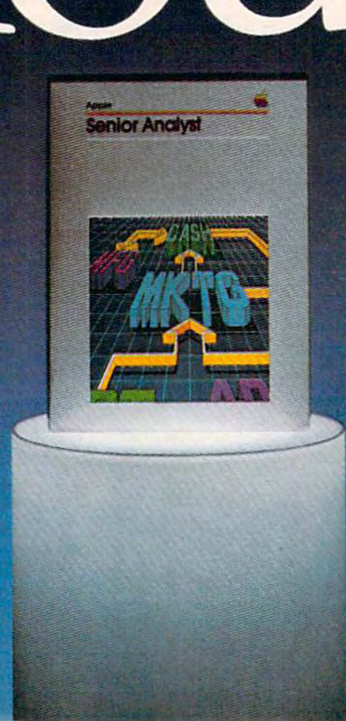

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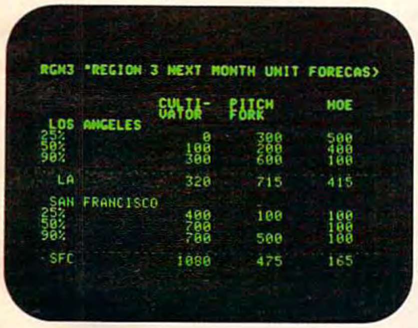

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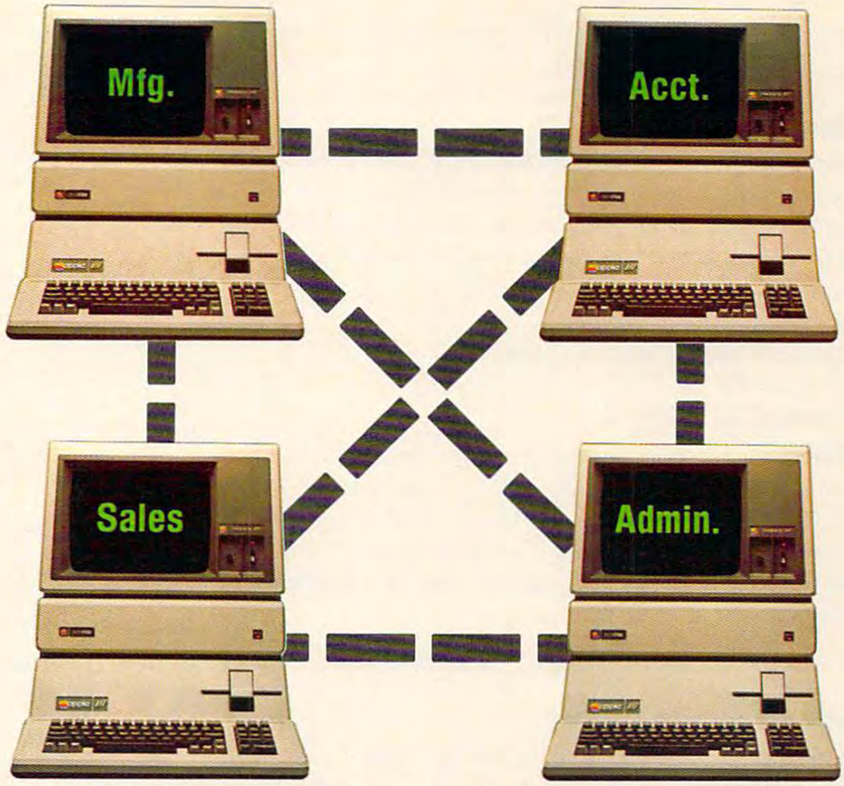

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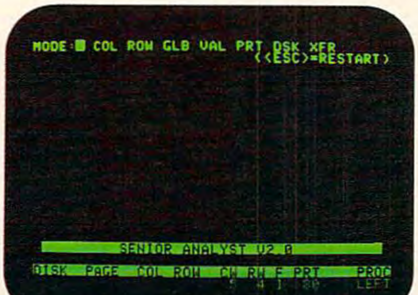

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Preschooler Programs

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
Schuylkill County Child Development Program
P.O. Box 183
Ringtown, 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.

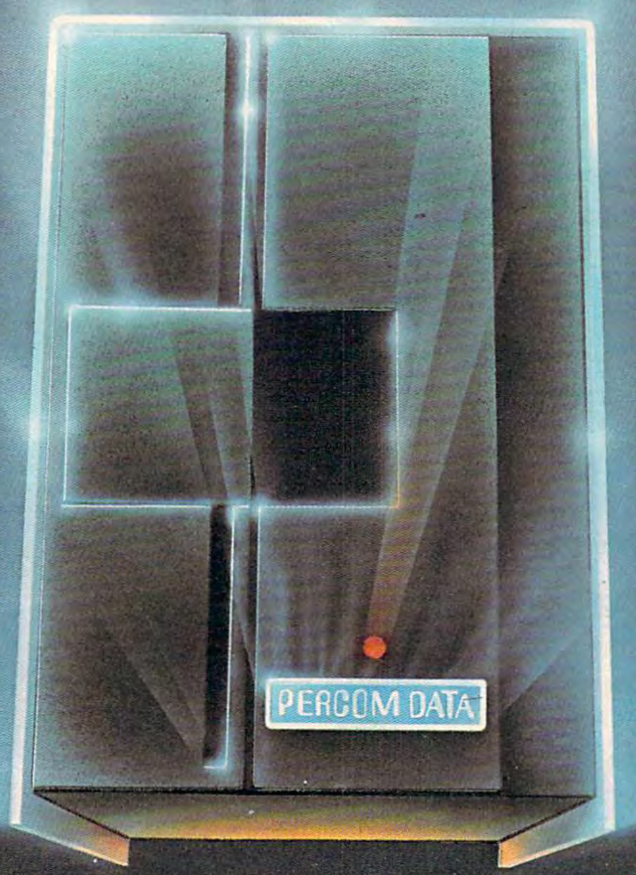
Scott Lapham

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. Halfhill, 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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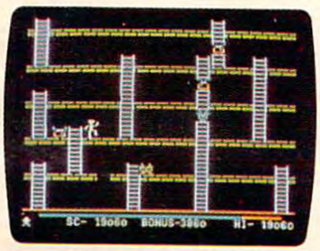

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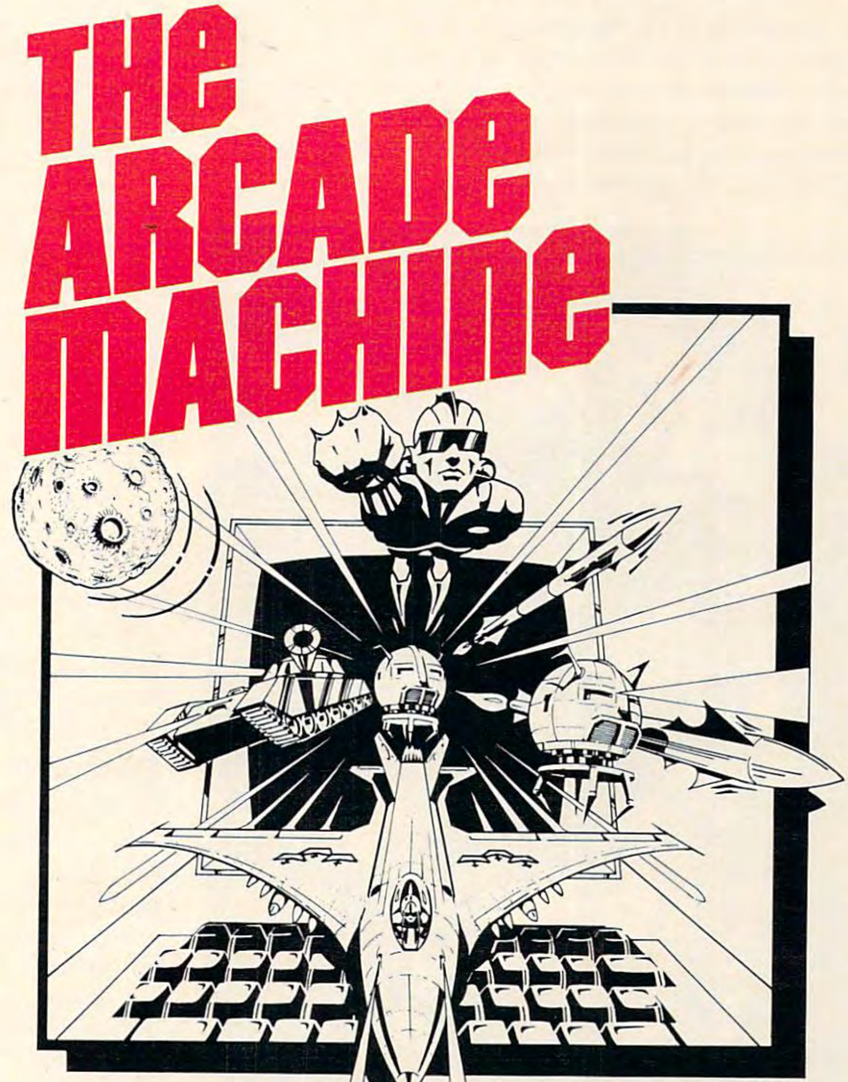

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complement your Mexican dinner, for instance.

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 microcomputrer 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."

TomorrowHouse Via Apple

Surprisingly, most of the microchip devices in the Xanadu house are already available off-the-shelf

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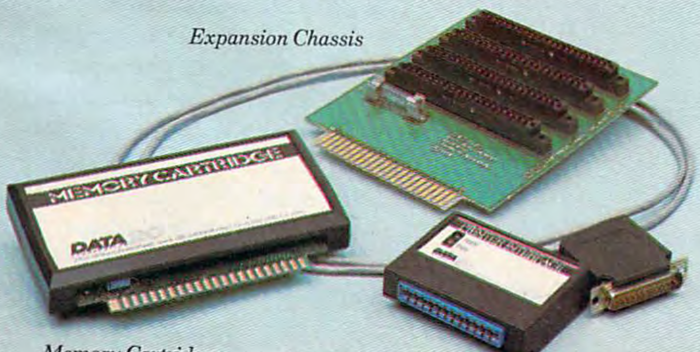

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items. Xanadu simply brings them all together in one place with little regard for expense. To demonstrate that the concepts are practical, Mason is planning a spin-off model of Xanadu, a less elaborate version that is relatively affordable. It, too, 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

"We could do almost anything in the home right now ... but it's just a matter of getting people to accept it."

$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, vice president of Compu-Homes.

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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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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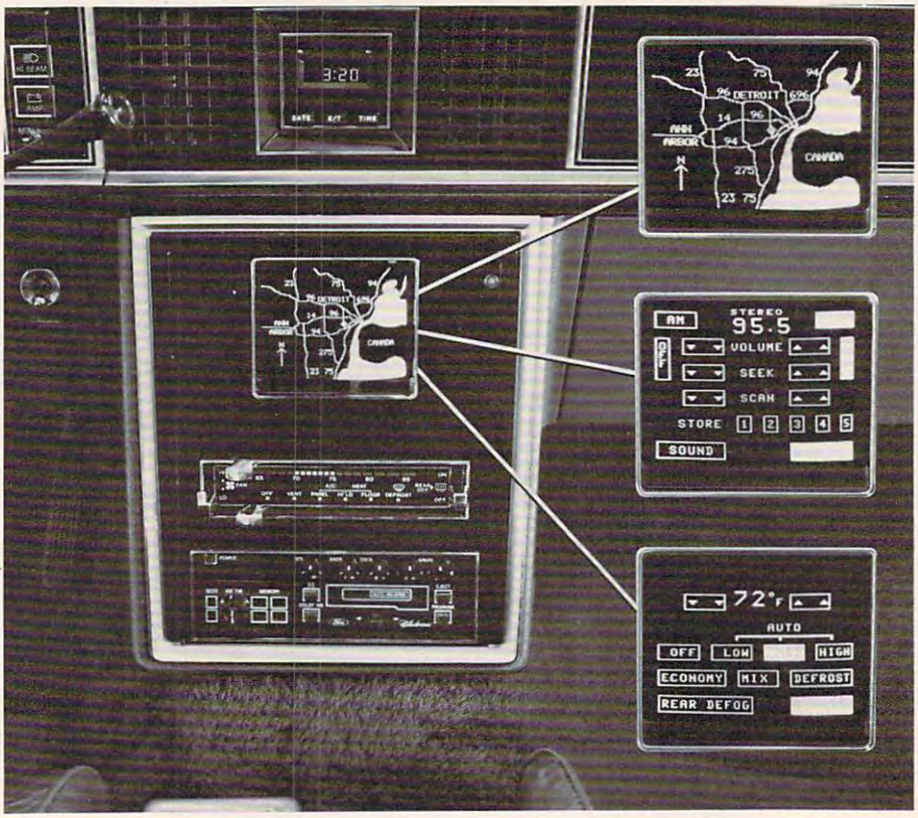

A Ford prototype of a multi-function dashboard CRT displays road maps, radio controls, and environmental readouts. Clock and calendar panels can also be called up.

'personalize' itself by adjusting the mirrors, the seats, and programming itself for your favorite radio stations," says Haase. "The car will personalize itself for the driver."

In a few years, dashboards may incorporate CRTs (cathode-ray tubes) or flat-panel LCD (liquid crystal display) screens for readouts. Tomorrow's road maps might even be in the form of computer graphics stored on floppy disks and displayed on the screen. "Of course, there you would have the possibility of bringing up maps of increasingly fine detail," suggests Haase. "You could have one map, perhaps, showing all of Michigan, another one showing just Detroit, and another showing maybe just one quadrant of Detroit."

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 shoulda hung a left on Elm Street...."

"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 personalized 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," explains Haase.

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-*warning* device seems a likely development, Haase expects stiff consumer resistance to any type of automatic collision-*avoidance* 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. ©

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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 homegrown 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, you know. We had the Atari game machine first, which is a pretty good little machine, I guess, but I was much more impressed with the computer for the additional things it could do."

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.

"I'd give up my stereo equipment before I'd give up my computer."

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. Leezer 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. Leezer'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 Leezers, following the pattern of the Millers in Georgia, may buy a second computer just for the children.

Marcia Thompson of Owatonna, Minnesota, a former schoolteacher, and her husband, who teaches high school electronics, bought a Commodore VIC-20 nine months ago for their first-grade boy. They bought the VIC because they wanted some compatibility with the PETs they were accustomed to at school. "We do have a couple games," she says, "but our main purpose was educational. It's been working out very well for that."

But Alan Orr of Pineville, Louisiana believes that many parents – even among those interested in computers – remain unconvinced of the educational value of home computing. As manager of the House Of Electronics across the river in Alexandria, he sees more and more parents shopping for a home computer "to educate the children." He suspects the real motive might be something akin to the Toy Train Set Syndrome.

"I've talked to a lot of parents in my store about the educational aspect, and many of them use that to rationalize buying a computer," says Orr. "What they really want it for is to play games, but they say they want it because it's educational for the children. It's sort of like psychological warfare."

Orr, however, like the other parents surveyed, has no doubts himself. Nine months ago he bought an Atari 800, a disk drive, and a printer that he hopes his two-year-old son will learn to use in a couple of years. "I want my boy, by the time he's three or four, to be doing some simple programming maybe, or things like *My First Alphabet*."

Meanwhile, he and his wife use the Atari to play games, and he's trying to catalog his 1000-album record collection. "I'm really involved with computers now," says Orr. "I'd give up my stereo equipment before I'd give up my computer."

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...."

"It started back in grade six.... Our class had a PET computer. Our teacher was very interested. We spent a lot of time after school talking about computers."

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. Then in seventh grade we had two PETs and I got even more interested. Then when I got up to eighth grade we had Apples and PDP-11s."

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 IIIs 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

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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

"I look at a computer as a tool that will help me make a living. ... I think they are a definite part of our future."

for Eaton Corporation in Portage, Michigan, uses TRS-80 Model IIIs 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-plus 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 enineering 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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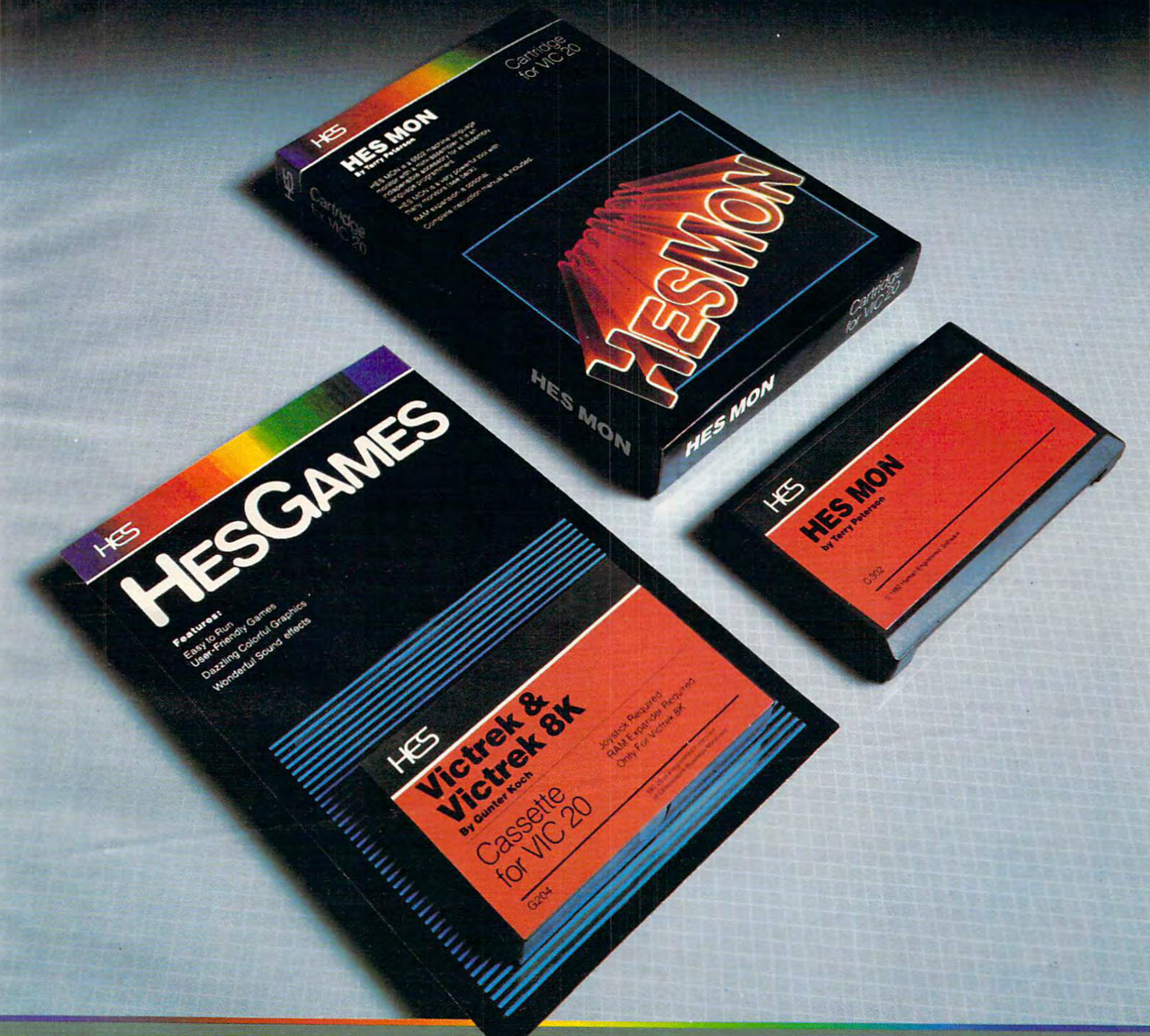

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students' attendance, grades, scores, and tests. Both Timmons and her husband have degrees in computer science and write all their own software. "The price came down so much, and they're so convenient, and they're so easy to use – anybody can program 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, *bi*nary dig*its*) 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, *R*ead *O*nly *M*emory, is for permanent storage. RAM, *R*andom *A*ccess *M*emory, 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 ½K 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;

you can always expand later. It depends entirely on your specific applications.

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 descenders due to the short vertical dimension of the matrix. Letters without descenders 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

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-helds, 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 typists 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 (sswwiittcchh bboouunnccee). 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.

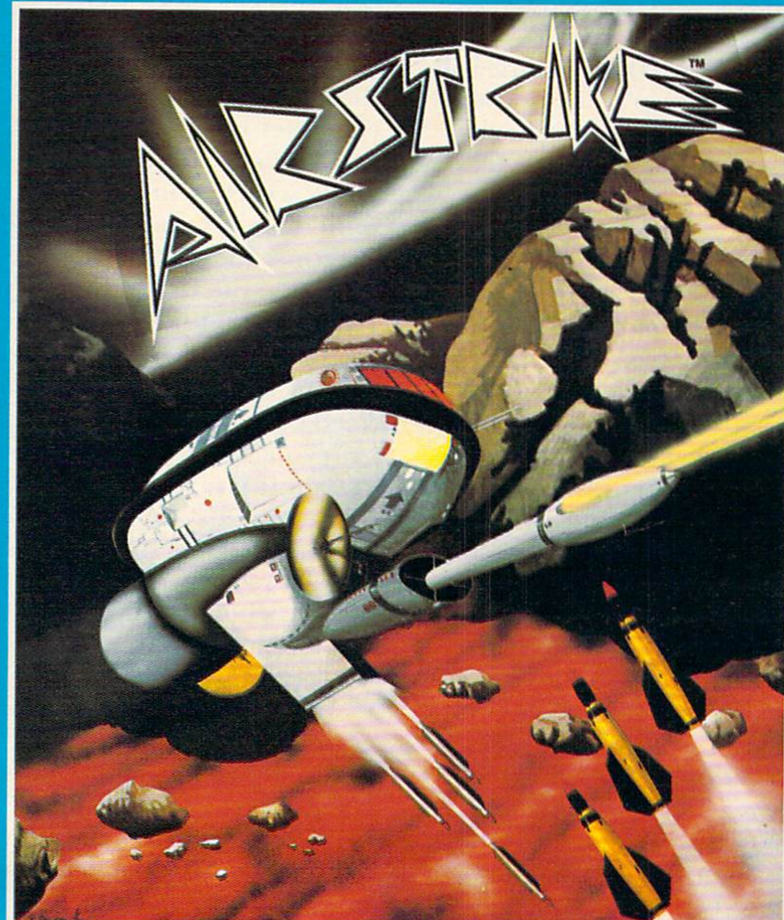
If you can touch type, or you intend to do a lot of programming, or you intend to use the computer for word processing, you need a good quality, mechanical switch type of keyboard. If the computer will be used mainly by young children, a flat panel, touch sensitive keyboard might be best. If you will 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!



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and graphs. In essence, any nonverbal and nonnumerical 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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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 myraid 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 peripherals you have in a system, 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.

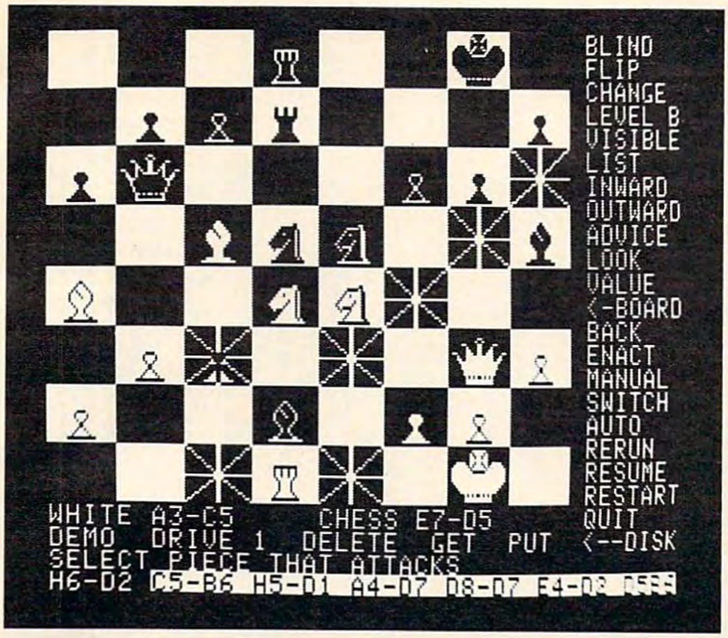
You may also want to consider joysticks, game paddles, or a light pen since these items are rather inexpensive ($20 to $50 per item). They can add to the pleasure of playing games.

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 load 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

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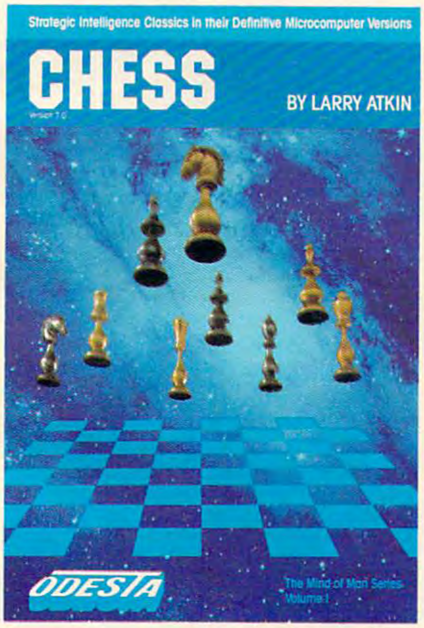
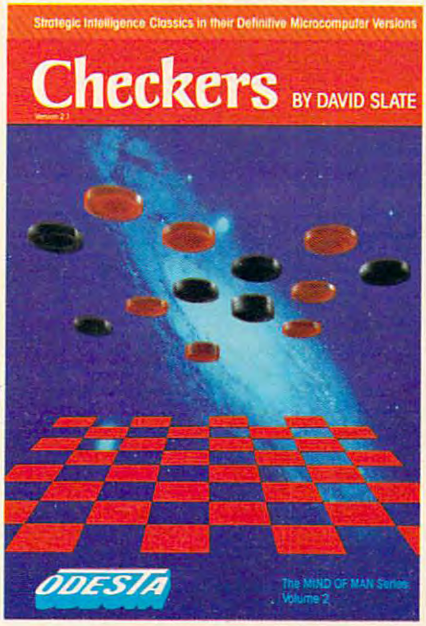
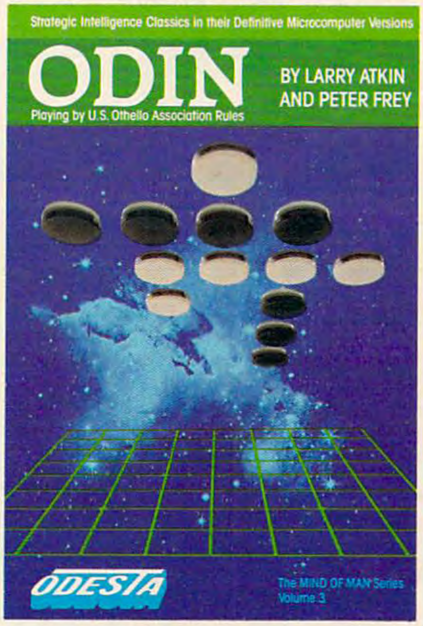
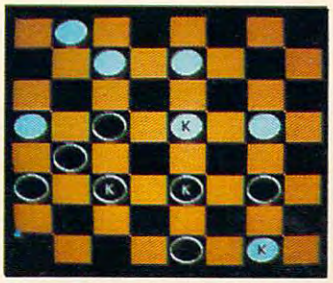


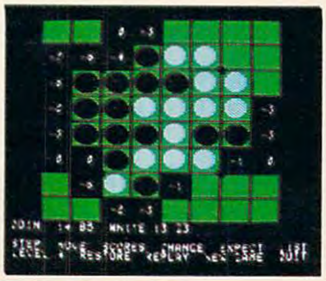




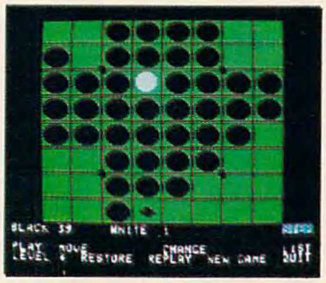
Checkers' features



Black to move and win
(From Checkers documentation)



"Scores" feature in Odin



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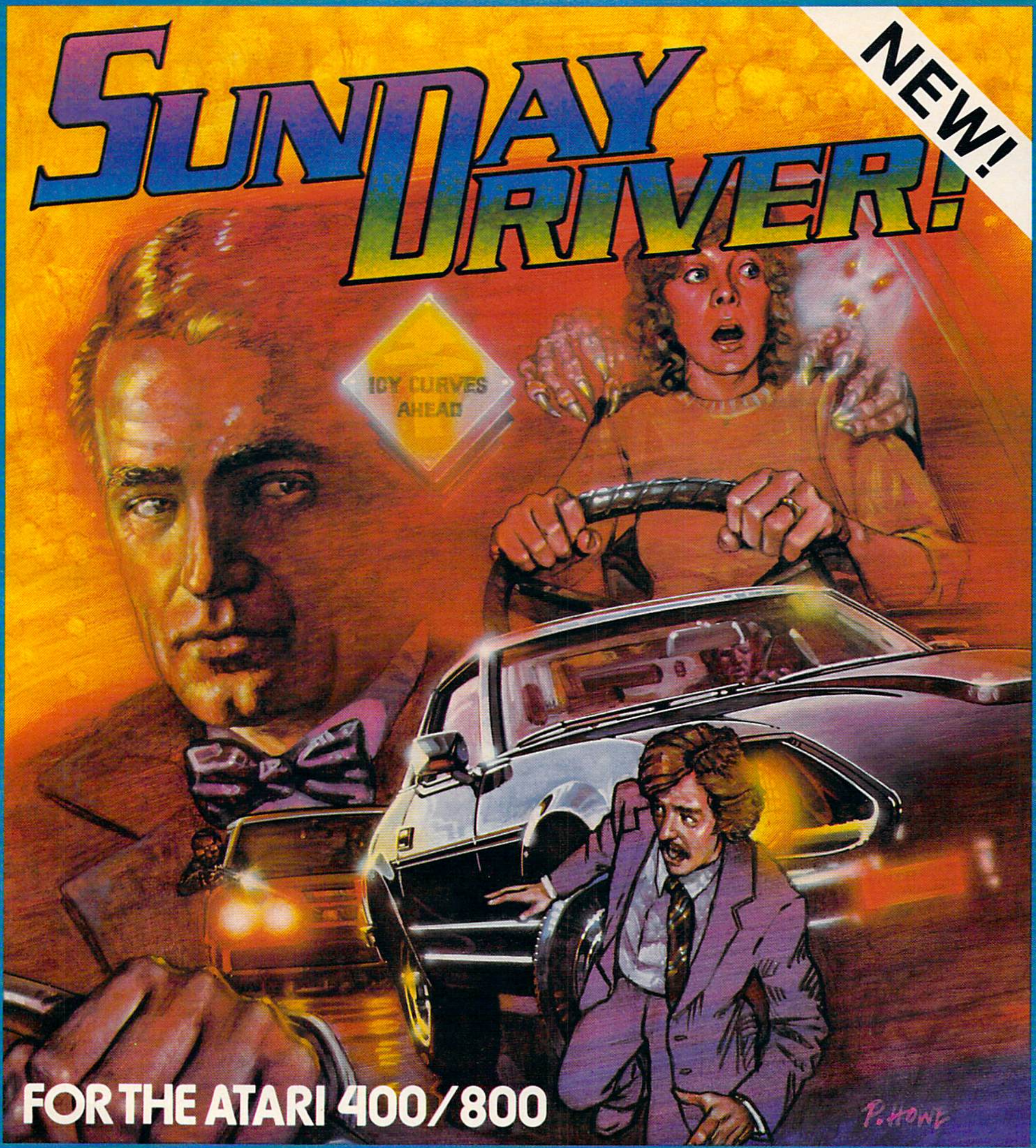
Charts and Analysis

The authors of this book have made every effort to insure the accuracy of the information presented in these tables. We assume no liability for error or omission in the information presented in this publication.

	MEMORY			MASS MEMORY STORAGE		SCREEN FORMAT		
	RAM Standard:	**Expansion to:**	**ROM Expansion**	**Tape Drive**	**Disk Drive**	**Lines x Characters**	**Character Matrix**	**Upper-And Lowercase**
Apple II & Apple II Plus	16K	48K	"Cards" inside unit	X	Up to six 143K per drive	24 x 40	5 x 7	No
Atari 400	16K	48K	ROM cartridges	X	Up to four 92K per drive	24 x 40	8 x 8	Yes
Atari 800	16K	48K	ROM cartridges	X	Same as Atari 400	24 x 40	8 x 8	Yes
Commodore 64	64K	N/A	"Cards" and cartridges	X	Up to five 170K per drive	25 x 40	8 x 8	Yes
Commodore PET/CBM	16 or 32K	32K	Internal sockets	X	Dual drive (up to four) 340K or one megabyte double density	25 x 40*	6 x 8	Yes
Commodore SuperPET	96K	N/A	Internal sockets	X	Same as PET	25 x 80	6 x 8	Yes
Commodore Max Machine	1K	N/A	Cartridges	X		25 x 40	8 x 8	Yes
Commodore VIC-20	5K	32K	Cartridges	X	Single 170K disk drive	22 x 23	8 x 8	Yes
Exidy Sorcerer	16K	48K	ROM "Paks"	X	Single 308K disk drive	30 x 64	8 x 8	—
Hewlett-Packard HP-85A	16K	32K	ROM "Drawer"	Built-in	Double density disk drives 286K	16 x 32	5 x 7	Yes
IBM Personal Computer	16K	512K	"Cards"	X	Up to two 320K disk drives	25 x 80	9 x 14	Yes
Mattel Intellivision	16K	N/A	—	X	—	24 x 40	4 x 8	Yes
NEC PC-8001A	32K	160K	One internal socket	X	Up to four 186K drives	25 x 80**	7 x 9	Yes
Osborne 1	64K	N/A	—		Built-in dual disk drives 160K each	24 x 52	9 x 10	Yes
Panasonic Hand Held Computer	2K	8K	ROM capsules	(Up to 8K non-volatile RAM capsules)	—	Single line, 26 character LCD display	8 x 6	No
Radio Shack Color Computer	4K	32K	Program "Paks"	X	Up to four 156K drives	16 x 32	6 x 16	No
Radio Shack Pocket Computer	1.9K	16K	—	X	—	Single line, 24 character LCD display	7 x 5	No
Radio Shack TRS 80 III	16K	48K	—	X	Up to four 175K disk drives	16 x 64	7 x 9	Yes
Sinclair ZX-81/ Timex TS-1000	1K/2K	16K	—	X	—	24 x 32	8 x 8	No
Texas Instruments TI-99/4A	16K	48K	Plug-in "Modules"	X	Up to three 90K disk drives	24 x 32	8 x 8	Yes
Xerox 820	64K	N/A	—	—	Up to two 300K disk drives	24 x 80	7 x 9	Yes
Zenith Z89	48K	N/A	—	—	One built-in 100K disk drive Up to three total disk drives allowed	25 x 80	5 x 7	Yes

*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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COLOR, GRAPHICS, & SOUND

	Required Additional Devices*	Computer List Price**	Comments	Number Of Colors	Maximum Resolution	Sound	Special Notes
Apple II & Apple II Plus	B/W or color TV Audio cassette player	$1330	16K RAM	16	280h x 192v	Speaker generates clicks	High resolution 8 colors. Low resolution 16 colors. Some color inaccuracy.
Atari 400 Atari 800	Atari 410 tape recorder ($89.95) B/W or color TV	299.95 899.95	16K	256	320h x 192v	4-voice, 4-octave special effects	16 graphics modes from all text to high-resolution. Four animated "sprites," or player/missile graphics, keyboard graphics, custom character set.
Commodore 64	B/W or color TV Tape recorder ($75)***	595	64K	16	320h x 200v	3-voice programmable synthesizer	Graphics characters, custom characters, mixed text and graphics, 8 animated "sprites."
Commodore PET/CBM (4032/8032)	Tape recorder ($75)	995/1495	32K	Monochrome	80h x 50v or 160h x 50v (CBM 8032)	1 voice, 3 octaves	Graphics characters.
Commodore SuperPET	CBM 8050, 1 megabyte dual disk drive ($1795)	1995	96K	Monochrome	160h x 50v	1 voice, 3 octaves	Special APL character set.
Commodore Max Machine	Same as Commodore 64	179.95	1K	16	320h x 200v	3 octaves, programmable synthesizer	Graphics characters, custom characters, mixed text and graphics, 8 animated "sprites."
Commodore VIC-20	B/W or color TV Tape recorder ($75)	260	5K	16	176h x 184v	3 voices plus white noise	Graphics characters, custom characters, mixed text and graphics.
Exidy Sorcerer	Cassette player, B/W TV	1295	16K	Monochrome	512h x 240v	None	Graphics characters, custom characters.
Hewlett-Packard HP-85A	(This computer is sold with a built-in tape player and thermal printer.)	2750	16K	Monochrome	192h x 256 v	Beeper	Graphics commands from BASIC.
IBM Personal Computer	Tape recorder B/W or color TV	1265	16K	16	640h x 200v	1 voice	Graphics characters, high resolution color and B/W graphics.
Mattel Intellivision	(Cassette player built in) B/W or color TV	599	16K	16	160h x 192v	3 voices	Video-game processor.
NEC PC-8001A	Audio cassette player B/W or color TV	995	32K	8	640h x 230v	1 voice	Green characters. High-resolution graphics.
Osborne 1	(No additional devices required. Built-in disk drives and CRT.)	1795	60K	Monochrome	52h x 24v	None	32 graphics characters.
Panasonic Hand Held Computer	—	500	2K	LCD display	159h x 8v	None	Optional TV interface allows 48 x 64, 8-color graphics.
Radio Shack Color Computer	Color TV Tape recorder ($59.95)	399.95	16K	8	192h x 256v	1 voice	Optional enhancement allows high-resolution graphics.
Radio Shack Pocket Computer	Cassette player ($79.95) Cassette interface ($49)	159.95	2.6K	Monochrome	126h x 5v	Beeper	
Radio Shack TRS 80 III	Cassette player ($59.95)	699	4K	Monochrome	128h x 96v	Simple sound via cassette interface	Optional enhancements add upper/lowercase and graphics characters. High-resolution video board optional.
Sinclair ZX-81/ Timex TS-1000	Cassette player B/W TV	99.95	1K/2K	Monochrome	64h x 48v	None	22 graphics characters.
Texas Instruments TI-99/4A	Cassette player B/W or color TV	299	16K	16	256h x 192v	3 voices plus white noise	High-resolution. Custom characters. 256 animated "sprites."
Xerox 820	2 disk drives	3295*	64K	Monochrome	N/A	None	
Zenith Z89	—	2895	48K	Monochrome	N/A	None	33 graphics characters.

* 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.


"...faithfully captures the look, spirit and play of arcade 'Space Invaders'".
-John Anderson, Creative Computing
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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:

	Principal	Yield	1983	1984	1985
CD					
All Savers					
Passbook					

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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by James Albanese

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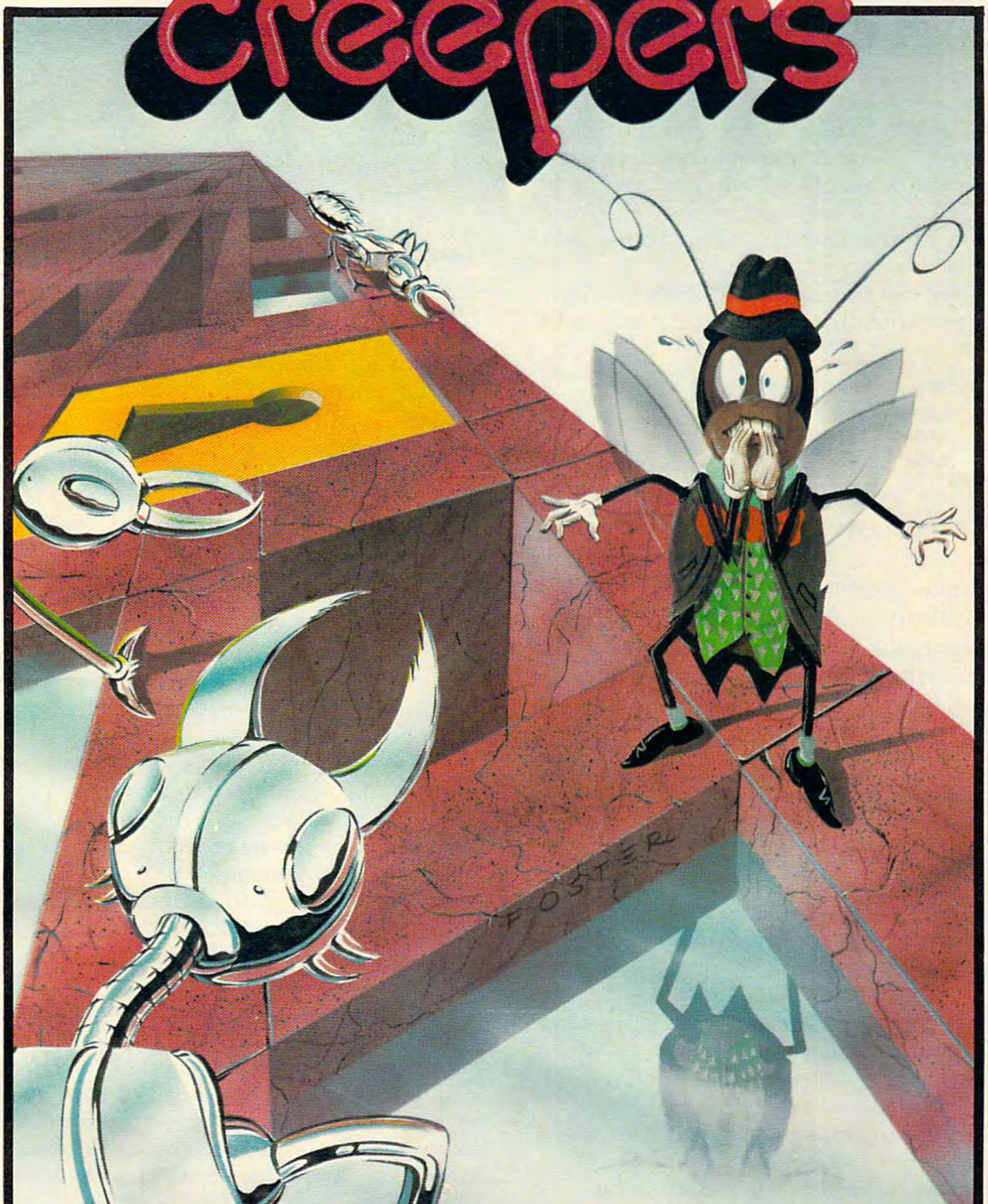

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know; some we wish to calculate.

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.

	Principal	Yield	1983	1984	1985
CD	10,000	16%			
All Savers	8,000	12%			
Passbook	2,000	6%			

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:

	Principal	Yield	1983	1984	1985
CD	10,000	16%	11,600	13,456	15,609
All Savers	8,000	12%	8,960	10,035	11,239
Passbook	2,000	6%	2,120	2,247	2,382

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 lets us 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.

If you wish, Tiny Plan will make up its own

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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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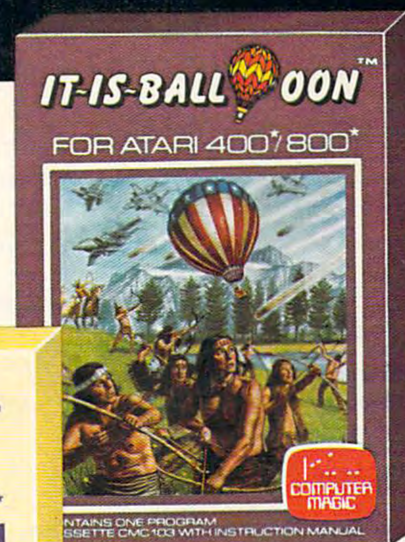

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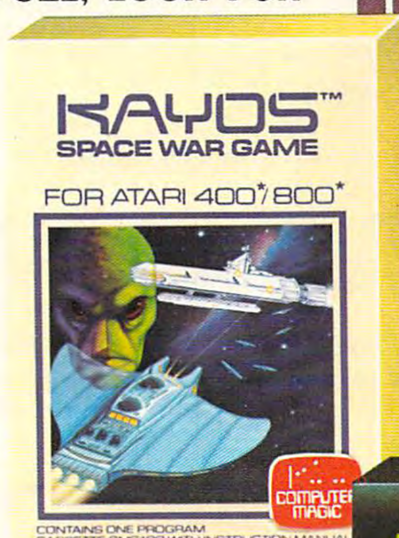

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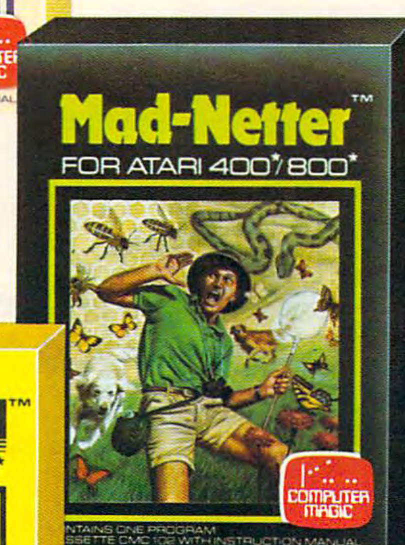

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%D compute the percent difference between the first row/column and the second row/column, using the first row/column as the base

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:

	1985
CD	15,609
ALL SAVERS	11,239
PASSBOOK	2,282
TOTAL	29,230

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$.

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 even 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 R$ = "": INPUT R$: IF R$<>"" THEN DA(R,I) = VAL(R$)
18070 R$ = "": INPUT R$: IF R$<>"" THEN DA(I,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 IFR$="Y"THEN120
140 PRINTCS$:PRINT"THANK YOU.":PRINT
150 END
160 REM BEGIN
170 GOSUB2410
180 GOSUB240
190 IFR$="N"THEN180
200 DIMDA(NR,NC)
210 DIMCN$(NC),RN$(NR)
220 GOSUB350
230 RETURN
240 REM CONFIGURE
250 PRINTCS$;:PRINT"HOW MANY ROWS AND"
260 PRINT:PRINT"COLUMNS IN THE MODEL ?":PRINT:
    PRINT
270 NR=0:PRINT"# ROWS (ACROSS)";:INPUTNR:IFNR<
    =0THENPRINT"WHAT?":GOTO270
280 NC=0:PRINT"# COLS (UP&DOWN)";:INPUTNC:IFNC
    <=0THENPRINT"WHAT?":GOTO280
290 MS=(NC+1)*(NR+1)*5+(NC+1)*13+(NR+1)*13
300 IFMS>SZTHENPRINT"NOT ENOUGH MEMORY":PRINT:
    GOTO270
310 PRINT:FORI=1TONR:FORJ=1TONC:PRINT"X";:NEXT
    :PRINT:NEXT
320 PRINT:PRINT"SHAPE OK (Y OR N) ?";
```

NOW. The only real limitation for your VIC 20 is imagination.

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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
CD					
All Savers					
Passbook					

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**
[5 columns: Principal, Yield, 1983, 1984, and 1985]

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
CD	10,000	16%			
All Savers	8,000	12%			
Passbook	2,000	6%			

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]

1ST COL NAME OR 'END'
? **1983**

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

2ND COL NAME OR 'END'
? **YIELD**

(continued)

(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
YIELD	12
1983	8960
1984	10035.2
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.

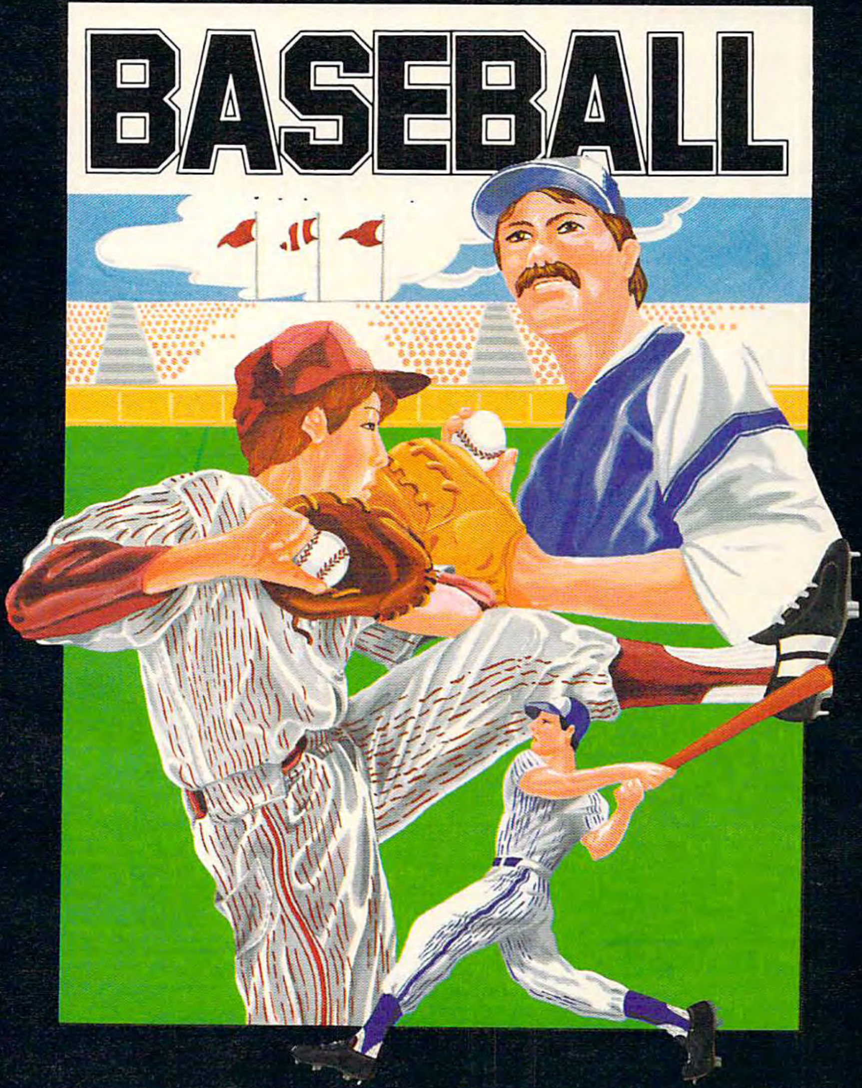
READY.

```
330 GOSUB2260
340 RETURN
350 REM SYMBOL TABLE
360 PRINTCS$;"WHAT IS THE NAME OF":PRINT:PRINT
    "EACH ROW AND COLUMN?"
370 PRINT: PRINT"NAMES CAN BE UP TO":PRINT:PRI
    NT"10 CHARACTERS LONG."
380 PRINT:PRINT:PRINT"ROWS (ACROSS) FIRST.":PR
    INT
390 FORI=1TONR
400 R$="":PRINTI;"OF";NR;
410 RN$(I)=LEFT$("R"+MID$(STR$(I),2)+BL$,10)
420 INPUTR$:IFR$<>""THENRN$(I)=LEFT$(R$+BL$,10
    )
430 NEXT
440 PRINT:PRINT:PRINT"COLUMNS (UP AND DOWN).":
    PRINT
450 FORI=1TONC
460 R$="":PRINTI;"OF";NC;
470 CN$(I)=LEFT$("C"+MID$(STR$(I),2)+BL$,10)
480 INPUTR$:IFR$<>""THENCN$(I)=LEFT$(R$+BL$,10
    )
490 NEXT
500 RETURN
510 REM BUILD MODELS
520 GOSUB580
530 GOSUB1140
540 GOSUB1660
550 PRINTCS$;"MODEL AGAIN (Y/N)?";
560 GOSUB2260
570 RETURN
580 REM ENTER DATA
590 PRINTCS$;"* DATA ENTRY STEP *":PRINT
600 PRINT"ENTER DATA (Y/N)?";
610 GOSUB2260
620 IFR$="N"THEN750
630 REM
640 PRINTCS$;"ENTER ROWS (Y/N)?";
650 GOSUB2260
660 IFR$="N"THEN690
670 PRINTCS$:GOSUB860:IFETHEN690
680 GOSUB760:GOTO670
690 REM
700 PRINTCS$;"ENTER COLS. (Y/N)?";
710 GOSUB2260
720 IFR$="N"THEN750
730 PRINTCS$:GOSUB1050:IFETHEN750
740 GOSUB950:GOTO730
750 RETURN
760 REM ENTER ROW
770 PRINTCS$;"ENTER";NC;"VALUES -"
780 PRINT"1 FOR EACH COLUMN.":PRINT
790 PRINT"** ROW ";RN$(R);" **":PRINT
800 PRINT:PRINT"COLUMN";TAB(11);"VALUE"
810 FORI=1TONC
820 PRINTLEFT$(CN$(I),5);:PRINTDA(R,I);
830 INPUTDA(R,I)
840 NEXT
850 RETURN
860 REM GET ROW #
870 E=0:N$="":PRINT"ROW NAME OR 'END'"
880 INPUTN$:IFN$="END"THENE=1:RETURN
890 N$=LEFT$(N$+BL$,10)
900 FORI=0TONR
910 IFRN$(I)=N$THENR=I:I=1E6
920 NEXT
930 IFI=NR+1THENPRINT"? ";:GOTO870
940 RETURN
950 REM ENTER COL
960 PRINTCS$;"ENTER";NR;"VALUES -"
970 PRINT"1 FOR EACH ROW":PRINT
980 PRINT"** COL ";CN$(C);" **":PRINT
990 PRINT:PRINT"ROW";TAB(11);"VALUE"
1000 FORI=1TONR
1010 PRINTLEFT$(RN$(I),5);:PRINTDA(I,C);
1020 INPUTDA(I,C)
1030 NEXT
1040 RETURN
1050 REM GET COL #
1060 E=0:N$="":PRINT"COL NAME OR 'END'"
1070 INPUTN$:IFN$="END"THENE=1:RETURN
1080 N$=LEFT$(N$+BL$,10)
1090 FORI=0TONC
1100 IFCN$(I)=N$THENC=I:I=1E6
1110 NEXT
1120 IFI=NC+1THENPRINT"? ";:GOTO1060
1130 RETURN
1140 REM CALCULATE
```

BASEBALL

FOR YOUR

ATARI 400/800



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```
1150 PRINTCS$;"* CALCULATE STEP *":PRINT
1160 PRINT"CALCULATE (Y/N)?";
1170 GOSUB2260
1180 IFR$="N"THEN1310
1190 REM
1200 PRINTCS$;"WORK ON ROWS (Y/N)?";
1210 GOSUB2260
1220 IFR$="N"THEN1250
1230 PRINTCS$:PRINT"1ST ";:GOSUB860:IFETHEN1250
1240 GOSUB1320:GOTO1230
1250 REM
1260 PRINTCS$;"WORK ON COLS. (Y/N)?";
1270 GOSUB2260
1280 IFR$="N"THEN1310
1290 PRINTCS$:PRINT"1ST ";:GOSUB1050:IFETHEN131
    0
1300 GOSUB1490:GOTO1290
1310 RETURN
1320 REM WORK ON ROWS
1330 R1=R
1340 GOSUB2180
1350 PRINT:PRINT"2ND ";:GOSUB860:IFETHEN1400
1360 R2=R
1370 PRINT:PRINT"ANS ";:GOSUB860:IFETHEN1400
1380 R3=R
1390 GOSUB1410
1400 RETURN
1410 REM DO ROW
1420 PRINT:PRINT"WORKING..."
1430 FORI=1TONC
1440 C3=I:C2=I:C1=I
1450 GOSUB2300
1460 NEXT
1470 PRINT:PRINT"COMPLETED"
1480 RETURN
1490 REM WORK ON COLS
1500 C1=C
1510 GOSUB2180
1520 PRINT:PRINT"2ND ";:GOSUB1050:IFETHEN1570
1530 C2=C
1540 PRINT:PRINT"ANS ";:GOSUB1050:IFETHEN1570
1550 C3=C
1560 GOSUB1580
1570 RETURN
1580 REM DO COL
1590 PRINT:PRINT"WORKING..."
1600 FORI=1TONR
1610 R3=I:R2=I:R1=I
1620 GOSUB2300
1630 NEXT
1640 PRINT:PRINT"COMPLETED"
1650 RETURN
1660 REM DISPLAY
1670 PRINTCS$;"* DATA DISPLAY STEP *"
1680 PRINT: PRINT"DISPLAY DATA (Y/N)?";
1690 GOSUB2260
1700 IFR$="N"THEN1890
1710 PRINT:REM ROWS
1720 PRINT:PRINT"DISPLAY ROWS (Y/N)?";
1730 GOSUB2260
1740 IFR$="N"THEN1800
1750 PRINT:GOSUB860:IFETHEN1800
1760 RT=0:FORI=0TONC:RT=RT+DA(R,I):NEXT
1770 N=INT((NC+1)/NL):IF(NC+1)-NL*N>0THENN=N+1
1780 C=0:GOSUB1900
1790 GOTO1750
1800 REM
1810 PRINT:PRINT"DISPLAY COLS (Y/N)?";
1820 GOSUB2260
1830 IFR$="N"THEN1890
1840 PRINT:GOSUB1050:IFETHEN1890
1850 CT=0:FORI=0TONR:CT=CT+DA(I,C):NEXT
1860 N=INT((NR+1)/NL):IF(NR+1)-NL*N>0THENN=N+1
1870 R=0:GOSUB2040
1880 GOTO1840
1890 RETURN
1900 REM ROW PANEL
1910 FORI=1TON
1920 PRINTCS$:PRINT"COLUMN    ";RN$(R):PRINT
1930 FORJ=1TO10
1940 IFC>NCTHENPRINT
1950 IFC<=NCTHENPRINTCN$(C);DA(R,C):C=C+1
1960 NEXT
1970 PRINT:PRINT
1980 PRINT"ROW TOTAL ";RT
1990 IFI<NTHENPRINT:PRINT"MORE ..."
2000 PRINT:PRINT"SPACE TO CONTINUE"
2010 GETR$:IFR$<>" " THEN2010
2020 NEXT
2030 RETURN
2040 REM COL PANEL
2050 FORI=1TON
2060 PRINTCS$:PRINT"ROW        ";CN$(C):PRINT
2070 FORJ=1TO10
2080 IFR>NRTHENPRINT
2090 IFR<=NRTHENPRINTRN$(R);DA(R,C):R=R+1
2100 NEXT
2110 PRINT:PRINT
2120 PRINT"COL TOTAL ";CT
2130 IFI<NTHENPRINT:PRINT"MORE ..."
2140 PRINT:PRINT"SPACE TO CONTINUE"
2150 GETR$:IFR$<>" "THEN2150
2160 NEXT
2170 RETURN
2180 REM GET OPERATOR
2190 PRINT:OP$=""
2200 FORI=1TONP:PRINTOP$(I);", ";:NEXT:PRINT
2210 INPUTOP$
2220 FORI=1TONP:IFOP$(I)=OP$THENI=1E6
2230 NEXT
2240 IFI=NP+1THENPRINT"TRY AGAIN":GOTO2190
2250 RETURN
2260 REM GET Y OR N
2270 GETR$:IFR$=""THEN2270
2280 IFR$<>"Y"ANDR$<>"N"THENPRINT:PRINT"KEY 'Y'
     OR 'N'";:GOTO2270
2290 RETURN
2300 REM CALCULATIONS
2310 IFOP$="+"THENDA(R3,C3)=DA(R1,C1)+DA(R2,C2)
2320 IFOP$="-"THENDA(R3,C3)=DA(R1,C1)-DA(R2,C2)
2330 IFOP$="*"THENDA(R3,C3)=DA(R1,C1)*DA(R2,C2)
2340 IFOP$="/"ANDDA(R2,C2)<>0THENDA(R3,C3)=DA(R
    1,C1)/DA(R2,C2)
2350 IFOP$="%"THENDA(R3,C3)=DA(R1,C1)*DA(R2,C2)
    /100
2360 IFOP$="%+"THENDA(R3,C3)=DA(R1,C1)+(DA(R1,C
    1)*DA(R2,C2)/100)
2370 IFOP$="%-"THENDA(R3,C3)=DA(R1,C1)-(DA(R1,C
    1)*DA(R2,C2)/100)
2380 IFOP$="%D"ANDDA(R1,C1)<>0THENDA(R3,C3)=((D
    A(R2,C2)-DA(R1,C1))/DA(R1,C1))*100
2390 DA(R3,C3)=INT((DA(R3,C3)*D2+5)/10)/D1
2400 RETURN
2410 REM INITIALIZE
2420 CS$=CHR$(147):REM CLEAR SCREEN
2430 NL=10
2440 NR=0:NC=0
2450 BL$="           "
2460 NP=8:DIM OP$(NP)
2470 FORI=1TONP:READOP$(I):NEXT
2480 DATA+,-,*,/,%,%+,%-,%D
2490 DP=2:D1=10^DP:D2=10^(DP+1)
2500 PRINTCS$;"TINY PLAN":PRINT:PRINT"VERSION 1
    .0 JULY 1982"
2510 PRINT:PRINT:PRINT"ELECTRONIC":PRINT:PRINT"
    SPREADSHEET"
2520 FORI=1TO8000:NEXT
2530 SZ=FRE(0)-150
2540 RETURN
```

For the Atari 400/800 Home Computer

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.

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Program 2: Atari Version

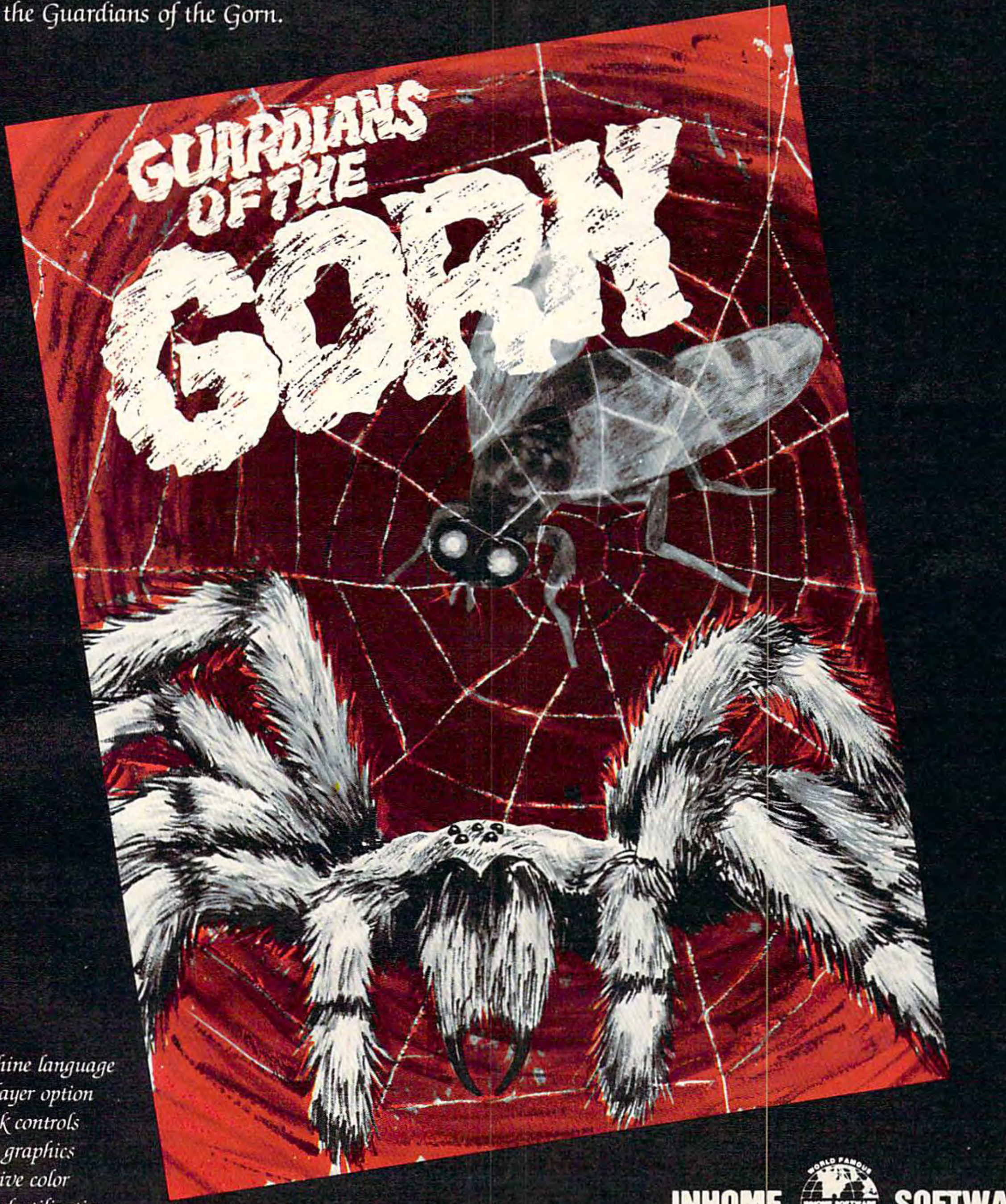
```
100 REM TINY PLAN
110 GOSUB 160
120 GOSUB 510
130 IF R$="Y" THEN 120
140 PRINT CS$:PRINT "THANK YOU.":PRIN
    T
150 END
160 REM BEGIN
170 GOSUB 2410
180 GOSUB 240
190 IF R$="N" THEN 180
200 DIM DA(NR,NC)
205 FOR I=0 TO NR:FOR J=0 TO NC:DA(I,
    J)=0:NEXT J:NEXT I
210 DIM CN$(NC*10),RN$(NR*10),N$(10)
220 GOSUB 350
230 RETURN
240 REM CONFIGURE
250 PRINT CS$;:PRINT "HOW MANY ROWS A
    ND"
260 PRINT :PRINT "COLUMNS IN THE MODE
    L ?":PRINT :PRINT
270 NR=0:PRINT "# ROWS (ACROSS)";:INP
    UT NR:IF NR<=0 THEN PRINT "WHAT?"
    :GOTO 270
280 NC=0:PRINT "# COLS (UP&DOWN)";:IN
    PUT NC:IF NC<=0 THEN PRINT "WHAT?
    ":GOTO 280
290 MS=(NC+1)*(NR+1)*6+(NC+1)*10+(NR+
    1)*10
300 IF MS>SZ THEN PRINT "NOT ENOUGH M
    EMORY":PRINT :GOTO 270
310 PRINT :FOR I=1 TO NR:FOR J=1 TO N
    C:PRINT "X";:NEXT J:PRINT :NEXT I
320 PRINT :PRINT "SHAPE OK (Y OR N) ?
    ";
330 GOSUB 2260
340 RETURN
350 REM SYMBOL TABLE
360 PRINT CS$;"WHAT IS THE NAME OF":P
    RINT :PRINT "EACH ROW AND COLUMN?
    "
370 PRINT :PRINT "NAMES CAN BE UP TO"
    :PRINT :PRINT "10 CHARACTERS LONG
    ."
380 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$(10*I-9,10*I)=T$
430 NEXT I
440 PRINT :PRINT :PRINT "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$(10*I-9,10*I)=T$
490 NEXT I
500 RETURN
510 REM BUILD MODELS
520 GOSUB 580
530 GOSUB 1140
540 GOSUB 1660
550 PRINT CS$;"MODEL AGAIN (Y/N)?";
560 GOSUB 2260
570 RETURN
580 REM ENTER DATA
590 PRINT CS$;"* DATA ENTRY STEP *":P
    RINT
600 PRINT "ENTER DATA (Y/N)?";
610 GOSUB 2260
620 IF R$="N" THEN 750
630 REM
640 PRINT CS$;"ENTER ROWS (Y/N)?";
650 GOSUB 2260
660 IF R$="N" THEN 690
670 PRINT CS$:GOSUB 860:IF E THEN 690
680 GOSUB 760:GOTO 670
690 REM
700 PRINT CS$;"ENTER COLS. (Y/N)?";
710 GOSUB 2260
720 IF R$="N" THEN 750
730 PRINT CS$:GOSUB 1050:IF E THEN 75
    0
740 GOSUB 950:GOTO 730
750 RETURN
760 REM ENTER ROW
770 PRINT CS$;"ENTER ";NC;" VALUES -"
780 PRINT "1 FOR EACH COLUMN.":PRINT
790 PRINT "** ROW ";RN$(R*10-9,R*10);
    " **":PRINT
800 PRINT :PRINT "COLUMN{5 SPACES}VAL
    UE"
810 FOR I=1 TO NC
820 PRINT CN$(I*10-9,I*10);"  ";DA(R,
    I),
830 TRAP 840:INPUT TT:DA(R,I)=TT
840 TRAP 40000:NEXT I
850 RETURN
860 REM GET ROW #
870 E=0:N$="":PRINT "ROW NAME OR 'END
    '"
880 INPUT N$:IF N$="END" THEN E=1:RET
    URN
890 IF LEN(N$)<10 THEN N$(LEN(N$)+1)=
    BL$
900 FOR I=1 TO NR
910 IF RN$(I*10-9,I*10)=N$ THEN R=I:I
    =1000000
920 NEXT I
930 IF I=NR+1 THEN PRINT "? ";:GOTO 8
    70
940 RETURN
950 REM ENTER COL
960 PRINT CS$;"ENTER ";NR;" VALUES -"
970 PRINT "1 FOR EACH ROW":PRINT
980 PRINT "** COL ";CN$(C*10-9,C*10);
    " **":PRINT
990 PRINT :PRINT "ROW{7 SPACES}VALUE"
1000 FOR I=1 TO NR
1010 PRINT RN$(I*10-9,I*10);"  ";DA(I
     ,C),
1020 TRAP 1030:INPUT TT:DA(I,C)=TT
1030 TRAP 40000:NEXT I
1040 RETURN
1050 REM GET COL #
1060 E=0:N$="":PRINT "COL NAME OR 'EN
     D'"
1070 INPUT N$:IF N$="END" THEN E=1:RE
     TURN
1080 IF LEN(N$)<10 THEN N$(LEN(N$)+1)
     =BL$
1090 FOR I=1 TO NC
1100 IF CN$(I*10-9,I*10)=N$ 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 *":P
     RINT
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.

Your only chance is to rescue the ships and aliens, and return them to the safety of their home base while dismantling the tendrils of the web and destroying the Guardians of the Gorn.



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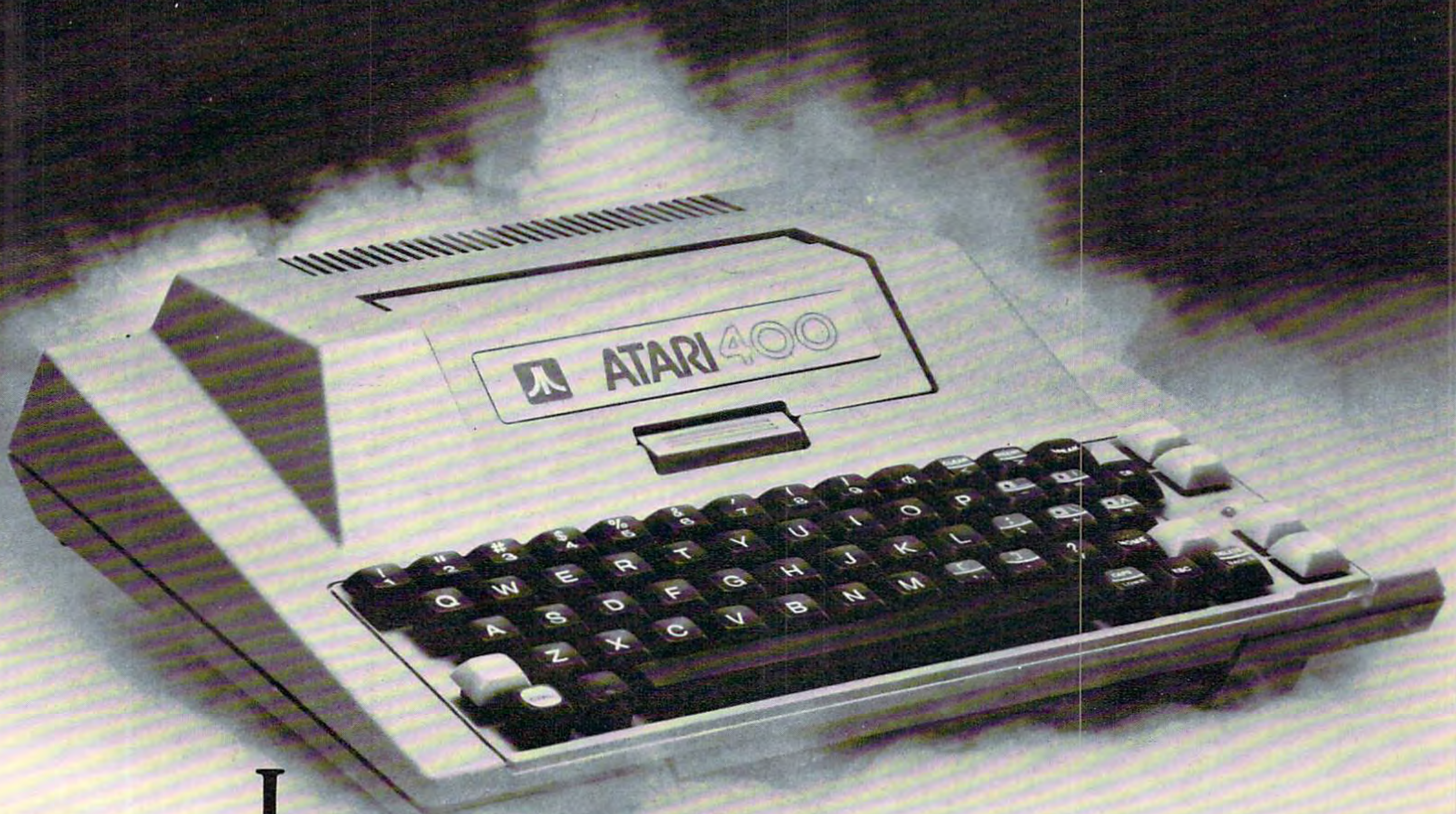
```
1170 GOSUB 2260
1180 IF R$="N" THEN 1310
1190 REM
1200 PRINT CS$;"WORK ON ROWS (Y/N)?";
1210 GOSUB 2260
1220 IF R$="N" THEN 1250
1230 PRINT CS$:PRINT "1ST ";:GOSUB 86
     0:IF E THEN 1250
1240 GOSUB 1320:GOTO 1230
1250 REM
1260 PRINT CS$;"WORK ON COLS. (Y/N)?"
     ;
1270 GOSUB 2260
1280 IF R$="N" THEN 1310
1290 PRINT CS$:PRINT "1ST ";:GOSUB 10
     50:IF E THEN 1310
1300 GOSUB 1490:GOTO 1290
1310 RETURN
1320 REM WORK ON ROWS
1330 R1=R
1340 GOSUB 2180
1350 PRINT :PRINT "2ND ";:GOSUB 860:I
     F E THEN 1400
1360 R2=R
1370 PRINT :PRINT "ANS ";:GOSUB 860:I
     F E THEN 1400
1380 R3=R
1390 GOSUB 1410
1400 RETURN
1410 REM DO ROW
1420 PRINT :PRINT "WORKING..."
1430 FOR I=1 TO NC
1440 C3=I:C2=I:C1=I
1450 GOSUB 2300
1460 NEXT I
1470 PRINT :PRINT "COMPLETED"
1480 RETURN
1490 REM WORK ON COLS
1500 C1=C
1510 GOSUB 2180
1520 PRINT :PRINT "2ND ";:GOSUB 1050:
     IF E THEN 1570
1530 C2=C
1540 PRINT :PRINT "ANS ";:GOSUB 1050:
     IF E THEN 1570
1550 C3=C
1560 GOSUB 1580
1570 RETURN
1580 REM DO COL
1590 PRINT :PRINT "WORKING..."
1600 FOR I=1 TO NR
1610 R3=I:R2=I:R1=I
1620 GOSUB 2300
1630 NEXT I
1640 PRINT :PRINT "COMPLETED"
1650 RETURN
1660 REM DISPLAY
1670 PRINT CS$;"* DATA DISPLAY STEP *
     "
1680 PRINT :PRINT "DISPLAY DATA (Y/N)
     ?";
1690 GOSUB 2260
1700 IF R$="N" THEN 1890
1710 PRINT :REM ROWS
1720 PRINT :PRINT "DISPLAY ROWS (Y/N)
     ?";
1730 GOSUB 2260
1740 IF R$="N" THEN 1800
1750 PRINT :GOSUB 860:IF E THEN 1800
1760 RT=0:FOR I=0 TO NC:RT=RT+DA(R,I)
     :NEXT I
1770 N=INT((NC+1)/NL):IF (NC+1)-NL*N>
     0 THEN N=N+1
1780 C=1:GOSUB 1900
1790 GOTO 1750
1800 REM
1810 PRINT :PRINT "DISPLAY COLS (Y/N)
     ?";
1820 GOSUB 2260
1830 IF R$="N" THEN 1890
1840 PRINT :GOSUB 1050:IF E THEN 1890
1850 CT=0:FOR I=0 TO NR:CT=CT+DA(I,C)
     :NEXT I
1860 N=INT((NR+1)/NL):IF (NR+1)-NL*N>
     0 THEN N=N+1
1870 R=1:GOSUB 2040
1880 GOTO 1840
1890 RETURN
1900 REM ROW PANEL
1910 FOR I=1 TO N
1920 PRINT CS$:PRINT "COLUMN
     {4 SPACES}";RN$(R*10-9,R*10):PRI
     NT
1930 FOR J=1 TO 10
1940 IF C>NC THEN PRINT
1950 IF C<=NC THEN PRINT CN$(C*10-9,C
     *10);" ";DA(R,C):C=C+1
1960 NEXT J
1970 PRINT :PRINT
1980 PRINT "ROW TOTAL ";RT
1990 IF I<N THEN PRINT :PRINT "MORE .
     .."
2000 PRINT :PRINT "SPACE TO CONTINUE"
2010 GET #1,A:IF A<>32 THEN 2010
2020 NEXT I
2030 RETURN
2040 REM COL PANEL
2050 FOR I=1 TO N
2060 PRINT CS$:PRINT "ROW{7 SPACES}";
     CN$(C*10-9,C*10):PRINT
2070 FOR J=1 TO 10
2080 IF R>NR THEN PRINT
2090 IF R<=NR THEN PRINT RN$(R*10-9,R
     *10);" ";DA(R,C):R=R+1
2100 NEXT J
2110 PRINT :PRINT
2120 PRINT "COL TOTAL ";CT
2130 IF I<N THEN PRINT :PRINT "MORE .
     .."
2140 PRINT :PRINT "SPACE TO CONTINUE"
2150 GET #1,A:IF A<>32 THEN 2150
2160 NEXT I
2170 RETURN
2180 REM GET OPERATOR
2190 PRINT
2200 FOR I=1 TO NP*2 STEP 2:PRINT OP$
     (I,I+1);", ";:NEXT I:PRINT
2210 TRAP 2210:INPUT T$:T$(LEN(T$)+1)
     =" ":T$=T$(1,2):TRAP 40000
2220 FOR I=1 TO NP*2 STEP 2:IF OP$(I,
     I+1)=T$ THEN I=1000000
2230 NEXT I
2240 IF I=NP*2+1 THEN PRINT "TRY AGAI
     N":GOTO 2190
2250 RETURN
2260 REM GET Y OR N
2270 GET #1,A:R$=CHR$(A)
2280 IF R$<>"Y" AND R$<>"N" THEN PRIN
     T :PRINT "KEY 'Y' OR 'N'";:GOTO
     2270
2290 RETURN
2300 REM CALCULATIONS
2310 IF T$="+" THEN DA(R3,C3)=DA(R1,C
     1)+DA(R2,C2)
2320 IF T$="-" THEN DA(R3,C3)=DA(R1,C
     1)-DA(R2,C2)
2330 IF T$="*" THEN DA(R3,C3)=DA(R1,C
     1)*DA(R2,C2)
2340 IF T$="/" AND DA(R2,C2)<>0 THEN
     DA(R3,C3)=DA(R1,C1)/DA(R2,C2)
2350 IF T$="%" THEN DA(R3,C3)=DA(R1,C
     1)*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.

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ARMY

```
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$="%D" AND DA(R1,C1)<>0 THEN
      DA(R3,C3)=((DA(R2,C2)-DA(R1,C1)
     )/DA(R1,C1))*100
2390 DA(R3,C3)=INT((DA(R3,C3)*D2+5)/1
     0)/D1
2400 RETURN
2410 REM INITIALIZE
2415 OPEN #1,4,0,"K"
2420 DIM CS$(1):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$:NEXT I
2480 DATA +,-,*,/,%,%+,%-,%D
2490 DP=2:D1=INT(10^DP+0.1):D2=INT(10
     ^(DP+1)+0.1)
2500 PRINT CS$;"TINY PLAN":PRINT :PRI
     NT "VERSION 1.0 JULY 1982"
2510 PRINT :PRINT :PRINT "ELECTRONIC"
     :PRINT :PRINT "SPREADSHEET"
2520 ? :? :? "PRESS START";
2521 IF PEEK(53279)<>6 THEN 2521
2530 SZ=FRE(0)-150
2540 RETURN
```

©

This program, with both Microsoft and Atari versions, can help you to 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″ EAR." 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.

Guesstimating

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 POKE59468,12:PRINTCHR$(142):GOSUB1020
110 PRINT"{DOWN}{REV}WARNING{OFF}: CONSULT YOU
    R DOCTOR BEFORE
120 PRINT"          USING THIS PROGRAM OR ANY"
130 PRINT"          OTHER WEIGHT-LOSS TECHNIQUE
    ."
140 PRINT"{DOWN}ARE YOU {REV}M{OFF}ALE OR {REV
    REV}F{OFF}EMALE?"
150 GETA$:IFA$<>"M"ANDA$<>"F"THEN150
160 SX=0:IF A$="F" THEN SX=1
170 IF SX=0 THEN 200
```

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A universal centronics parallel printer interface for the VIC-20 & C-64 computers. Obeys all standard VIC print commands.
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Suggested Retail — $29.95

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The CARDBOARD 3 is a fuse protected, economy expansion interface designed to allow the user to access more than one of the plug-in-type memory or utility cartridges lnow available. It will accept up to three cartridges at once.
Suggested Retail — $29.95

cardriter 1

A light pen for the VIC-20 and C-64 computers with a switch on the barrel and 6 good programs.
Suggested Retail — $29.95

cardboard 6

The CARDBOARD 6 is a fuse protected expansion interface designed to allow the user to access more than one of the plug-in-type memory or utility cartridges now available. Additionally it allows switch selection of games and other programs now available in the cartridge format, without the necessity of turning the computer off and on again, thereby saving a great deal of stress on your VIC-20 and on your television or monitor.
Suggested Retail — $139.95

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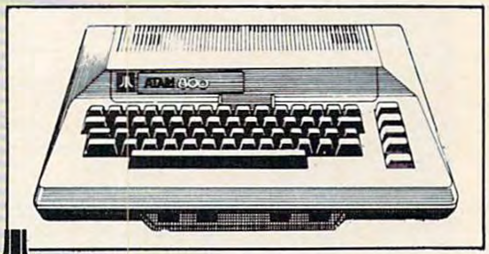

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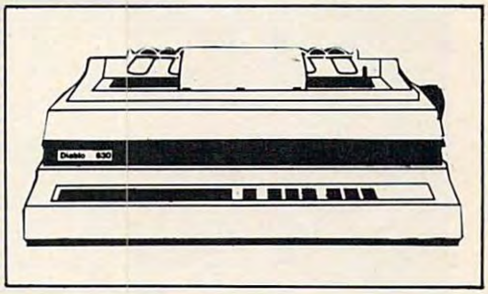

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Conversion Notes For Apple, OSI, VIC, Color Computer, etc.

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 CalCalc 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=5:GOSUB 1020
300 HTAB PX:VTAB PY:INVERSE:PRINT
    CHR$(I+64):NORMAL:PRINT ":";LEFT$
    (FOOD$,19)
305 PY=PY+1
310 IF I=13 THEN PX=20:PY=5
```

Also, remove the IF/THEN qualifiers from lines 340-360 (since the Apple doesn't have a realtime clock), and use:

```
330 VTAB 20
```

These suggestions are a good general guide to follow when converting any PET/CBM program. Since the VIC has a 22-column display, VIC owners should change line 270 to read:

```
270 FOR I=1 TO 10
```

and line 330 to:

```
330 CP$="[HOME][22 DOWN]"
```

```
180 PRINT"{DOWN}ARE YOU PREGNANT";:GOSUB98Ø:IF
     YES THEN PREG=1
190 PRINT"{DOWN}ARE YOU NURSING";:GOSUB98Ø:IF
     YES THEN NU=1
200 GOSUB1Ø2Ø
210 PRINT"ENTER Ø IF NOT KNOWN:"
220 INPUT"NUMBER OF CALORIES CONSUMED? Ø{Ø3 LE
    LEFT}";CAL
230 IF CAL<Ø THEN PRINT"{DOWN}{BELL}{REV}IMPOS
    SIBLE":FORW=1TO5ØØ:NEXT:GOTO2ØØ
240 IFCAL>=45ØØTHENPRINT"{DOWN}";CAL;" CALORIE
    S?  ARE YOU SURE";:GOSUB98Ø:IF1-YES T
    HEN2ØØ
250 IF CAL THEN 73Ø
260 PX=Ø:GOSUB 1Ø2Ø
270 FOR I=1 TO 26
280 READ FOOD$,CL,AMOUNT$
290 IF FOOD$="END" THEN 33Ø
300 PRINT TAB(PX);"{REV}";CHR$(I+64);"{OFF}:";
    LEFT$(FOOD$,19)
310 IF I=13 THEN PX=2Ø:PRINT"{13 UP}";
320 NEXT I
330 CP$="{HOME}{24 DOWN}"
340 IF TI-T>6Ø AND TI-T<12Ø THEN PRINTCP$;"ENT
    ER {REV}#{OFF} OR {REV}LETTER{OFF} OF
     FOOD";
350 IF TI-T>12Ø AND TI-T<18Ø THEN PRINTCP$;"PR
    ESS {REV}RETURN{OFF} TO GO ON      ";
360 IF TI-T>18Ø THEN PRINTCP$;"PRESS {REV}*{OF
    OFF} WHEN DONE     ";:T=TI
370 GETA$:IF(A$<"A"ORA$>"Z")ANDA$<>CHR$(13)AND
    A$<>"*"ANDA$<>"#"THEN34Ø
380 IFA$<>CHR$(13)THEN41Ø
390 NX=NX+1:IF FOOD$="END" THEN RESTORE:NX=Ø
400 GOTO 26Ø
410 RESTORE
420 IFA$="#"THEN6ØØ
430 IFA$="*"THEN66Ø
440 FOR I=1 TO NX*26+ASC(A$)-64
450 READ FOOD$,CL,AMOUNT$
460 NEXT
470 GOSUB1Ø2Ø
480 PRINT"FOOD: ";FOOD$
490 PRINT"CALORIES PER ";AMOUNT$;": ";CL
500 PRINT"{DOWN}ENTER QUANTITY OF ABOVE FOOD
510 PRINT"CONSUMED, USING A MULTIPLE OR
520 PRINT"A DECIMAL FRACTION? Ø{Ø3 LEFT}";:INP
    UT QU
530 IF QU=Ø THEN 59Ø
540 IF QU<Ø THEN PRINT"{REV}{DOWN}{BELL}IMPOSS
    IBLE":FORW=1TO5ØØ:GOTO47Ø
550 PRINT"{DOWN}CALORIES OF ";FOOD$;":";CL*QU
560 PRINT"{DOWN}CALORIES CONSUMED SO FAR:";:CA
    L=CAL+CL*QU:PRINTCAL
570 PRINT"{Ø2 DOWN}PRESS {REV}RETURN{OFF} TO C
    ONTINUE..."
580 GETA$:IFA$<>CHR$(13)THEN58Ø
590 RESTORE:NX=Ø:GOTO 26Ø
600 GOSUB1Ø2Ø:PRINT"{DOWN}ENTER ABSOLUTE QUANT
    ITY"
610 PRINT"{DOWN}OF CALORIES FOR FOOD NOT ON LI
    ST:"
620 PRINT"{Ø2 DOWN}? Ø{Ø3 LEFT}";:INPUT CL
630 IF CL=Ø THEN NX=Ø:GOTO 26Ø
640 IF CL<Ø THEN PRINT"{DOWN}{REV}{BELL}IMPOSS
    IBLE":FORW=1TO5ØØ:NEXTW:GOTO6ØØ
650 QU=1:GOTO56Ø
660 GOSUB1Ø2Ø
670 PRINT"TOTAL CALORIES CONSUMED:";CAL
680 PRINT"{Ø2 DOWN}DOES THAT SOUND REASONABLE"
    ;:GOSUB98Ø
690 IF YES THEN 73Ø
700 PRINT"{DOWN}DO YOU WANT TO":PRINT"RE-ENTER
     THE CALORIES";:GOSUB98Ø
710 IF YES THEN CAL=Ø:GOTO26Ø
720 PRINT"{CLEAR}":END
```

(continued on p. 90)

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```
730 GOSUB1020
740 INPUT"WHAT IS YOUR AGE? 20{04 LEFT}";AGE
750 IFAGE<20ORAGE>70THENPRINT"{DOWN}{REV}YOU M
    UST BE BETWEEN 20 AND 70"
760 IFAGE<20ORAGE>70THENFORW=1TO1000:NEXT:GOTO
     730
770 IFAGE>=20ANDAGE<=30THENCPD=3200:IF SX THEN
     CPD=2300
780 IFAGE>=30ANDAGE<=40THENCPD=3104:IF SX THEN
     CPD=2231
790 IFAGE>=50ANDAGE<=60THENCPD=2768:IF SX THEN
     CPD=1990
800 IFAGE>=60ANDAGE<=70THENCPD=2528:IF SX THEN
     CPD=1587
810 CPD=CPD+1000*NU+450*PREG
820 PRINT"{DOWN}ON A SCALE OF {REV}1{OFF}-{REV
    REV}5{OFF}"
830 PRINT"(1=MODERATELY ACTIVE, 5=VERY ACTIVE"
840 PRINT"HOW ACTIVE ARE YOU?"
850 GETA$:IFA$<"1"ORA$>"5"THEN850
860 CPD=CPD+VAL(A$)*200
870 GOSUB1020:PRINT"{DOWN}ESTIMATED ENERGY EXP
    ENDITURE":PRINT"IN CALORIES IN ONE DA
    Y:";CPD
880 PRINT"{DOWN}TOTAL CALORIC INTAKE IN ONE DA
    Y:";CAL
890 DF=CAL-CPD
900 PRINT"{DOWN}NUMBER OF DAYS TO PROJECT"
910 INPUT"WEIGHT LOSS/GAIN? 1{03 LEFT}";ND
920 IF ND<1 THEN 910
930 PRINT"{DOWN}AT THE CURRENT CONSUMPTION, YO
    U SHOULD"
940 IF DF<0 THEN PRINT"LOSE ";:GOTO 960
950 PRINT"GAIN ";
960 PRINTINT(ABS(DF*ND)/3500);" POUNDS."
970 END
980 PRINT"? (Y/N):";
990 GETA$:IFA$<>"Y"ANDA$<>"N"THEN990
1000 YES=0:IFA$="N"THENPRINT"{REV}NO":RETURN
1010 YES=1:PRINT"{REV}YES":RETURN
1020 PRINT"{CLEAR}";
1030 PRINT"  $$$   $$   $     $$$   $$   $    $
    $$
1040 PRINT" NM  M NM M 'MM   NM  M NM M 'MM   NM
     M
1050 PRINT"'M{REV})   {OFF}'M{REV})  _{OFF}'_ {R
    REV} {OFF}  'M{REV})   {OFF}'M{REV}) ~
     _{OFF}' {REV} {OFF} 'M{REV})    "
1060 PRINT"' {REV} {OFF}    ' {REV} {OFF}: {REV}
     {OFF}' {REV} {OFF}   ' {REV} {OFF}      ~
    ' {REV} {OFF}: {REV} {OFF}' {REV} {OF
    OFF} ' {REV} {OFF}
1070 PRINT"' {REV} {OFF}    ' {REV} {OFF} M{REV}
     {OFF}' {REV} {OFF}   ' {REV} {OFF}
    ' {REV} {OFF} M{REV} {OFF}' {REV} {OF
    OFF} ' {REV} {OFF}
1080 PRINT" M{REV} {OFF}##M' {REV}     {OFF}' {R
    REV} {OFF}#M M{REV} {OFF}##M' {REV}    ~
     {OFF}' {REV} {OFF}#MM{REV} {OFF}##M

1090 PRINT"   _{REV}    {OFF} M{REV} {OFF} M{REV}
     {OFF} M{REV}    {OFF}  _{REV}    {OFF}
     M{REV} {OFF} M{REV} {OFF} M{REV}    {
    OFF}  _{REV}     "
1100 PRINTTAB(11);"$$$$$$$$$$$$$$$$$$"
1110 PRINTTAB(11);"{REV}CALORIE CALCULATOR"
1120 PRINT"@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@
    @@"
1130 RETURN
1140 DATA CHEDDAR CHEESE,113,1'' CUBE
1150 DATA COTTAGE CHEESE,27, 1 OZ
1160 DATA WHOLE MILK,166,1 CUP
1170 DATA NONFAT MILK,87,1 CUP
1180 DATA GRAPEFRUIT,77,1 CUP
1190 DATA ORANGES,70,1 MED.
1200 DATA CANTALOUPES,37,1/2 MELON
1210 DATA APPLES,87,1 MED.
1220 DATA ORANGE JUICE,108,1 CUP
1230 DATA CORN FLAKES,96,1 CUP
1240 DATA WHITE BREAD,63,1 SLICE
1250 DATA WHOLE WHEAT BREAD,55,1 SLICE
1260 DATA HAMBURGER MEAT,316,3 OZ
1270 DATA STEAK,293,3 OZ
1280 DATA LAMB CHOP,480,4 OZ
1290 DATA BACON,48,1 SLICE
1300 DATA HAM,340,3 OZ
1310 DATA FLOUNDER,78,4 OZ
1320 DATA TUNA FISH,170,3 OZ
1330 DATA CHICKEN,227,4 OZ
1340 DATA EGGS,640,1 CUP
1350 DATA SUGAR,48,1 TBS
1360 DATA CARROTS,68,1 CUP
1370 DATA POTATOES,120,1 MED.
1380 DATA BEET GREENS,39,1 CUP
1390 DATA LETTUCE,7,4 SM. LEAVES
1400 DATA SPINACH,46,1 CUP
1410 DATA BAKED BEANS,295,1 CUP
1420 DATA LIMA BEANS,152,1 CUP
1430 DATA CORN,92,8'' EAR
1440 DATA PEAS,74,.5 CUP
1450 DATA TOMATOES,30,1 MED.
1460 DATA 4% BEER,150,12 OZ.
1470 DATA BLACK COFFEE,9,1 CUP
1480 DATA COLA BEVERAGES,83,6 OZ
1490 DATA POTATO CHIPS,108,10 2'' CHIPS
1500 DATA END,0,0
```

Program 2: Atari Version

```
100 GRAPHICS 0:POKE 752,1:GOSUB 1020:
    DIM A$(1),FOOD$(19),AMOUNT$(10)
105 OPEN #1,4,0,"K":POKE 82,0
110 PRINT "{DOWN}WARNING: CONSULT YOU
    R DOCTOR BEFORE"
120 PRINT "{9 SPACES}USING THIS PROGR
    AM OR ANY"
130 PRINT "{9 SPACES}OTHER WEIGHT-LOS
    S TECHNIQUE."
140 PRINT "{DOWN}ARE YOU MALE OR FEMA
    LE?"
150 GET #1,A:A$=CHR$(A):IF A$<>"M" AN
    D A$<>"F" THEN 150
160 SX=0:IF A$="F" THEN SX=1
170 IF SX=0 THEN 200
180 PRINT "{DOWN}ARE YOU PREGNANT";:G
    OSUB 980:IF YES THEN PREG=1
190 PRINT "{DOWN}ARE YOU NURSING";:GO
    SUB 980:IF YES THEN NU=1
200 GOSUB 1020
210 PRINT "ENTER 0 IF NOT KNOWN:":?
220 TRAP 220:PRINT "{UP}{DEL LINE}NUM
    BER OF CALORIES CONSUMED?0{2 LEFT}
    ";:POKE 752,0:INPUT CAL:POKE 752,
    1:TRAP 40000
230 IF CAL<0 THEN PRINT "{DOWN}{BELL}
    IMPOSSIBLE":FOR W=1 TO 500:NEXT W
    :GOTO 200
240 IF CAL>=4500 THEN PRINT "{DOWN}";
    CAL;" CALORIES? ARE YOU SURE";:G
    OSUB 980:IF 1-YES THEN 200
250 IF CAL THEN 730
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);
    ":";FOOD$:PY=PY+1
310 IF I=13 THEN PX=20:PY=10
320 NEXT I
330 REM
340 IF PEEK(20)>60 AND PEEK(20)<120 T
```

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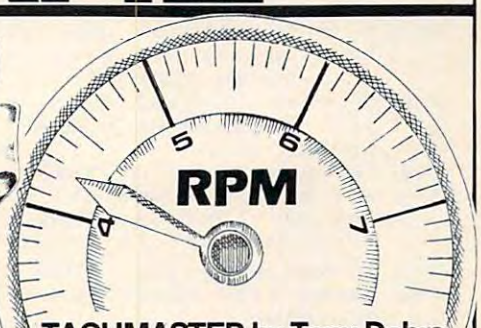

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```
    HEN POSITION 2,23:? "ENTER # OR L
    ETTER OF FOOD";
350 IF PEEK(20)>120 AND PEEK(20)<180
    THEN POSITION 2,23:? "PRESS RETUR
    N TO GO ON{5 SPACES}";
360 IF PEEK(20)>180 THEN POSITION 2,2
    3:? "PRESS * WHEN DONE{4 SPACES}"
    ;:POKE 20,0
365 IF PEEK(764)=255 THEN 340
370 GET #1,A:A$=CHR$(A):IF (A$<"A" OR
     A$>"Z") AND A$<>CHR$(155) AND A$
    <>"*" AND A$<>"#" THEN 340
380 IF A$<>CHR$(155) THEN 410
390 NX=NX+1:IF FOOD$="END" THEN RESTO
    RE :NX=0
400 GOTO 260
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 NEXT I
470 GOSUB 1020
480 PRINT "FOOD: ";FOOD$
490 PRINT "CALORIES PER ";AMOUNT$;":
    ";CL
500 PRINT "{DOWN}ENTER QUANTITY OF AB
    OVE FOOD"
510 PRINT "CONSUMED, USING A MULTIPLE
     OR":?
520 TRAP 520:PRINT "{UP}{DEL LINE}A D
    ECIMAL FRACTION?0{2 LEFT}";:POKE
    752,0:INPUT QU:POKE 752,1:TRAP 40
    000
530 IF QU=0 THEN 590
540 IF QU<0 THEN PRINT "{DOWN}{BELL}I
    MPOSSIBLE":FOR W=1 TO 500:GOTO 47
    0
550 PRINT "{DOWN}CALORIES OF ";FOOD$;
    ":";CL*QU
560 PRINT "{DOWN}CALORIES CONSUMED SO
     FAR:";:CAL=CAL+CL*QU:PRINT CAL
570 PRINT "{2 DOWN}PRESS RETURN TO CO
    NTINUE..."
580 GET #1,A:A$=CHR$(A):IF A$<>CHR$(1
    55) THEN 580
590 RESTORE :NX=0:GOTO 260
600 GOSUB 1020:PRINT "{DOWN}ENTER ABS
    OLUTE QUANTITY"
610 PRINT "{DOWN}OF CALORIES FOR FOOD
     NOT ON LIST:":?
620 TRAP 620:PRINT "{UP}{DEL LINE}?0
    {2 LEFT}";:POKE 752,0:INPUT CL:PO
    KE 752,1:TRAP 40000
630 IF CL=0 THEN NX=0:GOTO 260
640 IF CL<0 THEN PRINT "{DOWN}{BELL}I
    MPOSSIBLE":FOR W=1 TO 500:NEXT W:
    GOTO 600
650 QU=1:GOTO 560
660 GOSUB 1020
670 PRINT "TOTAL CALORIES CONSUMED:";
    CAL
680 PRINT "{2 DOWN}DOES THAT SOUND RE
    ASONABLE";:GOSUB 980
690 IF YES THEN 730
700 PRINT "{DOWN}DO YOU WANT TO":PRIN
    T "RE-ENTER THE CALORIES";:GOSUB
    980
710 IF YES THEN CAL=0:GOTO 260
720 PRINT "{CLEAR}":END
730 GOSUB 1020:? :?
740 TRAP 740:PRINT "{UP}{DEL LINE}WHA
    T IS YOUR AGE?20{3 LEFT}";:POKE 7
    52,0:INPUT AGE:POKE 752,1:TRAP 40
    000
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 FOR W=1
    TO 300:NEXT W:GOTO 730
770 IF AGE>=20 AND AGE<=30 THEN CPD=3
    200:IF SX THEN CPD=2300
780 IF AGE>=30 AND AGE<=40 THEN CPD=3
    104:IF SX THEN CPD=2231
790 IF AGE>=50 AND AGE<=60 THEN CPD=2
    768:IF SX THEN CPD=1990
800 IF AGE>=60 AND AGE<=70 THEN CPD=2
    528:IF SX THEN CPD=1587
810 CPD=CPD+1000*NU+450*PREG
820 PRINT "{DOWN}ON A SCALE OF 1-5"
830 PRINT "(1=MODERATELY ACTIVE, 5=VE
    RY ACTIVE"
840 PRINT "HOW ACTIVE ARE YOU?"
850 GET #1,A:A$=CHR$(A):IF A$<"1" OR
    A$>"5" THEN 850
860 CPD=CPD+VAL(A$)*200
870 GOSUB 1020:PRINT "{DOWN}ESTIMATED
     ENERGY EXPENDITURE":PRINT "IN CA
    LORIES IN ONE DAY:";CPD
880 PRINT "{DOWN}TOTAL CALORIC INTAKE
     IN ONE DAY:";CAL
890 DF=CAL-CPD
900 PRINT "{DOWN}NUMBER OF DAYS TO PR
    OJECT"
910 PRINT "WEIGHT LOSS/GAIN?1{2 LEFT}
    ";:POKE 752,0:INPUT ND:POKE 752,1
920 IF ND<1 THEN 910
930 PRINT "{DOWN}AT THE CURRENT CONSU
    MPTION, YOU SHOULD"
940 IF DF<0 THEN PRINT "LOSE ";:GOTO
    960
950 PRINT "GAIN ";
960 PRINT INT(ABS(DF*ND)/3500);" POUN
    DS."
970 END
980 PRINT "? (Y/N):";
990 GET #1,A:A$=CHR$(A):IF A$<>"Y" AN
    D A$<>"N" THEN 990
1000 YES=0:IF A$="N" THEN PRINT "NO":
    RETURN
1010 YES=1:PRINT "YES":RETURN
1020 PRINT "{CLEAR}";
1030 ? "  {3 N}{3 SPACES}{2 N}
    {3 SPACES}{N}{5 SPACES}{3 N}
    {3 SPACES}{2 N}{3 SPACES}{N}
    {4 SPACES}{3 N}"
1040 ? " {F}{G}  {G} {F}{G} {G} {B}
    {2 G}{3 SPACES}{F}{G}  {G} {F}
    {G} {G} {B}{2 G}  {F}{G}  {G}"
1050 ? "{B}{G}{H}{3 SPACES}{B}{G}{H}■
    ■{J}{B} ■  {B}{G}{H}{3 SPACES}
    {B}{G}{H}■■{J}{B} ■ {B}{G}{H}
    {3 SPACES}"
1060 ? "{B} ■{3 SPACES}{B} ■{N}{V}■
    {B} ■  {B} ■{3 SPACES}{B} ■{N}
    {V}■{B} ■ {B} ■"
1070 ? "{B} ■{3 SPACES}{B} ■ {G}■{B}
    ■ {B} ■{3 SPACES}{B} ■ {G}■{B}
    ■ {B} ■"
1080 ? " {G}■{2 M}{G}{B} {4 SPACES}
    {B} ■{M}{G} {G}■{2 M}{G}{B}
    {4 SPACES}{B} ■{M}{2 G}■{2 M}
    {G}"
1090 ? "  {J}{3 SPACES} {G}■ {G}■
    {G}{3 SPACES}  {J}{3 SPACES}
    {G}■ {G}■ {G}{3 SPACES} {J}
    {3 SPACES}"
1110 ? :POKE 85,11:? "CALORIE CALCULA
    TOR"
1120 PRINT "{40 R}"
1130 RETURN
1140 DATA CHEDDAR CHEESE,113,1'' CUBE
```

(continued on p. 94)

```
1150 DATA COTTAGE CHEESE,27, 1 OZ
1160 DATA WHOLE MILK,166,1 CUP
1170 DATA NONFAT MILK,87,1 CUP
1180 DATA GRAPEFRUIT,77,1 CUP
1190 DATA ORANGES,70,1 MED.
1200 DATA CANTALOUPES,37,1/2 MELON
1210 DATA APPLES,87,1 MED.
1220 DATA ORANGE JUICE,108,1 CUP
1230 DATA CORN FLAKES,96,1 CUP
1240 DATA WHITE BREAD,63,1 SLICE
1250 DATA WHOLE WHEAT BREAD,55,1 SLICE
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1270 DATA STEAK,293,3 OZ
1280 DATA LAMB CHOP,480,4 OZ
1290 DATA BACON,48,1 SLICE
1300 DATA HAM,340,3 OZ
1310 DATA FLOUNDER,78,4 OZ
1320 DATA TUNA FISH,170,3 OZ
1330 DATA CHICKEN,227,4 OZ
1340 DATA EGGS,640,1 CUP
1350 DATA SUGAR,48,1 TBS
1360 DATA CARROTS,68,1 CUP
1370 DATA POTATOES,120,1 MED.
1380 DATA BEET GREENS,39,1 CUP
1390 DATA LETTUCE,7,4 SM. LEAVES
1400 DATA SPINACH,46,1 CUP
1410 DATA BAKED BEANS,295,1 CUP
1420 DATA LIMA BEANS,152,1 CUP
1430 DATA CORN,92,8'' EAR
1440 DATA PEAS,74,.5 CUP
1450 DATA TOMATOES,30,1 MED.
1460 DATA 4% BEER,150,12 OZ.
1470 DATA BLACK COFFEE,9,1 CUP
1480 DATA COLA BEVERAGES,83,6 OZ
1490 DATA POTATO CHIPS.108,10 2'' CHIPS
1500 DATA END,0,0
```

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For TI 99/4 (or 99/4A), with or without Extended BASIC, VIC, Radio Shack Color Computer (16K Extended BASIC), and Apple – choose from this selection of four different sorting subroutines.

All Sorts Of BASIC Sorts

C. Regena
Cedar City, UT

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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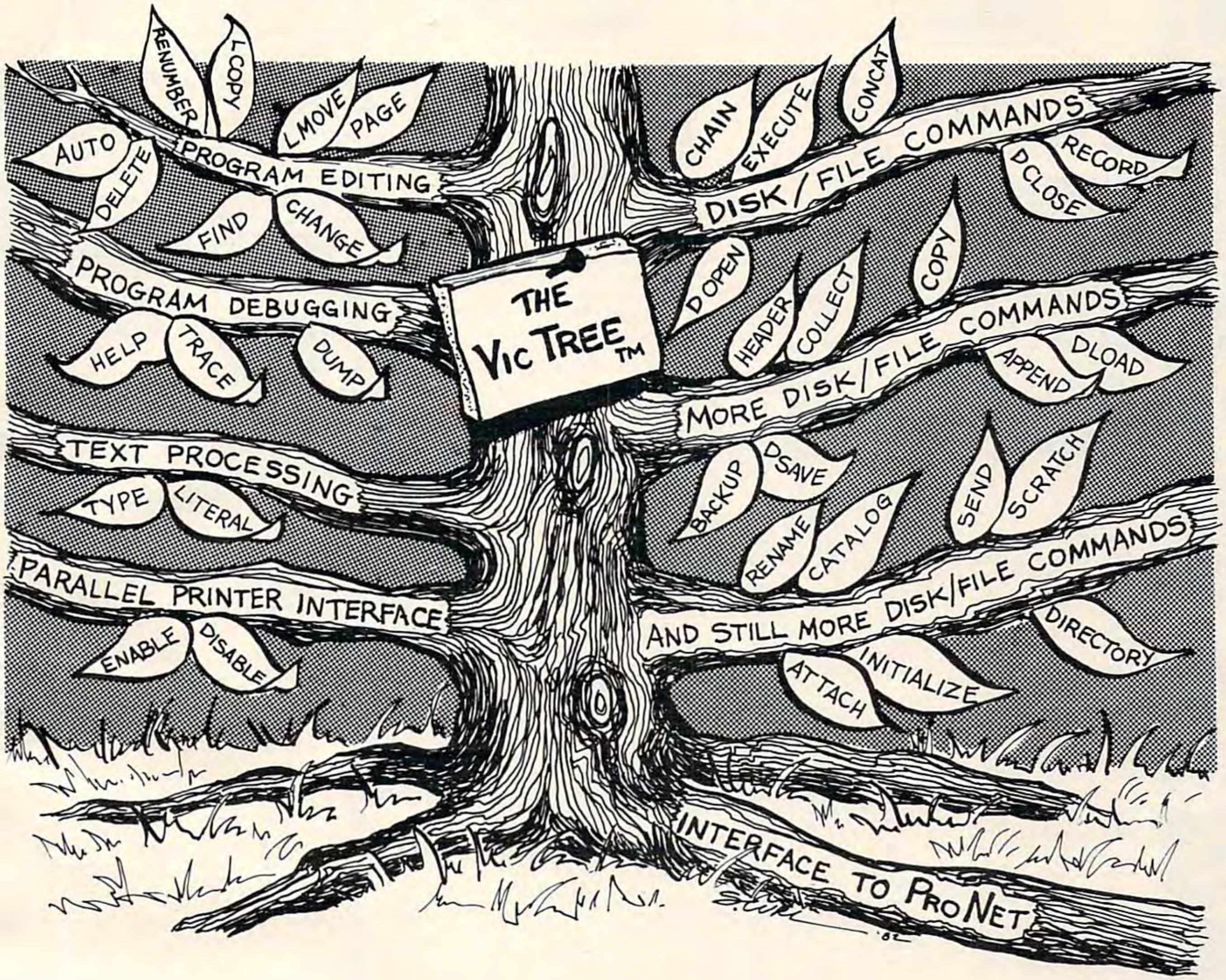

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