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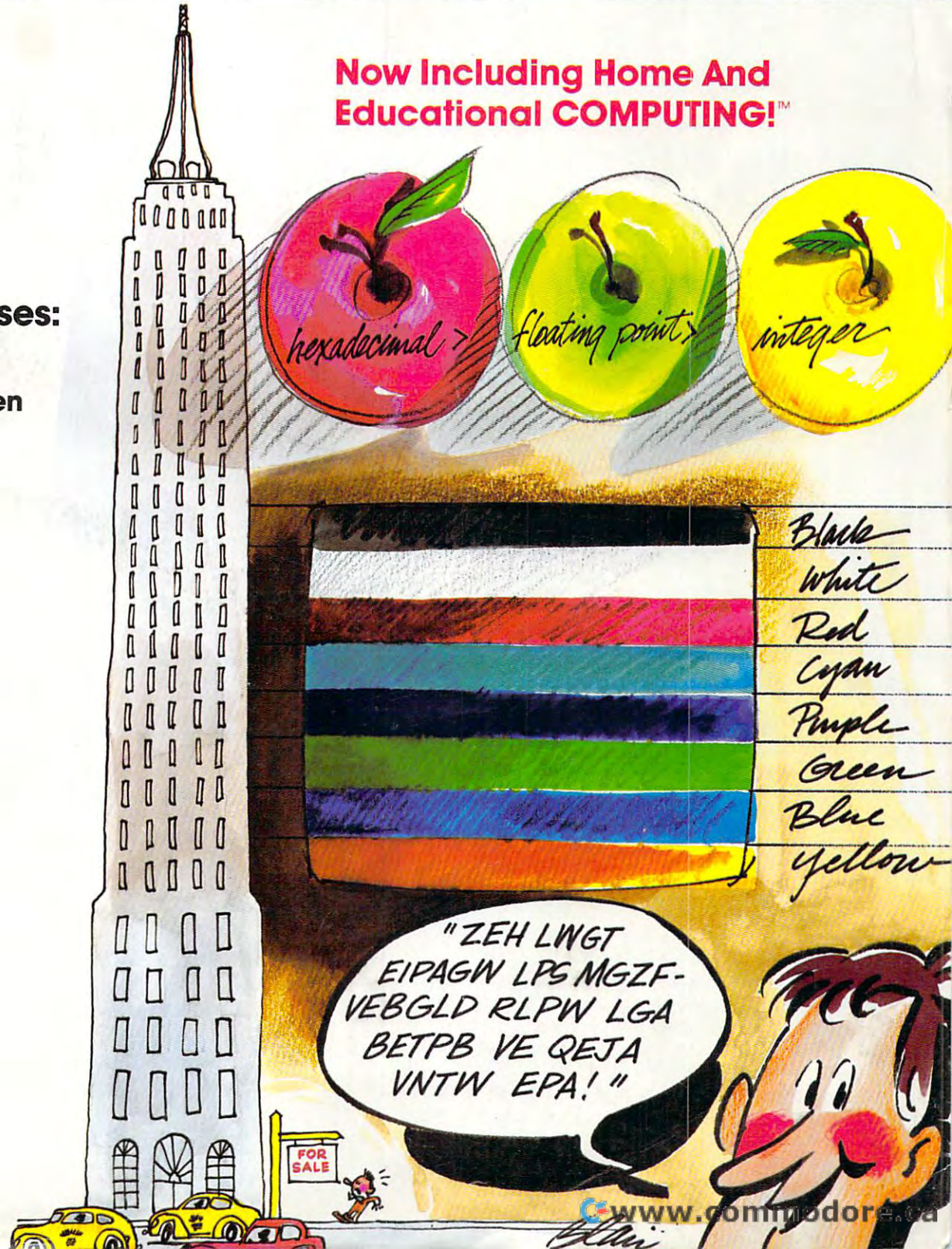

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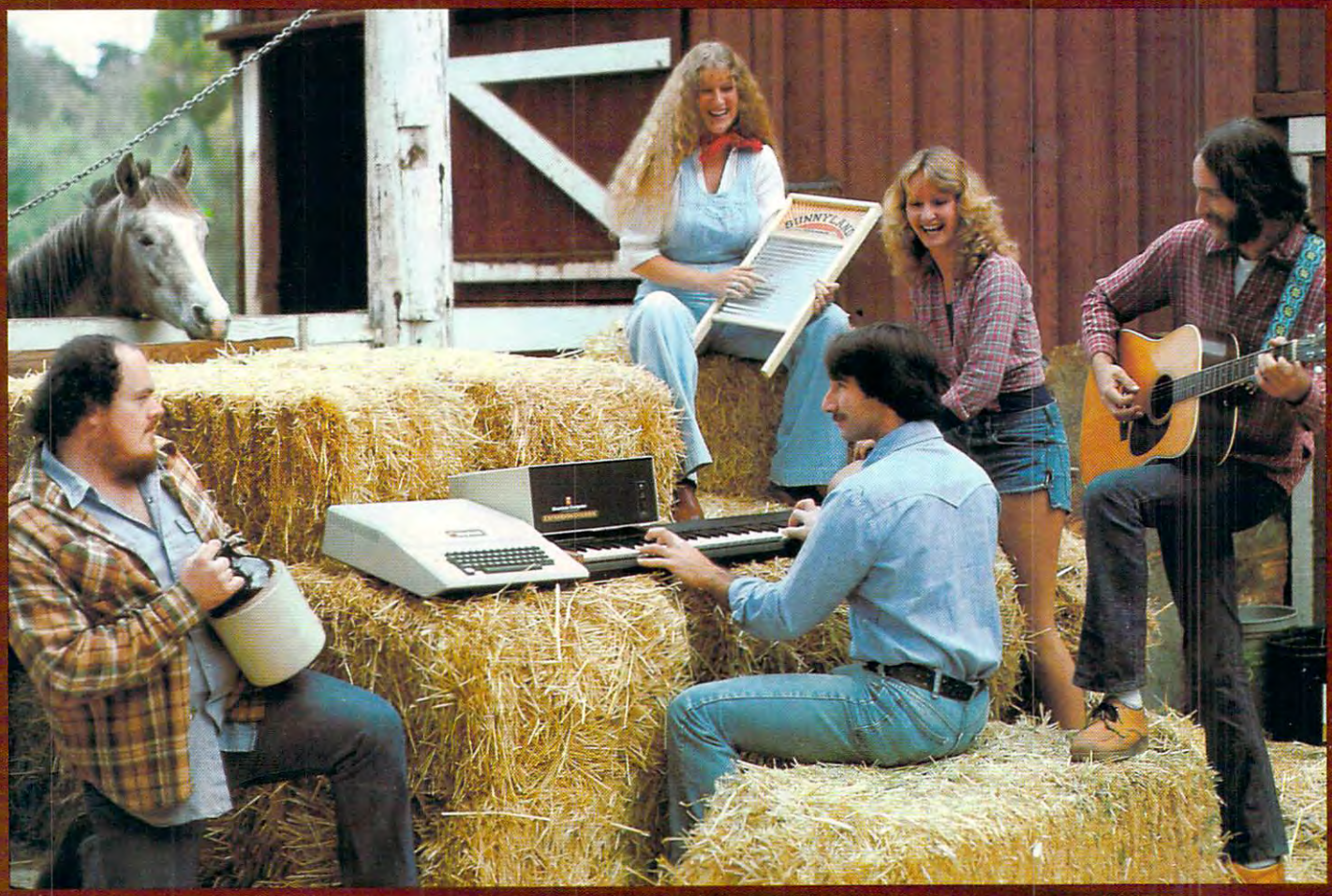

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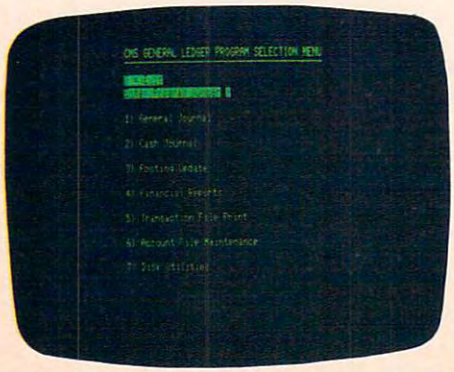

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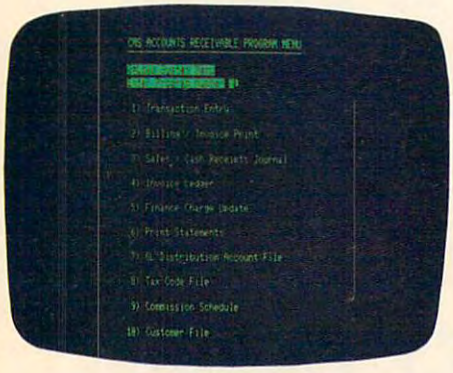

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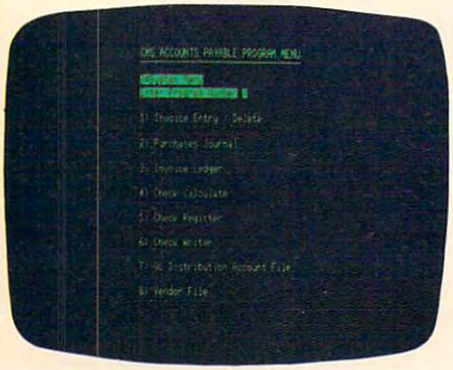

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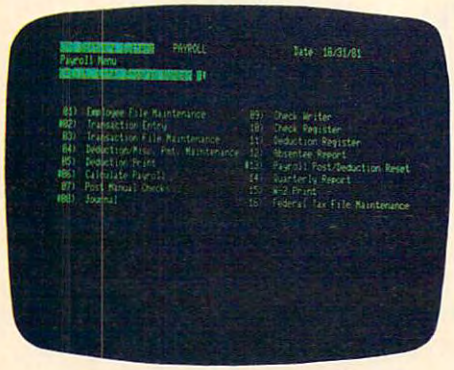

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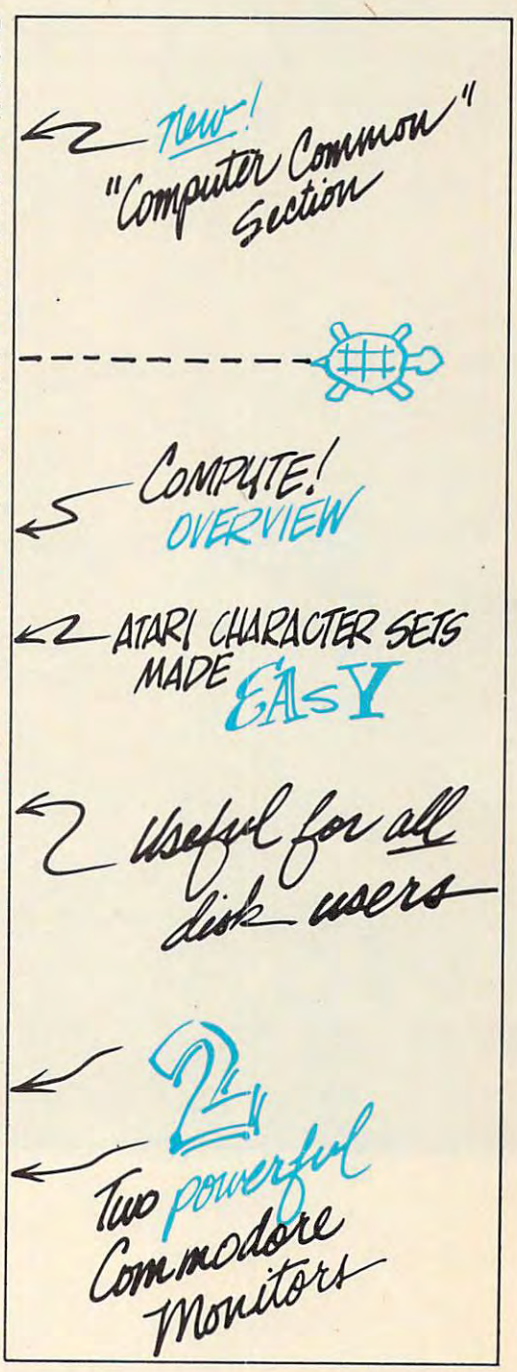

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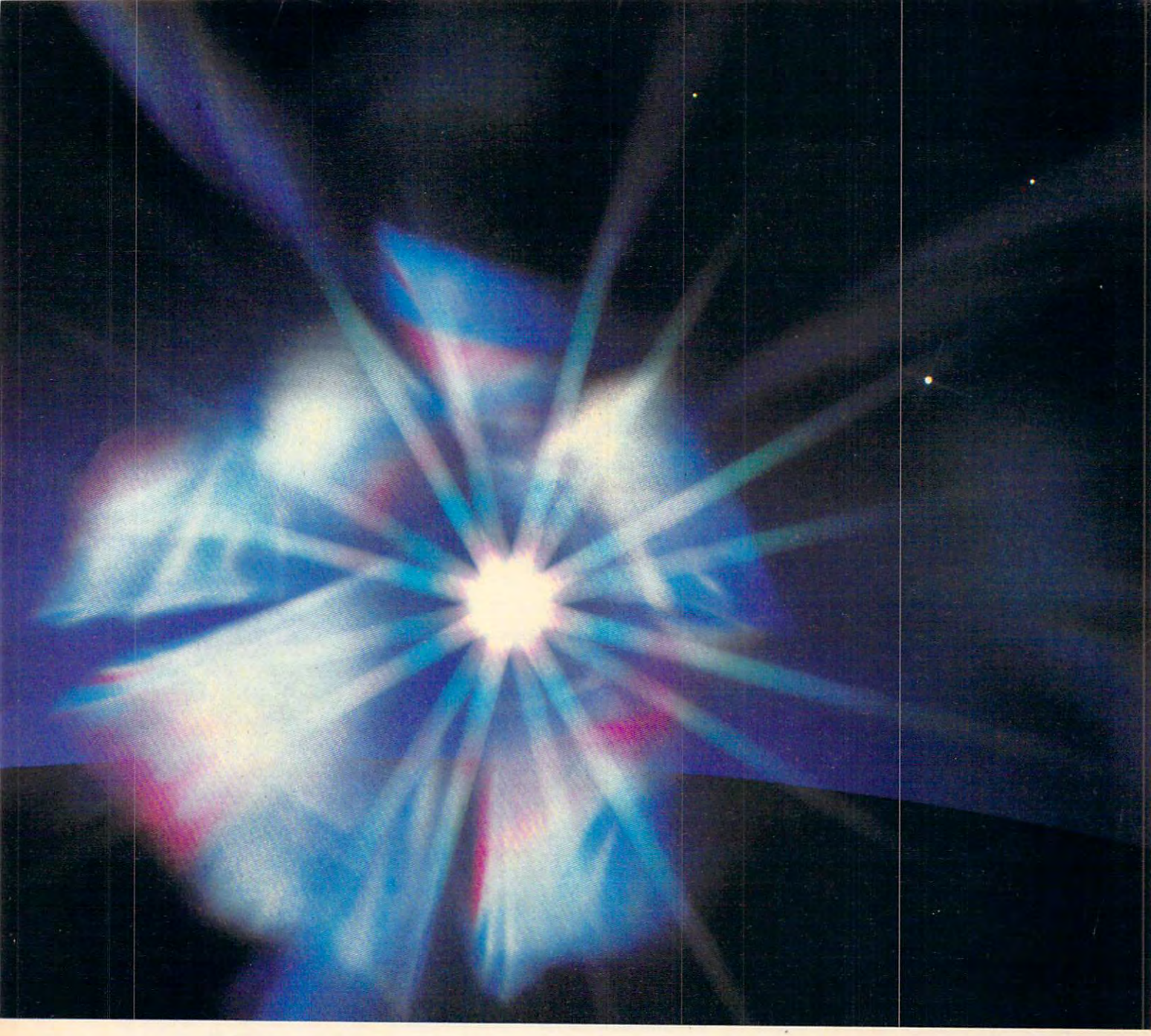

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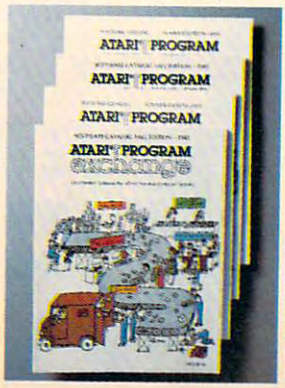

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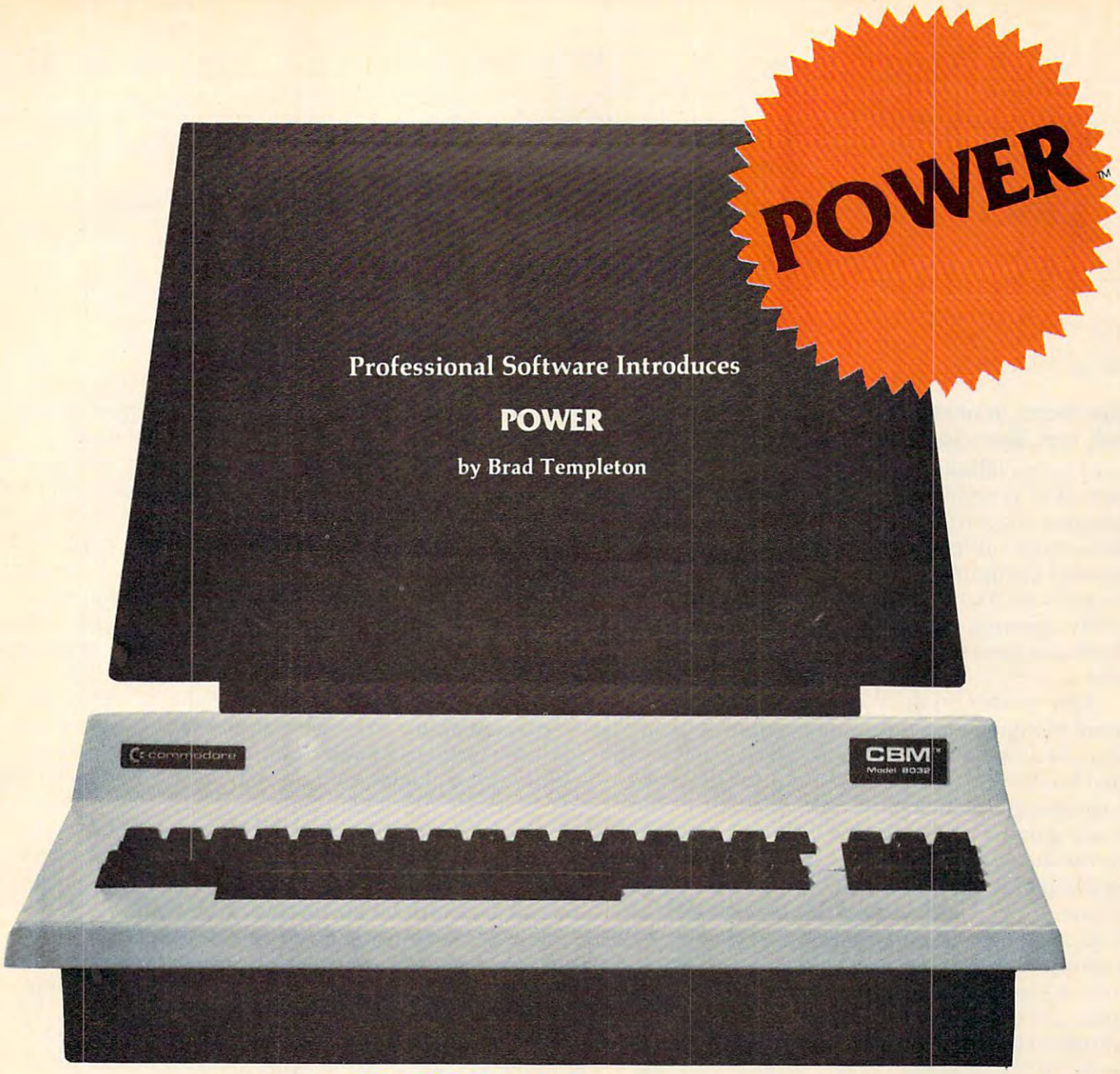

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The Editor's notes...

Robert C. Lock
Publisher/Editor

Injunctions, Injunctions, And More Injunctions Atari, Inc., Goes To War

And I'm not talking about the popular Eastern Front WW II simulation, either. If you picked up a computer magazine recently, you couldn't help noticing the full-page software piracy ads Atari Personal Computer Systems has been running everywhere. Atari has been moving quickly and quietly against major and minor software vendors whose products step on the toes of Atari arcade games.

One vendor on the West coast, recently losing a round of injunctions and counter-injunctions, serves as a case in point. The popular game, developed by the vendor from "scratch" for the Atari computer, mirrors in part a very successful Atari arcade game. Does Atari, Inc. have the software out for the personal computers? Well no, but that's not the point. In spite of the fact that the computer version of the game is significantly expanded, quite original in coding (there was none before this version), and rumored to be a real pleasure, the current state of software law appears to side with Atari ... at least it did at the end of the current round of claims. The visual image and theme of the game are decidedly Atari's, thus we end up with protection based to some extent on concept. Pure and simple.

Let The Vendor Beware

The way we hear it, Atari informed these vendors that they would have to stop the sale or distribution of this software. The vendors pointed out that they had developed the game and its program code originally, etc... To no avail, it turned out; Atari obtained an injunction to halt distribution. The vendors asked Atari to license the game to *them*, thus generating royalties for Atari, and permitting the vendors to pursue sale and distribution. Atari said no, but did apparently ask the vendors if *they* would consider developing a version of the game for Atari! Predictably enough, the vendors declined, and went to court, obtaining an injunction allowing sale and distribution. Whereupon, Atari went back and emerged victorious, for the moment, quashing that injunction (I believe that was Round 2?), and obtaining the one that's currently in force (Round 3?).

Then Linda Turned To John And ...

First of all, I fully support Atari's right to protect their proprietary software. That principle has to be firmly embedded in the computer industry to allow it to grow and nurture even more exciting future growth. But there does seem to be a grey area here which needs to be more fully explored. I suspect, with this recent flurry of legal activity, that the screen is becoming cloudy, as it were. I assume no one is arguing whether this game is original, unique program code. I assume no one argues that it took months to develop, perfect, refine, and yes, enhance.

So, we're back to concept, visual image, style of presentation... Would it have made any difference if the imagery had been uniquely different? Can it be? I mean there are only so many ways to program an arcade style game on a 10 or 12 inch screen. One begins with chasers and chasees, and proceeds from there. The general form is that chasers have sophisticated weaponry, and grow more sophisticated as the game progresses (we call these "skill levels"). Chasees have various means of fighting back. And that, with allowance for creative variation, is the backbone of computer-based gaming, arcade style.

At this point in the analysis, we're several stages removed from actual program code. Its uniqueness has become moot for the moment. In this case there is no computer software to check against the twice-released game. Atari hasn't developed it yet. If the existing game is a direct "copy" of the Atari arcade game, I would guess they'll end up the winners, and software vendors will be a bit wiser for it.

Let The Good Times Scroll

Here's the danger of it ... depending on the tightness of court interpretations of this portion of the fight, we're leery of ending up in a situation so broadly defined it defeats "competitive" gaming. Given that we're arguing concepts and imagery, rather than written program code and precisely comparable listings, a broad interpretation of the rights to "player-missile graphics" would cripple the software industry, leaving access to a few. Those few, at this point, would be the companies currently holding the reins on the arcade market. Two biggies, by the way, are Atari and Commodore. Com-

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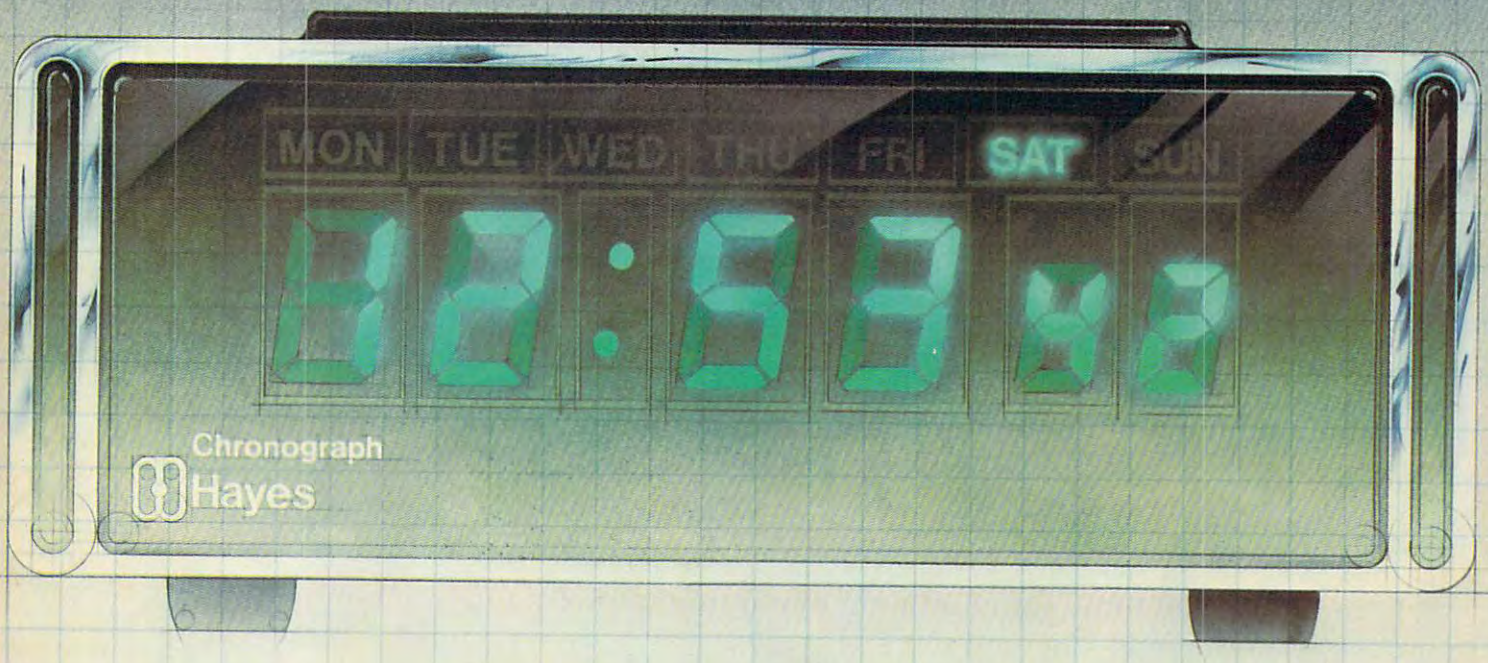

Hayes Microcomputer Products, Inc. 5835 Peachtree Corners East, Norcross, Georgia 30092 404/449-8791

modore, you see, has the right to produce all Bally arcade games for the new VIC-20.

We're confident the courts would not allow a TV producer to claim proprietary rights to "soap operas," police shows, or westerns. Let's hope the situation that's just now shaping up in the computer gaming industry will avoid the same undue constraints, while protecting the rights of all.

An Apology, And A New Year

Our 1982 production schedule is finalized and, as you should discover with this issue, we're back on schedule. You should be receiving your magazine around the first of the cover date month (or perhaps a bit earlier). That's the way we want it. Never quite wishing to bow to the needs of newsstand distribution overseas, we don't see much point in sending you the February issue in December. We'll stay on this schedule now, our production department is rolling along, and **COMPUTE!** grows on. And, oh yes, the next time we schedule publication of a book, we'll know whereof we speak when we calculate our production time! Thanks for your patience.

Best wishes for a happy and productive New Year from all of us at **COMPUTE!** ©

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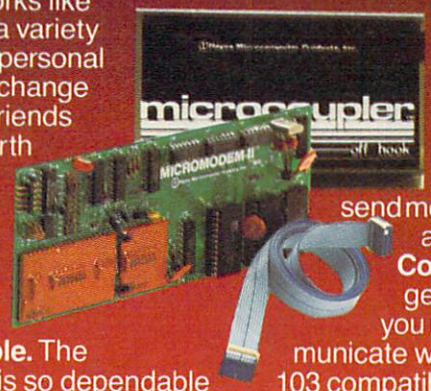

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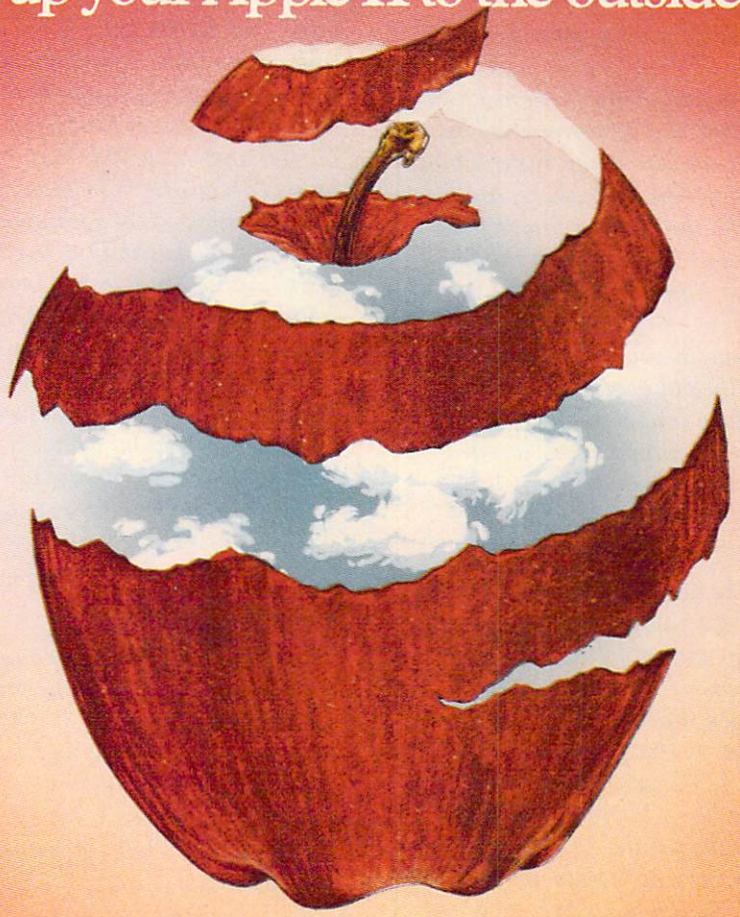

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Ask The Readers

Robert Lock, Richard Mansfield And Readers

If you have any questions (or answers to the questions printed below) please write to: Ask The Readers, **COMPUTE!** Magazine, P.O. Box 5406, Greensboro, NC 27403.

Answers

"There is a small design flaw in the way that Commodore BASIC chains between programs. The flaw is small, but will result in certain strings disappearing (and being replaced by a string of BASIC tokens).

Strings defined in a program as a constant (i.e. A$ = "Hello") are not allocated space in RAM. The pointer to that string points back into the program to the line containing the literal. This is normally fine, but when the program chains into another program, the string pointers now point to some piece of your new program. Now what?

The solution is to not use any strings assigned as a constant. The assignment above should be replaced by A$ = "Hello" + " ". The null concatenation insures that BASIC will copy the string to RAM somewhere, and it will still exist after chaining to the next routine. Please note that DATA statements count as constants in this context. Use READ A$:A$ = A$ + " " to copy the string to upper RAM.

This is all wasteful if you do not chain to other routines, or if you don't use the old variables in the new routine, but be careful. Certain tokens (like RETURN) will redefine the character set or window size, a real problem if you don't realize why it happened."

Michael Schaffer

---

*"I would like to respond to the question raised in "Ask The Readers," **COMPUTE!** #16, regarding the future of the 6502. I keep hoping some manufacturer will do a 16 bit version of the 6502 ... as good as the 6809 seems to be, it is still a traumatic switch for those who have cut their teeth on the 6502, to say nothing of the software and hardware investment in the 6502 machines. To me, this shift to the 6809 seems more like a lateral — rather than a forward-looking move for the future.*

If I must switch, my choice would be to opt for a 16 bit machine such as the 68000. Then my present 6502 unit would become a smart terminal to access the power of the 16 bit unit. In the interim, maybe some clever and enterprising reader will create a dual (parallel operation?) 6502 machine to emulate 16 bit operation.

*I believe that if there must be a change (and there will be, as progress demands) then **COMPUTE!** magazine will demonstrate immeasurable foresight by choosing to lead the way into the 16 bit personal computer world.*

Dr. Charles DeSantis

"I have been following the discussions about 'software piracy' in various publications and I am quite impressed with the arguments about 'protection' vs. 'backupability.' I'm in favor of the backupists in general. As the King of Siam is reputed to have said, 'Is a puzzlement!'

I kind of hate to do this, but all of the discussion so far has left out one other *part of the problem. I have a PET 2001 with Upgrade ROM. There is a lot of good software out there for the Apple, Atari, and others that I can't just LOAD and RUN. Say I have a friend with an Apple. He bought a $200 program that I covet. If I convert it to PET and use it, I'm a pirate? I certainly won't buy it unconverted and, after all that work, I'm in no mood to pay the producer... After all,* he *ignored me! I don't know the answer to this searing, burning question either, but I thought I could stir the pot with it.*

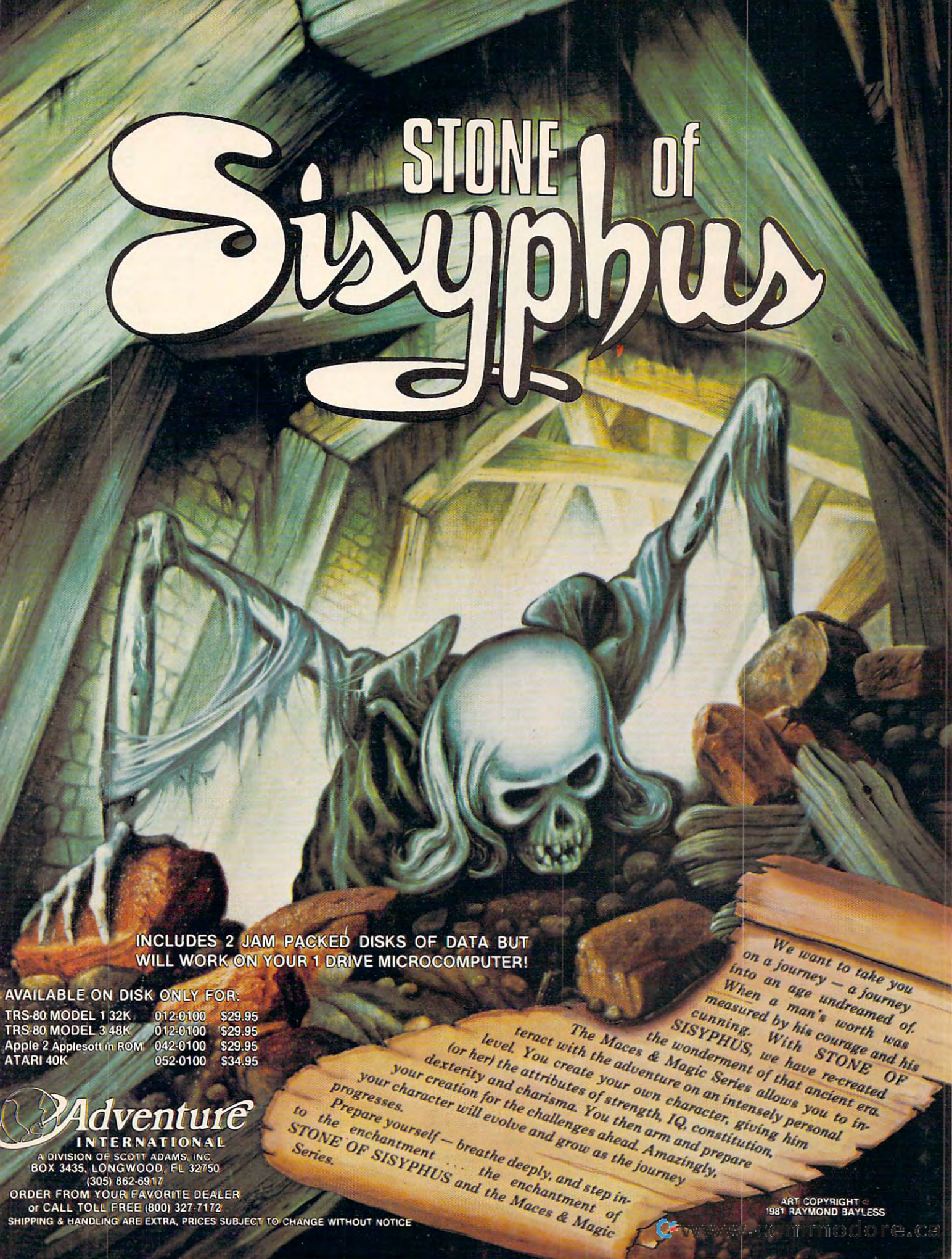
I'm looking forward to the articles about the 2.1 and 2.5 DOS. Let me throw in one thing that I've learned the hard way. COPYD0 TO D1 doesn't work in DOS 2.5 unless both disks have the same *ID! During the copy sequence, if the next source program is cataloged on a different Directory block, you get DISK ID ERROR. In partial answer to M.J. Band, the U3 through U9 commands access RAM locations where you can put disk control programs of your own. If you knew the disk environment. The possibilities are fascinating! For instance, a* sort *routine could be put in there which would presort the output of your file while the PET did other work. Or maybe one that would recognize only CHR$(13) as a delimiter so you wouldn't have to use all those GETs to recover ordinary text with commas in it. (Make that delimiter an option, I have a program that doesn't put RETURNS at the end of a line, just CHR$(29)s at the beginning. It's in ROM, I can't fix it.)"*

R. Vanderbilt Foster

Questions

"I had read that you may double your disk's holding capacity by cutting out the proper notches on the backside of your disk's envelope. So, I grabbed my Wabash single density disks, a scissor and went snipping away. Several problems arose after trying to use the backsides on my Atari 810 disk drive. First I received many 144 errors (device done) while formatting the disk under DOS 2.0S, but successful (I thought) under DOS 1. My second problem occurred when I failed to be able to copy any files to disk. I had the speed and head pressure adjusted but still no luck."

Thomas M. Krischan



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Although it is possible, in theory, to record on both sides of ordinary disks, it is not a good idea. Some disks are designed to be "double-sided" and provisions are made to thicken and strengthen the disk so that the recordings on each side will not interfere with one another. "Print-through," where the information being magnetized on one side also appears on the second side, can obviously play havoc with whatever was already on the second side.

In addition, disk surfaces are so delicate that a single cigarette ash, floating onto the disk, can render it useless. This would suggest that cutting holes in the outer envelope might deform the surface, or worse. One final drawback: attached to the inner surface of the envelope is a soft, textured fabric designed to trap any stray particles and keep them off the disk surface. Using the opposite disk side causes it to spin in the opposite direction, dislodging and redepositing any foreign matter back onto the surface.

"This is first and foremost a great big thank you letter. Thank you for existing so that numbskulls like me have a place to turn to in their ignorance.

Last winter I wrote another computer magazine a letter deploring the dearth of PET material in their columns. Almost as soon as the issue with my letter in it hit the post-boxes, I was inundated by letters from helpful guys (especially Jim Butterfield) who turned me on to you all. Thank goodness! Wish I had the time to thank each of them individually.

One big cloud still hangs over my head though. Why does everybody have to be so much smarter than I? Acronyms fly all over the place in everything I read. And a body would think that you all were more at home inside your PET than you are in your own living rooms. When I open up my 2001, I'm lucky if I can tell back from front! Is there any way short of becoming an electronics wizard for us above referenced numbskulls to get to know what you all are talking so glibly about? Tell me please, how do I get to address $A000 from here?

A kind word which you may wish to pass on to your advertisers is this: If you want us numbskulls to buy your products, stop writing your ads in shorthand!"

J. Paul Morris

We strive to provide articles and programs which are clearly written and easily utilized by all readers. Nevertheless, computer terms are confusing and new ones are added every year. One solution is to buy a dictionary of microcomputer terms — most bookstores carry several. From time to time, we reprint glossaries and we include a number of articles each month which are, essentially, tutorial. Also, "The Beginner's Page" explores a different subject each month (this month it's *loops*) with extensive definitions of terms and example programs. Finally, "Ask The Readers" itself has become a popular forum for the exchange of information.

"How can you get access to all 48K of memory in a 48K Atari? Is it possible to write a self-booting program (somehow) which doesn't need to use a cartridge at all? Or is there a way to remove the cartridge while in DOS, load the object code in binary form, and execute it directly?"

Rick Grosckiewicz

When you remove the cartridge from a 48K Atari, the top 8K is accessible as RAM, but without a programming language, how do you use it? You can use 6502 "machine language" in which programs can be written to "boot" (automatically load) in when the computer is turned on. They can be in the form of a cassette boot (see "SHOOT," **COMPUTE!** #16) or with DOS as an AUTORUN.SYS file. Commercial software such as Microsoft BASIC, Visicalc, or BASIC A + all can use this extra RAM. There is more information on this in the DOS Manuals and in **COMPUTE!**'s Atari Gazette.

"I would like to know where I can get a list of furniture manufacturers who make desks to house my Atari 800 and peripherals."

Robert Fersch ©

Computers And Society

David D. Thornburg
Innovision
Los Altos, CA

Further Ramblings On The Mind ...

When I first started reading Douglas Hofstadter's book, *Goedel, Escher and Bach*, I thought I would be lucky to finish reading it by 1990. While the book is fascinating and I pick it up from time to time, I have had to set it aside for more pressing matters. It was thus with some trepidation that I bought a copy of *The Mind's I*, a recently published book (Basic Books) by Douglas Hofstadter and Daniel Dennett.

Hofstadter's field is artificial intelligence, and Dennett's is philosophy. Dennett recently published a collection of his essays on epistemology (*Brainstorms, Philosophical Essays on Mind and Psychology*, MIT Press). It appeared that these two powerhouse thinkers decided to collaborate on a book which covered an area of immense interest to each of them — the nature of the mind.

At first glance, *Mind's I* appears to be a collection of articles from various sources, each of which deals with one perspective on the concept of the mind. Hofstadter's and Dennett's notes after each article provide a cohesive framework which helps the book hang together. For example, Alan Turing's landmark article "Computing Machinery and Intelligence," in which the famous Turing test is described, is followed by "The Turing Test: A Coffeehouse Conversation," an article Hofstadter first published in *Scientific American*.

The Turing Test

Turing's test, in its simplest form, has an experimenter sitting at two terminals — one of which is connected to a computer and the other of which is connected to a similar terminal manned by another human being. The experimenter is free to direct questions through each terminal and is supposed to deduce, from the responses, which terminal is connected to the computer. Turing suggested that if the experimenter is not able to do this reliably, then we can say that the computer is, in fact, thinking.

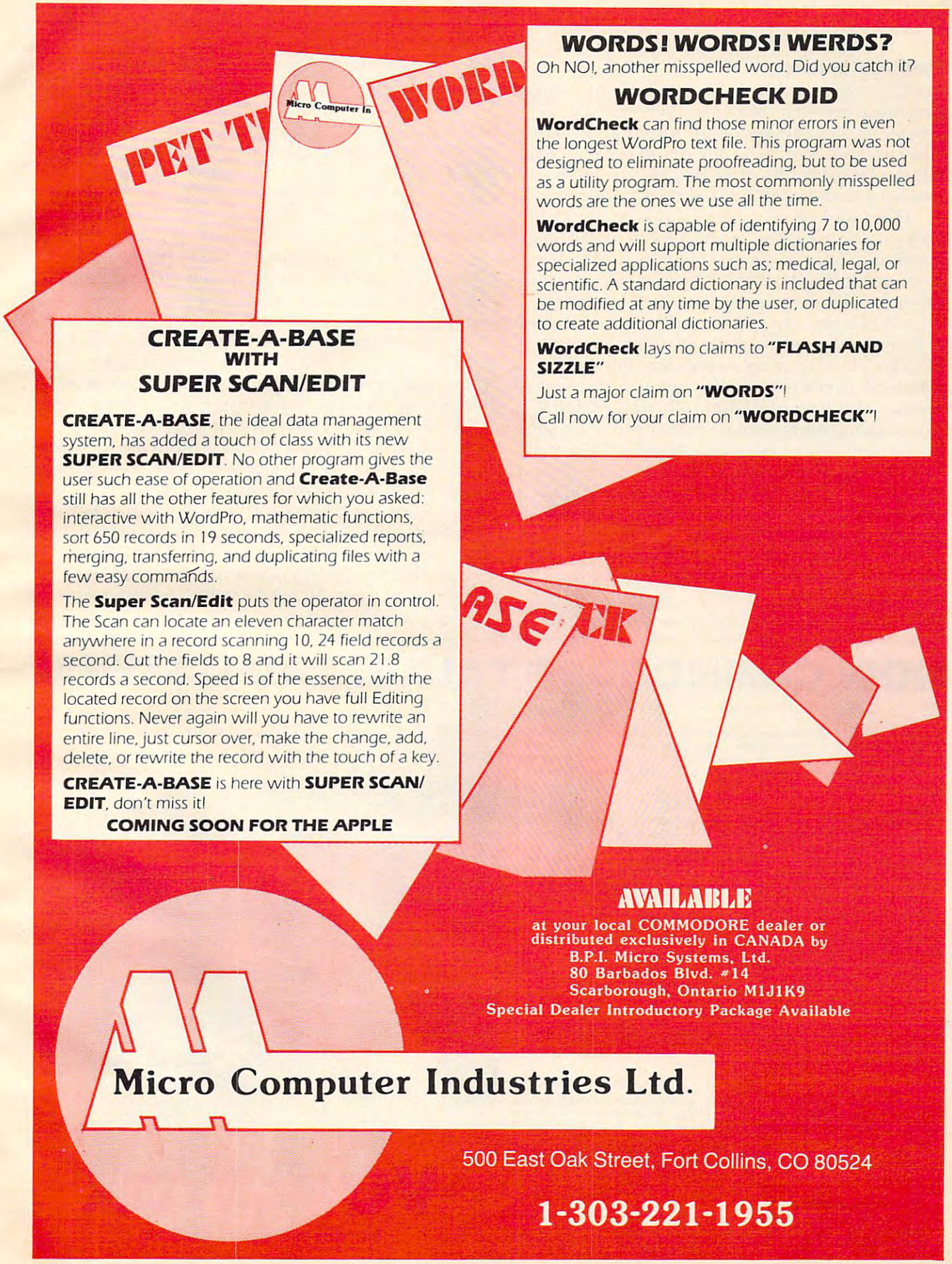
... he concentrates in the idea that the mind is an intentional system ...

In Hofstadter's article, the issue is raised as to whether a good simulation of thinking is the same thing as thinking itself. This theme recurrs several times in the book and is not easily answered.

The collection of articles in this book cover the concept of the mind from a multitude of approaches. Hofstadter and Dennett provide a balanced picture. The strict reductionist view of life and mind resulting from a seething molecular soup in which small units, accidentally formed, are subjected to fierce competition for resources with which to replicate, is presented by an excerpt from Richard Dawkin's book, *The Selfish Gene*. A more mysterious quality for the mind is suggested by Harold Morowitz's article "Rediscovering the Mind" which first appeared in *Psychology Today*. One cannot help but be struck by the tremendous diversity of opinion expressed in this book. There is something to please and infuriate any reader, regardless of his or her philosophical leanings.

The function of this book is less to present a particular view than to raise the level of conversation about the topic. After all, it is senseless to ask if machines can think when we have yet to agree on just what thinking or consciousness is.

Dennett's book, *Brainstorms*, has a different goal. The collection of essays in this book are designed to elucidate Dennett's own philosophical view of the mind — a view which is aided by the experimental evidence being accumulated in many fields. His theory differs from other models in important ways. The physical model of the mind, for example, implies that when two creatures have the same thought in common (e.g., the belief that snow is white), then they have something physical in common too (their brains are in the same physical state). This is extremely unlikely, as Dennett points out.



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Intentional Systems

His theory does not deny the possibility of a correspondence between mental and physical states. Instead he concentrates on the idea that the mind is an *intentional* system — one whose behaviour can, at least sometimes, be explained and predicted by treating it as though it had beliefs and desires.

If one looks only at external views of the system, it is logical to ask if this model applies to machines as well as to human minds. Consider a computer programmed to play chess. One can examine this system from three perspectives. By taking the *design stance*, one can predict the game's behavior by knowing the details of the computer and its program. As long as the system behaves as programmed, predictions made from this analysis will be true. This stance is most useful when dealing with simple systems (strike a match and it will light). The *physical stance* bases predictions on the actual physical state of the system, and then uses the laws of nature to predict what will happen next. This approach is most difficult to apply to a machine as complex as a digital computer.

Chess playing computers are practically inaccessible to prediction from either the design or physical stance. Even their own designers would have a hard time describing these machine's behavior from the design stance. The best strategy for someone playing against such a machine is to treat it as if it followed the rules and goals of chess. One assumes that the computer will both function as designed and that it will "choose" the most optimal move.

This attribution of rationality to the system is the cornerstone of the *intentional stance*. One predicts behavior in such systems by assuming them to possess certain information and to be directed by certain goals. This ascription of *beliefs* and *desires* to machines appears to suggest that machines are capable of "thought."

The aspect of Dennett's argument which I find most appealing is its reluctance to tackle thought on a microscopic scale. As long as he is able to deduce the characteristics of a system from its behavior, he is unlikely to get much criticism from any of us who feel that it is nonsense to suggest that machines are capable of what we, as humans, would call consciousness or thought.

Both *The Mind's I* and *Brainstorms* are fascinating books. You should approach them cautiously — they are not light reading. You might decide that the real issue is not whether machines are capable of thought, but just what constitutes thought in the first place. ©

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*Data Source: Epson MX-800 Operation Manual

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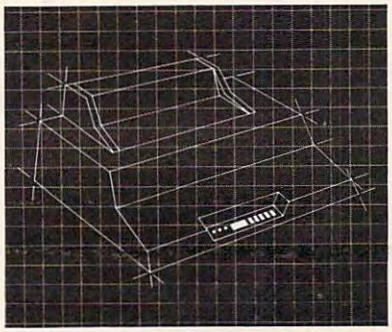

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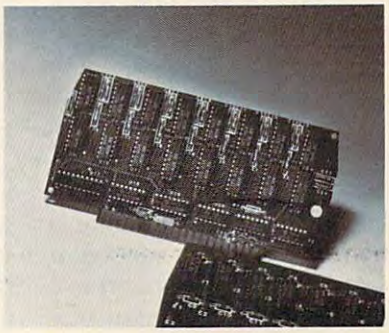

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The Beginner's Page

Loops

Richard Mansfield
Assistant Editor

You'll hear the term *algorithm* from time to time. It merely means a *procedure*, a way of getting something done. For example, let's assume that your programming becomes so impressive that you decide to start a software business. You want to generate a list of possible names for your new venture and then pick out the best one. You could make a list yourself, but you are a programmer and you have a computer which could make your list in a jiffy. All you need to figure out is the algorithm: the steps your computer needs to follow to create the list. Most algorithms, especially for jobs involving lists, use loops.

First put all your favorite words about software into a table of DATA statements. This will give the computer something from which to make its list. Then, you use a *nested loop* to combine the data in all possible ways.

Loop Forms

The *loop* is one of the primary ways that a computer does its work: FOR I=1 TO 10. (Do something. Print the variable *I*, for example). NEXT I. This structure means: as long as *I* is still between 1 and 10, print *I* on the screen. Raise the value of *I* by one (NEXT I) and *loop* (jump back to the FOR statement which will check to see if *I* is still within bounds). We, ourselves, loop every day (and we ask others to loop for us), but we don't think of it as looping. If you were about to make a list (by hand), you might start off by taking a sheet of paper and writing down the numbers 1. 2. 3. etc. along one side. This is precisely the loop in our example above.

Another common loop form is "please find me the map; it's in that pile." (FOR I=1 TO 50: IF X$(I)="MAP" THEN PRINT "HERE IT IS.": NEXT I) Of course, when you use the "IF" structure, you cannot put NEXT I on the same line. If you did, the NEXT part would *only* loop IF X$(I)="MAP." Anything following IF is governed by that IF and will not be carried out unless the IF comes true.

"Will you please wait two seconds before telling me your name?" (FOR I=1 TO 2000: NEXT I: PRINT "MY NAME IS COMPUTER.") This is called a *delay loop* because the computer does nothing between the FOR and the NEXT. It just waits until it counts to 2000 which takes about two seconds.

Nesting

If you put a loop within a loop, the inner one is called a *nested loop*. "Ask all six people in this room what their three favorite foods are." (FOR I=1 TO 6: FOR J=1 TO 3: PRINT "WHAT'S A FAVORITE FOOD OF YOURS?": NEXT J: NEXT I) It's easiest to grasp nested loops by working from the inner loop out. The *J* loop is asking the question three times before it transfers the control back to its master loop *I*. The total number of loopings (*iterations* is the technical term) will be 18 (*I's iterations multiplied by J's*).

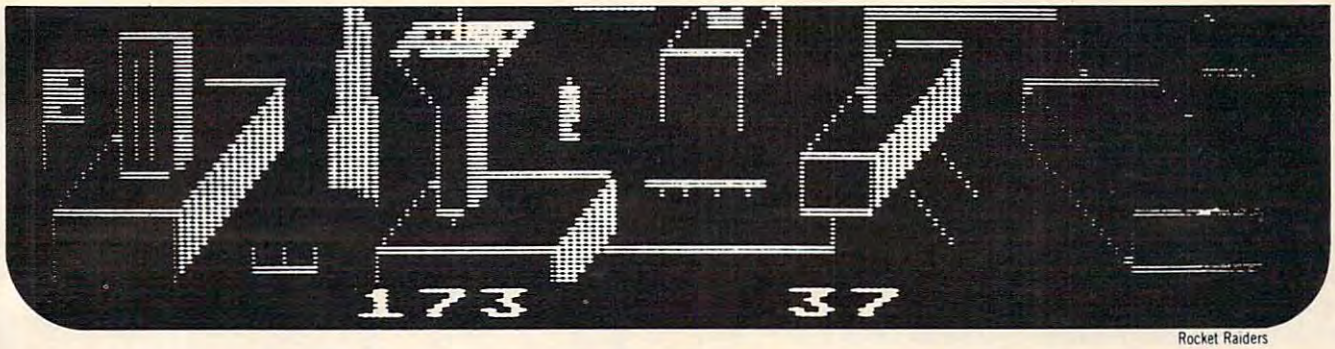
Why do we use *I* for our counting variables in loops? It's just conventional. It must have once meant *increments* or *iterations* or *index*, but that hardly matters. It is convenient because you can then remember never to use *I* elsewhere in your programs for other variables — *I* is always your master loop variable. Then, logically, it is common practice to use *J* for a nested loop within the *I* loop. Also, for timing delay loops, it is a good habit to reserve the variable *T* as we did above. *T*, of course, stands for Time. It is not used anywhere else in programs (for the same reasons).

Picking A Company Name

Our algorithm for listing possible company names is a nested loop. We picked eight adjectives we liked and came up with seven nouns. This means we have two lists which we want to combine into one list. We put the adjectives and nouns into their own separate DATA lines and READ them into two *arrays*. An array is a table or list — a grouping of items which are somehow related to each other so we want them stored together under the same name. In this case we set up two *string arrays:* ADJECTIVE$ #1 through #8 and NOUN$ #1 through #7. The loop in line 120 hangs unique tags on each word in the DATA statement as it reads and memorizes each item. For example, when it READs "super" it tags it with the variable name ADJECTIVE$(2). If you finished RUNning the program and directly asked the computer ? ADJECTIVE$(5) it would print "QUALITY." For information on string arrays on the Atari see **COMPUTE!** #11 pg. 103 and **COMPUTE!** #16 pg. 36.

Knowing that putting a noun before an adjective usually results in nonsense (apple red) we decided to refine our list of potential names for our company by only permitting adjectives to modify nouns. This means we want to list a noun and go through all eight possible adjectives for it before listing the next noun. This is very like asking six people to name three favorite foods.

The nesting is in lines 140 to 180. Notice that



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☐ **INTRUDER ALERT!** by Dennis Zander (Atari, 16K)
This is a fast paced action game in which you must escape from the "Dreadstar" with the secret plans. The droids are after you and you must find and enter your ship in order to escape. If you fail, the rebellion is doomed. **PRICE** ..... **$16.95** cassette **$20.95** diskette

☐ **THE RINGS OF THE EMPIRE:** by Dennis Zander (Atari 16K)
The Empire has developed a series of battle stations protected by one or more rings of energy. You must destroy these weapons by attacking them in your Y-wing fighter armed with Zydon torpedoes. Each time you blast through the rings and destroy the station, the Empire develops a new station with more protective rings.
PRICE ..... **$16.95** cassette **$20.95** diskette

☐ **FOREST FIRE!:** by Richard Petersen (Atari,24K)
Using excellent color graphics, your Atari is turned into a fire scanner to help you direct operations to contain a forest fire. You must compensate for changes in wind, weather and terrain. Not protecting valuable property can result in startling penalties. Life-like variables make FOREST FIRE a very suspenseful and challenging simulation. **PRICE** ..... **$16.95** cassette **$20.95** diskette

☐ **PILOT:** by Michael Piro (Atari, 16K)
Pilot your small airplane to a successful landing using both joysticks to control throttle and attack angle. PILOT produces a true perspective rendition of the runway, which is constantly changing. Select from two levels of pilot proficiency.
PRICE ..... **$16.95** cassette **$20.95** diskette

☐ **ALPHA FIGHTER:** by Douglas McFarland (Atari, 16K)
Consisting of two different programs, ALPHA FIGHTER requires you to destroy the alien starships. As you become more successful, the games get harder and and harder. **PRICE** ..... **$14.95** cassette **$18.95** diskette

☐ **GIANT SLALOM:** by Dennis Zander (Atari, 16K)
Bring the Winter Olympics to your computer anytime of the year! Use the joystick to guide your skier's path down a giant slalom course consisting of open and closed gates. Choose from three levels of difficulty. Take practice runs or compete against from two to eight additional skiers.
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☐ **HODGE PODGE:** by Marsha Meredith (Apple 48K, Applesoft or Integer BASIC)
This captivating program is a marvelous learning device for children from 18 months to 6 years. HODGE PODGE consists of many cartoons, animations and songs which appear when any key on the computer is depressed. A must for any family containing young children and an Apple.
PRICE ..... **$19.95** diskette

☐ **STUD POKER:** by Jerry White (Atari, 16K)
This is the classic gambler's card game. You will find the computer to be a worthy opponent who occasionally bluffs but never cheats! STUD POKER employs all of the Atari's sound, color and graphics capabilities.
PRICE ..... **$14.95** Cassette **$18.95** diskette

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TEACHER'S PET (Atari,24K; North Star) **$16.95/ $20.95**
BRIDGE 2.0 (Atari, 24K; North Star) **$19.95 / $23.95**
NOMINOES JIGSAW (Atari, 24K) ..... **$17.95 / $21.95**
Please specify "TNT" version when ordering programs.

☐ **CRANSTON MANOR ADVENTURE:** by Larry Ledden (Atari, North Star and CP/M)
You must enter mysterious Cranston Manor and attempt to collect its many treasures. This extemely challenging program will provide you with many hours (days?) of adventure. The program may be interrupted at will and your status saved onto the diskette.
PRICE ..... **$21.95** diskette

☐ **BLOCKADE:** by Edward Schneider (Atari, 16K)
Every games library needs Blockade program, and this is one of the best. Choose from three levels of difficulty and play against another person or by yourself against the clock.
PRICE ..... **$14.95** cassette **$18.95** diskette

☐ **TEACHER'S PET:** by Arthur Walsh (Atari, Apple, TRS-80, PET, North Star and CP/M (MBASIC) systems).
This is an introduction to computers as well as a learning tool for the young computerist (ages 3-7). The program provides counting practice, letter-word recognition and three levels of math skills.
PRICE ..... **$14.95** cassette **$18.95** diskette

☐ **FORM LETTER SYSTEM:** (Atari, North Star and Apple)
This is the ideal program for creating personalized form letters! FLS employs a simple-to-use text editor for producing fully justified letters. Addresses are stored in a separate file and are automatically inserted into your form letter along with a personalized salutation. Both letter files and address files are compatible with **ARTWORX** MAIL LIST 3.0 and TEXT EDITOR programs.
PRICE ..... **$39.95** diskette

☐ **TEXT EDITOR:** (Atari and North Star)
This program is very "user friendly" yet employs all essential features needed for serious text editing with minimal memory requirements. Features include common sense operation, two different justification techniques, automatic line centering and straightforward text merging and manipulation. TEXT EDITOR files are compatible with **ARTWORX** FORM LETTER SYSTEM.
PRICE ..... **$39.95** diskette

☐ **MAIL LIST 3.0:** (Atari, Apple and North Star)
The very popular MAIL LIST 2.2 has now been upgraded. Version 3.0 offers enhanced editing capabilities to complement the many other features which have made this program so popular. MAIL LIST is unique in its ability to store a maximum number of addresses on one diskette (typically between 1200 and 2500 names!). Entries can be retrieved by name, keyword(s) or by zip codes. They can be written to a printer or to another file for complete file management. The program produces 1, 2 or 3-up address labels and will sort by zip code (5 or 9 digits) or alphabetically (by last name). Files are easily merged and MAIL LIST will even find and delete duplicate entries! The address files created with MAIL LIST are completely compatible with **ARTWORX** FORM LETTER SYSTEM.
PRICE ..... **$49.95** diskette

☐ **THE VAULTS OF ZURICH:** by Felix and Ted Herlihy (Atari, 24K, PET)
Zurich is the banking capital of the world. The rich and powerful deposit their wealth in its famed impregnable vaults. But you, as a master thief, have dared to undertake the boldest heist of the century. You will journey down a maze of corridors and vaults, eluding the most sophisticated security system in the world. Your goal is to reach the Chairman's Chamber to steal the most treasured possession of all: THE OPEC OIL DEEDS!
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☐ **BRIDGE 2.0** by Arthur Walsh (Atari (24K), Apple TRS-80, PET, North Star and CP/M (MBASIC) systems)
Rated #1 by Creative Computing, BRIDGE 2.0 is the only program that allows you to both bid for the contract and play out the hand (on defense or offense!). Interesting hands may be replayed using the "duplicate" bridge feature. This is certainly an ideal way to finally learn to play bridge or to get into a game when no other (human) players are available.
PRICE ..... **$17.95** cassette **$21.95** diskette

☐ **ENCOUNTER AT QUESTAR IV:** by Douglas McFarland (Atari, 24K)
As helmsman of Rikar starship, you must defend Questar Sector IV from the dreaded Zentarians. Using your plasma beam, hyperspace engines and wits to avoid Zentarian mines and death phasers, you struggle to stay alive. This BASIC/Assembly level program has super sound, full player missile graphics and real time action.
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☐ **THE NOMINOES JIGSAW PUZZLE:**
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the NEXT J will always loop back to line 150 until the FOR J condition (count up to eight) is satisfied. Then the program will execute the NEXT I.

Can we nest at even deeper levels? Sure. Typing a new line: 165 FOR T = 1 TO 2000: NEXT T will provide a short delay loop between each item as it appears on the screen. Could we see the list backwards? Change two lines: 140 FOR I = 7 TO 1 STEP -1 and: 150 FOR J = 8 TO 1 STEP -1. Every other name? 150 FOR J = 1 TO 8 STEP 2. Only names beginning with the letter *A*? 155 IF LEFT$ (ADJECTIVE$(J),1) <> "A" THEN GOTO 170. (For Atari: 165 IF ADJECTIVE$(J*20–19,J*20–19 <> "A" THEN 180)

As you can see, all kinds of choices, refinements, or modifications are possible within loops by merely changing a few instructions to the machine. The combination of loops and *branches* (lines starting with IF or ON) coupled with the computer's great speed (you try to count from one to 2000 in two seconds) is the essence of the great power of computers.

Microsoft Version

```
100 DATA SUPER,ACME,AMERICAN,RAINBO
    W,QUALITY,INTERGALACTIC,RE
    LIABLE,FOOLPROOF
110 DATA PROGRAMS,SOFTWARE,COMPUTER
    WARE,CODE,LISTINGS,INFORMA
    TION,MAGIC
120 FOR I = 1 TO 8: READ ADJECTIVE$
    (I): NEXT I
130 FOR I = 1 TO 7: READ NOUN$(I):
    NEXT I
140 FOR I = 1 TO 7
150 FOR J = 1 TO 8
160 PRINT ADJECTIVE$(J)" "NOUN$(I)
170 NEXT J
180 NEXT I
```

Atari Version

```
100 DATA SUPER,ACME,AMERICAN,RAINB
LITY,INTERGALACTIC,RELIABLE,FOOLPR
110 DATA PROGRAMS,SOFTWARE,COMPUTE
CODE,LISTINGS,INFORMATION,MAGIC
120 DIM ADJECTIVE$(8*20),NOUN$(7*2
P$(20),L1(8),L2(7)
130 FOR I=1 TO 8:READ TEMP$:ADJECT
*20-19,I*20)=TEMP$:L1(I)=LEN(TEMP$
 I
140 FOR I=1 TO 7:READ TEMP$:NOUN$(
9,I*20)=TEMP$:L2(I)=LEN(TEMP$):NEX
150 FOR I=1 TO 7
160 FOR J=1 TO 8
170 PRINT ADJECTIVE$((J-1)*20+1,(J
+L1(J));" ";NOUN$((I-1)*20+1,(I-1)
(I))
180 NEXT J
190 NEXT I
```

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INVEST

Gregory R. Glau
P.O. Box 1627
Prescott, AZ 86302

Editor's Note: Program 1 is the Microsoft version. Program 2 contains the lines which should be changed to permit "INVEST" to run on the Atari. Lines 12000-14999 are the printer routine and might need slight modifications for different printers. For the Atari, change all PRINTs to LPRINT and remove the TAB statements. — RTM

Other than having a place to live, there's only one reason to buy real estate: *to make money.*

INVEST will give you a head start if you're considering this unique investment medium. It'll show you how real estate leverage, inflation, and rent income will all add up to put real cash into your pocket: if you make the right investment decisions.

And once you find some properties to consider, INVEST will detail the benefits to you, to aid you in making that *right* decision.

You may have heard lots of stories about real estate — many are true! — about how you can buy property for little or no cash down, and then let your wonderful tenants pay for the property for you! About how the government allows a *real* tax break for real estate investors (called depreciation) which will put cold cash into your pocket come tax time. And, these days, depreciation works a double advantage for us because, while we're allowed to depreciate the property on our tax returns, the building is actually *increasing* in value every day — often as much as 15 or 20% in a year's time.

Stocks and bonds and gold and jewelry simply can't match this.

There are four areas which give you a return on your realty investment: cash flow, equity build-up, asset appreciation, and tax savings.

The whole purpose of INVEST is to let you figure, by changing the data, exactly what an investment will do for you and detail that information for all four factors (cash flow, appreciation, etc.). Then it's your job to find some properties and use INVEST to help you determine which is the best for you!

Learning The Vocabulary

Cash flow is simply what's left after you collect your rents and then make the payments, pay any expenses, etc. For instance, if your rents (for, say, a duplex you want to buy) are $500 per month, you'll have a total income of $6000 per year ($500 per month x 12 months).

If your monthly payments and expenses total $400 per month, you'll have a yearly cost of $4800 ($400 per month x 12 months). This will give you a positive cash flow of $1200 per year ($6000 collected less the $4800 spent).

Sometimes, particularly with an investment which has a low down payment, you could have a *negative* cash flow. For instance, if your payments plus expenses ran $7000 per year, you'd be $1000 in the hole at the end of the year ($6000 collected less $7000 spent equals a minus $1000). This isn't always bad, as we'll see in a moment.

Equity buildup is the second area where you get a return on your investment. As you make the payments on the property, part of the payment goes for interest, and part for principal. At the start, this interest section eats up most of the payment and, as time passes, the part devoted to principal gets larger and larger.

Note that this is not cash which you'll get as you do when you collect the rents. It's like a savings account — you'll get this part of your investment when you sell the property, because each part of your payment that goes against the principal reduces what you owe on the property.

For instance, if you bought a $100,000 fourplex with $10,000 down, you'd have to borrow $90,000. If you sold it to me tomorrow for, say, $120,000, you'd come out of the deal with a $20,000 profit, right?

However, say you held it for a year and then sold it for the same price. At the end of the year, your payments would have reduced the amount you owed on the property — the actual reduction would depend on the interest rate and length of the loan. But let's say that it, the principal, had been reduced $5,000 over the course of that year. Now, you'd end up with $25,000 (instead of the $20,000 above) — while the extra $5,000 is not profit, it does come back to you, just as if you'd put it into a savings account.

1st example:

Selling price	**$120,000**	
still owe	**– 90,000**	
down payment	**– 10,000**	
cash	**20,000**	**(all profit)**

2nd example (hold the property for a year):

selling price	**$120,000**	
still owe	**–85,000**	**remember — our payments have reduced the principal from $90,000 down to $85,000**
down payment	**–10,000**	
cash	**$ 25,000**	

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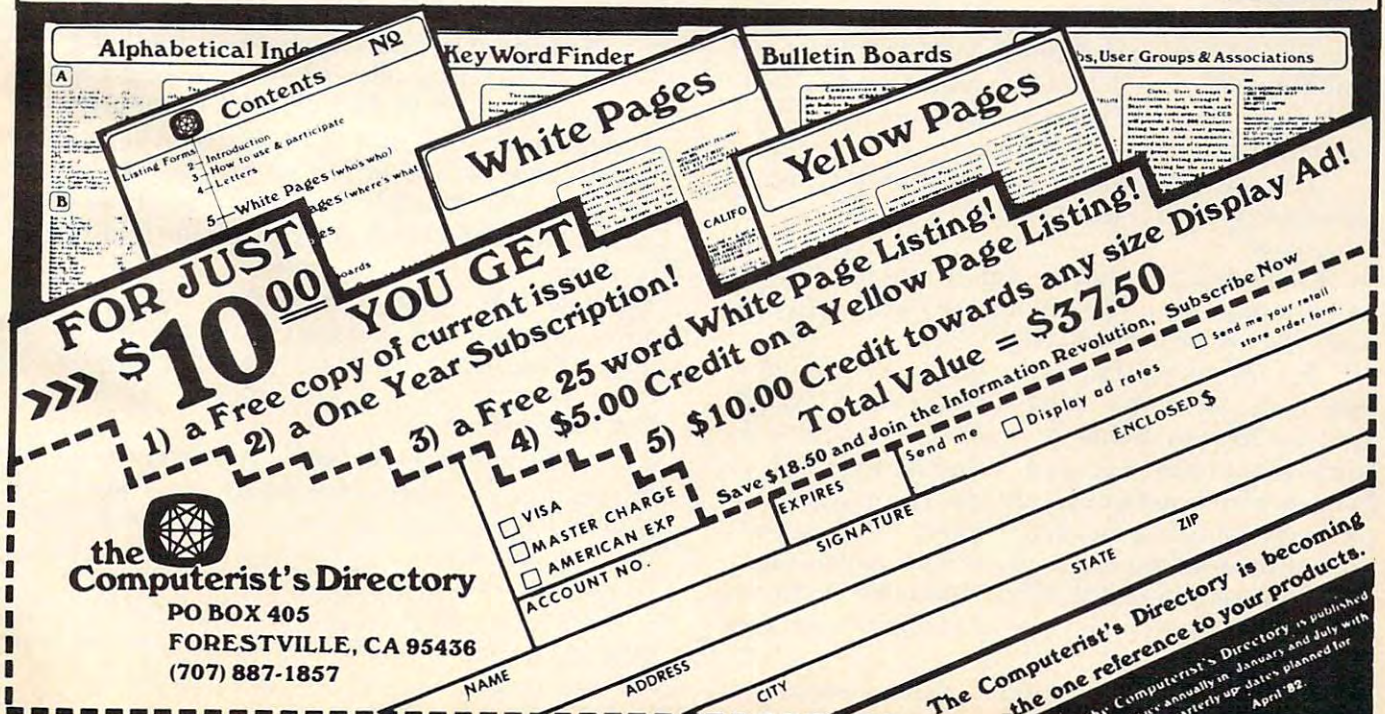

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Of this, $20,000 is your profit and $5,000 represents a return to you of your *equity* just as if you'd saved this money in a bank. And each payment you make (actually it's those wonderful tenants who make the payments for you, right?) increases the equity, your ownership, in the property.

The third way you get a return on your investment is through *asset appreciation*. This is the amount a building increases in value because of rising prices, inflation. In many cases in recent years, income property has gone up in value *faster* than the rate of inflation.

And, as you may already know, there are two types of inflation: *normal* inflation and *forced* inflation. But even if normal inflation slows down — and don't bet that it will — you can use *forced inflation* ... fixing up a property to make it rent for more, thus making it worth more.

Perhaps you could buy a property for, say, $65,000 and with some paint and carpeting and cleaning *increase* its value to $75,000. And, of course, you can always *combine* the two types of inflation, and really increase the return on your investment.

Finally, *tax savings* is the fourth method of return on a real estate investment. Tax savings stems from depreciation, the concept that everything wears out and thus, at some time in the future, it will have to be replaced. The Congress of the US has recognized this fact, particularly in regard to investment real estate, and allows the owner of such property to depreciate a part of the building and of its contents each year (just as if he took X amount of cash and put it into a bank) to help pay for the replacement cost of the building or contents.

Depreciation is based on what accountants call "useful" life, and varies on a building with its age, condition, etc. An old building might have a "useful life" of only 10 or 12 years, while a new structure might be expected to last 30 years.

The actual length for depreciation for any particular property must be determined *by your accountant*.

Obviously, the shorter the "useful life," the more depreciation you can take per year, and the more the tax savings will be.

For instance, let's picture that you bought (or want to buy) a triplex which will cost you $100,000. First, we have to deduct the value of the land — land cannot be depreciated, it doesn't wear out. Let's say that you figure, from tax records and property comparisons, that the land value is about 15% of the total purchase price. This means the land cost was $15,000 (15% of $100,000). Deducting this from the purchase price of $100,000, you now have $85,000 left.

Now, the carpeting drapes, appliances, and so on will wear out faster than the building, so you're allowed a faster rate of depreciation on these items. Again, *ask your accountant*. In INVEST, we figure that about half the value of the furnishings are in items that have a three year "useful life" for depreciation, and then about half the value is in items that would have a seven year "useful life," so we've taken them and lumped them together, and figured an average of a five year useful life.

In this example, if you have furnishings worth 5% of the value of the property, you'd have furnishings worth $5,000 (5% of $100,000).

So, you deduct the value of the furnishings ($5,000) from the net property value (after the land has been removed) of $85,000, which gives you a net building value of $80,000.

Let's further assume that your accountant tells you that this building has a "useful life" of 20 years.

Now, to figure the depreciation: you have an $80,000 building, with a life of 20 years...you simply divide the value by the years, to get a per-year amount for depreciation. $80,000 divided by 20 years equals $4,000 per year. This is the amount of depreciation per year allowed on this building.

INVEST takes things a step farther, by asking you how many months this year you'll own this property. It will then give you two displays and printouts — one for this year, the number of months you'll own the property, and then for next year, which is figured at a full twelve months. Obviously, if you're buying the building in June, you wouldn't own it for a full year, so INVEST automatically will calculate the exact depreciation (and tax savings) for the part of the year you'll actually own the property.

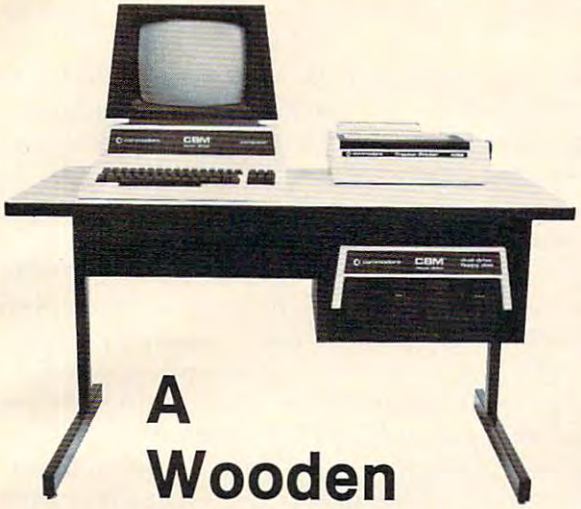
Added to the building depreciation is the depreciation you're allowed on its contents. Remember that we had $5,000 worth of carpeting, drapes, appliances, and so on. We're using an "average useful life" of five years, so we divide the amount of $5,000 by five years, for an allowable depreciation of $1,000 per year on the building's contents.

Total depreciation, then, is the building depreciation of $4,000 per year plus the contents depreciation of $1,000 ... for a total of $5,000 per year.

The Tax Savings

This is the amount you can deduct from your income tax. To figure your tax savings (how much *less* you'll have to pay in taxes, or how much *cash* they'll send back to you), multiply your tax bracket by the amount of depreciation.

For example, if you're in the 30% tax bracket, you'd save 30% of $5,000 depreciation, or $1,500 on your taxes.



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It's important to note that these savings — tax savings — return to you in the form of cash, either in a tax refund or because you will pay less in taxes than you would have had to without them, as compared to *equity buildup* and *asset appreciation*, which return to your wallet only when you sell the property.

In fact, the tax savings are often enough to offset any negative cash flow you might have from a property. So, while you might have $100 a month in negative cash flow, perhaps at the end of the year you'll get back that cash, just as if you'd saved it in a bank every month!

INVEST will show you exactly what your results will be.

So, these are the four vital areas we need to consider for any real estate investment: cash flow, equity buildup, asset appreciation, and tax savings.

"INVEST" will not only show you what each item will do, based on your own data, but will also summarize and total them, compare them to your down payment, and provide you with a return on your investment percentage.

And this, your *return on investment*, is really the important figure for any investment program. All the various parts of any investment, such as the real estate we've been examining here, are combined in this figure.

It's fascinating to see this in action, because many of us think in terms of savings accounts (perhaps 5 or 6% on our money) ... or certificates of deposit (perhaps 14%) ... or stocks (what will the market do tomorrow?) ... or limited edition prints (nice to hang on the wall, but who can we sell it to?) ... or money market accounts (10 or 12%) ... and when you see what real estate can do for you — even a small duplex or triplex — you will be astonished.

Using INVEST

Once you get a printout of a specific set of data, the program will automatically end. Up to that point — before you ask for a printout — you can alter any data any number of times, to display different results. Then, when you have the display you want, you can request a hard copy.

There's a delay at the end of page two of the instructions: while you're reading them, your computer is reading array information into its RAM. We're using three double-dimension arrays:

Q is the information used to get your monthly payment. The program will multiply the amount of your loan(s) by the proper monthly figure, to arrive at a monthly payment. You can input up to 3 loans, for 15, 20 or 25 years, and at interest rates from 10% to 18%, in .5% steps. Then "INVEST" will total the payment, display it, and let you change the amount, if you wish to. This situation might occur if you happen to be assuming an old loan, at less than 10% — you can answer 10%, and then change the payment total to match your correct figure.

E1 ... is the array with the figures for the first-year equity buildup.
E2 ... is the array for the second-year equity buildup.

Two arrays are used here because the equity buildup is different for each year — you will pay *more* on the principal of your loan during the second year than you did the first. The actual multipliers are based on the length and terms of your loan — a loan at 10% for 15 years will have a much faster and higher equity buildup than one at 16% for 25 years.

Total rents are just that — if the property you're considering is a fourplex, input total rents from *all* units.

If you don't know the actual amount of taxes and insurance, or expenses, use your best estimate.

Your accountant will know your approximate tax bracket, or you can check the tables on Form 1040, or look back at your latest tax return.

When you're asked to input payment information, you must input something — if you skip around and just put the payment amount in (without the interest rate or length of the loan), you won't get credit for any equity buildup — the computer just can't tell what equity buildup will actually be *better* than what's shown.

Following is a list of the major variables used in INVEST. There are others used mathematically, so if you change the program, please read through it to make sure you don't use something already used.

Table 1.

INVEST

Major variables:

E$	**. . . date**
A$	**. . . property address**
M1$	**. . misc. information (1)**
M2$	**. . misc. information (2)**
PR	**. . . asking/purchase price of the property**
L	**. . . . estimated life for depreciation**
A	**. . . . % estimated annual asset appreciation**
R	**. . . . current rents**
AR	**. . . anticipated rents**
M	**. . . . months of ownership this year**
T	**. . . . estimated taxes and insurance per month**
E	**. . . . estimated expenses per month**
V	**. . . . % land value (as a percent of the price)**
B	**. . . . the tax bracket you're in**
DP	**. . . down payment amount**
F	**. . . . % furnishing's value (% of the price)**
F1	**. . . first year cash flow**
F2	**. . . second year cash flow (full year)**
EB	**. . . equity buildup, first year**
ET	**. . . equity buildup, second year**
A5	**. . . asset appreciation, first year**
A6	**. . . asset appreciation, second year**

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Softlights

By Fred Huntington

More and more fantastic things are becoming available for the Apple®. We just received one of my favorites – the **Passport Designs SOUNDCHASER Computer Music System.** It's easy to set up and an absolute blast to play with.

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Figure 1: Sample Run

```
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CASH FLOW ESTIMATE, BASED ON OWNING THIS PROPERTY FOR 6 MONTHS
THE FIRST YEAR, 12 MONTHS THE SECOND YEAR.  FIRST YEAR CASH FLOW
BASED ON CURRENT RENTS OF 1200 MONTHLY, AND THE 2ND YEAR IS BASED ON
ANTICIPATED RENTS OF 1300 PER MONTH.  ESTIMATED
APPRECIATION IS 8 %.
----------------------------------
ALL FIGURES ARE APPROXIMATE
----------------------------------

                          1ST YEAR          2ND YEAR
MONTHLY RENTS             7200.00          15,600.00

MORTGAGE PAYMENTS         7338.01          14,676.01
TAXES + INSURANCE          240.00             480.00
MISC.  EXPENSES            300.00             600.00

ESTIMATED CASH FLOW       -678.01            -156.01

==========================================================================

RETURN ON INVESTMENT ANALYSIS

                                    1ST YEAR          2ND YEAR

CASH FLOW (FROM ABOVE )             -678.01            -156.01
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   AND A LIFE FOR DEPRECIATION
   OF 20 YEARS.  DEPRECIATION
   THE FIRST YEAR IS 2500 AND
   THE 2ND YEAR IS 5000
   THE FURNISHINGS ARE WORTH 5
    % OF THE PROPERTY COST.

TAX SAVINGS                          750.00            1500.00
--------------------------------------------------------------------------
YOUR RETURN ON INVESTMENT IS        4314.20            9911.85

YOUR DOWN PAYMENT WAS $ 10000
YOUR % RETURN ON INVESTMENT IS        43.14 %            99.12 %
```

Program 1.

```
4 GOSUB21000
5 GOSUB17000
7 REM PAYMENT PERCENTAGE FIGURES ~
    ARE HERE
8 REM TO GET THE MONTHLY PAYMENT,
    MULTIPLY THE
9 REM AMOUNT OF THE LOAN BY THE F
    IGURE.
```

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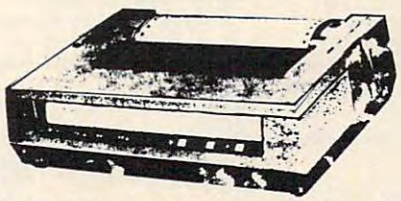

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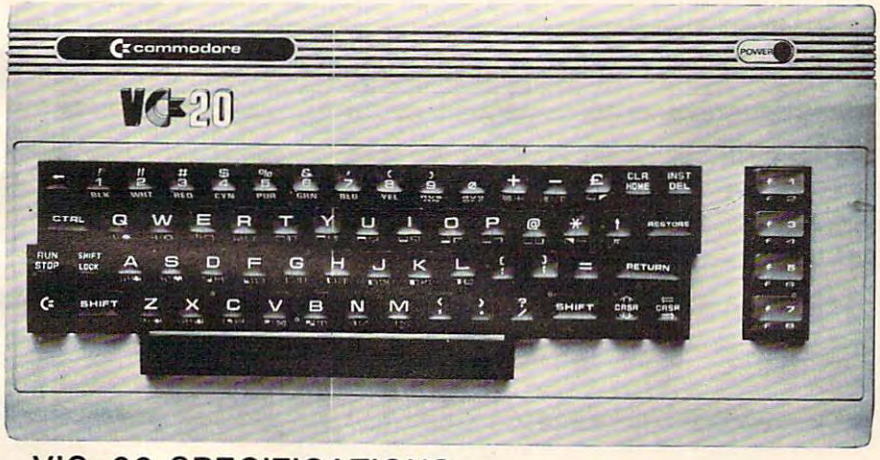

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   9.984,9.44
12 DATA 11.366,10.3219,9.8013
13 DATA 11.6919,10.6643,10.1647
14 DATA 12.0017,11.0109,10.5323,12
   .3253,11.3615,10.9036
16 DATA 12.6525,11.7158,11.2784,12
   .9832,12.0738,11.6565
18 DATA 13.3175,12.4383,12.0377,13
   .6551,12.8,12.4217
20 DATA 13.9959,13.1679,12.8084,14
   .34,13.5389,13.1975
22 DATA 14.6871,13.9126,13.5889,15
   .0371,14.2891,13.9825
23 DATA 15.3901,14.6681,14.378
24 DATA 15.7458,15.0495,14.7753,16
   .1043,15.4332,15.1743
30 DIM Q(18,4)
32 DIM E1(18,4)
34 DIM E2(18,4)
40 FORY=1TO17
50 FORI=1TO3
60 READQ(Y,I)
70 NEXTI
80 NEXTY
100 REM EQUITY FIRST YEAR BUILD-UP
110 DATA 30.3165,16.5472,9.4702,29.
    0169,15.5381,8.713
120 DATA 27.7628,14.5823,8.009,26.5
    522,13.6764,7.3549
130 DATA 25.3853,12.8195,6.7496,24.
    2612,12.0094,6.1886
140 DATA 23.1776,11.2426,5.6695,22.
    132,10.5195,5.1902
150 DATA 21.1306,9.8378,4.7482,20.1
    653,9.1939,4.3401
160 DATA 19.2365,8.5881,3.9648,18.3
    459,8.0195,3.6187
170 DATA 17.4898,7.4830,3.3007,16.6
    672,6.9813,3.0097
180 DATA 15.8796,6.5076,2.7419,15.1
    234,6.0639,2.4964
190 DATA 14.4001,5.6481,2.2718
200 FORY=1TO17
210 FORI=1TO3
220 READ E1(Y,I)
240 NEXTI
250 NEXTY
300 REM EQUITY BUILDUP FOR 2ND YEAR

310 DATA 33.4911,18.2799,10.4619,32
    .2146,17.2504
315 DATA 9.6733
320 DATA 30.9755,16.2697,8.9358,29.
    7719,15.3348,8.2467
330 DATA 28.6048,14.4453,7.6056,27.
    4737,13.5996,7.0081
340 DATA 26.3768,12.7945,6.4521,25.
    312,12.0309,5.9359
360 DATA 24.2863,11.3070,5.4573,23.
    2916,10.6193,5.0130
380 DATA 22.3289,9.9687,4.6022,21.4
    005,9.3547,4.2213
390 DATA 20.5028,8.7721,3.8693,19.6
    351,8.2232,3.5456
400 DATA 18.7997,7.7043,3.2462,17.9
    929,7.2145,2.9700
410 DATA 17.2170,6.7530,2.7162
420 FORY=1 TO 17
430 FORI = 1 TO 3
440 READE2(Y,I)
460 NEXTI
470 NEXTY
2000 PRINT"HIT ANY KEY TO CONTINUE..
    .";:GETL$
2004 HOME:PRINT
2005 PRINT:INVERSE:PRINT TAB(17)"INV
    EST   ":NORMAL:PR:PRINT"PL
    EASE ANSWER THE FOLLOWING
2007 PRINT
2008 INVERSE:PRINT"ANSWER 'END' TO S
    TOP NOW":NORMAL:PRINT:PRIN
    T
2010 INPUT"TODAY'S DATE";E$
2015 IFE$="END"THENPRINT"   END OF P
    ROGRAM   ":END
2020 PRINT
2030 INPUT "PROPERTY ADDRESS";A$
2032 HOME
2033 PRINT"MISC. INFORMATION IS ANY ~
    DATA THAT"
2034 PRINT"YOU'D LIKE LISTED ON THE ~
    PRINTOUT,"
2036 PRINT"PROPERTY (DUPLEX, TRIPLEX
    ), AND SO"
2037 PRINT"ON.  IF YOU DON'T WANT AN
    YTHING PRINTED"
2038 PRINT"FOR MISC. INFO, JUST HIT ~
    RETURN.":PRINT
2040 PRINT:INPUT"MISC INFO(1)";M1$
2050 INPUT"MISC INFO(2)";M2$
2060 PRINT:PRINT:INPUT"ASKING/OFFERI
    NG PRICE ";PR
2065 IFPR<1THEN2060
2070 HOME:PRINT
2072 PRINT"DEPRECIATION, THE 'WEARIN
    G-OUT' OF"
2073 PRINT"A PROPERTY, IS WHERE THE ~
    MAJOR"
2074 PRINT"TAX SAVINGS FROM A REAL E
    STATE"
2075 PRINT" INVESTMENT COME FROM.  "
    :PRINT
2076 PRINT"CONSULT WITH YOUR ACCOUNT
    ANT -- ";:INVERSE:PRINT"PL
    EASE";:NORMAL
2077 PRINT" AS TO THE USEFUL LIFE OF
     THIS"
2078 PRINT" PROPERTY.  NATURALLY, TH
    E SHORTER"
2079 PRINT" THE BETTER. AS THE SHORT
    ER PERIOD WILL SAVE MORE I
```

```
    N TAXES.":PRINT
2080 PRINT" YOU MIGHT ALSO WANT TO C
    HANGE THE BASIS FOR THE DE
    PRECIATION"
2081 PRINT" IN THIS PROGRAM.":PRINT:
    PRINT"TO SEE WHAT THE DIFF
    ERENCE IS IN"
2082 PRINT" TAX SAVINGS FOR, FOR INS
    TANCE, 15 YEARS OR 20 YEAR
    S OR 25 YEARS, ETC."
2083 INPUT "ESTIMATED LIFE FOR DEPRE
    CIATION IN YEARS ";L:PRINT

2084 IFL < 1 THEN 2070
2085 HOME:PRINT
2086 PRINT"APPRECIATION IS WHAT INFL
    ATION WILL":PRINT"DO TO A ~
    PROPERTY.  IF YOU THINK
2087 PRINT" THIS MIGHT GO UP IN VALU
    E 10% PER YEAR, ANSWER 10.
      YOU'LL HAVE THE
2088 PRINT" CHANCE TO CHANGE THIS AN
    SWER LATER ON, SO YOU'LL B
    E ABLE TO SEE WHAT
2089 PRINT" DIFFERENT INFLATION RATE
    S WILL DO TO YOUR RETURN."
    :PRINT
2090 INPUT "ESTIMATED APPRECIATION P
    ER YEAR ";A
2091 HOME:PRINT
2092 INPUT"CURRENT TOTAL RENTS PER M
    ONTH ";R
2093 HOME:PRINT
2100 INPUT"ANTICIPATED TOTAL RENTS P
    ER MONTH ";AR
2102 HOME:PRINT
2108 PRINT
2110 PRINT"HOW MANY MONTHS WILL YOU ~
    OWN THIS"
2115 PRINT"PROPERTY THIS YEAR ? ";M
2116 IF M > 12 THEN 2108
2117 IF M < 0 THEN 2108
2118 PRINT:PRINT
2120 INPUT"TAXES + INSURANCE PER MON
    TH ";T
2130 PRINT
2140 INPUT "ESTIMATED EXPENSES PER M
    ONTH ";E
2141 PRINT:PRINT:PRINT"YOU CAN'T DEP
    RECIATE THE LAND, SO":PRIN
    T"THE VALUE OF THE LAND HA
    S TO BE
2142 PRINT"DEDUCTED FROM THE TOTAL P
    RICE, BEFORE
2143 PRINT"THE DEPRECIATION CAN BE C
    ALCULATED.":PRINT
2144 PRINT"AS A PERCENT OF THE TOTAL
     PRICE":PRINT"(10%=10...15
    %=15, ETC.)";:INPUT V
2145 V5=V:V5=INT(V5*10^2+.5)/100
2147 HOME:PRINT
2150 INPUT "%TAX BRACKET YOU'RE IN (
    30%=30) ";B
2155 IF B<0 THEN 2147
2156 IF B>100 THEN 2147
2161 PRINT:PRINT"(YOUR DOWN PAYMENT ~
    MUST BE AT LEAST":PRINT"$1
    --FOR MATH PURPOSES":PRINT

2162 PRINT:INPUT"DOWN PAYMENT";DP
2163 IF DP<1 THEN 2161
2166 PRINT:PRINT"(20%=20  30%=30) ET
    C.)
2167 PRINT"FURNISHING AS A PERCENT O
    F THE PRICE":INPUT F
2168 IF F>100 THEN 2167
2169 IF F<0 THEN 2167
2170 PRINT
2185 F=INT(F*10^2+.5)
2190 GOSUB6000
2195 GOSUB5000:REM  INPUT PAYMENT DA
    TA
2200 HOME:PRINT
2210 PRINT "TOTAL MONTHLY PAYMENT ";

2215 FOR C=1 TO 3
2220 P(9)=P(9)+P(C)
2230 NEXT C
2240 Z9=P(9):GOSUB 15000
2250 PRINT Z9$
2280 PRINT
2290 INPUT "DO YOU WANT TO CHANGE TH
    IS <1=YES>";Q
2300 IF Q=1 THEN 2400
2310 GOTO 2420
2400 REM CORRECT PAYMENT AMOUNT
2410 PRINT:INPUT "CORRECT PAYMENT TO
    TAL ";P(9)
2420 GOSUB7000
2430 GOTO9000:REM PRINT
3032 HOME:PRINT
5000 HOME:PRINT:PRINT"NOW WE HAVE TO
     FIGURE YOUR"
5001 PRINT"MONTHLY PAYMENT FOR THIS ~
    PROPERTY.":PRINT:PRINT"YOU
     CAN INPUT UP TO 3 PAYMENT
    S":PRINT
5002 P(8)=0:P(3)=0
5003 PRINT"IF YOUR PAYMENT DATA IS D
    IFFERENT":PRINT"THAT WHAT ~
    IS ASKED FOR, ANSWER
5004 PRINT"AS CLOSELY AS YOU CAN.":P
    RINT
5005 PRINT:INVERSE:PRINT"YOU MUST IN
    PUT SOMETHING"
5006 PRINT"--EVEN IF YOU CHANGE IT L
    ATER ON"
5007 NORMAL:PRINT
5010 PRINT:PRINT:PRINT"ANSWER 1 TO C
    ONTINUE...
5015 PRINT"ANSWER 2 WHEN DONE....."
5020 PRINT:INPUT Q
```

```
5030 IF Q=1 THEN 5200
5040 IF Q=2 THEN 5500:REM RETURN
5050 GOTO 5007
5200 REM TO ZERO OUT ALL PRIOR PAYME
    NT DATA
5210 C=C+1:REM COUNTER
5250 INPUT "YEARS (15-20-25)";Y(C)
5260 IF Y(C)=15 THEN I=1:GOTO 5300
5270 IF Y(C)=20 THEN I=2:GOTO 5300
5280 IF Y(C)=25 THEN I=3:GOTO 5300
5285 GOTO 5250
5300 PRINT:PRINT"YOUR RATE CAN BE FR
    OM 10 TO 18"
5305 PRINT"IN .5 STEPS.":PRINT:PRINT

5310 INPUT "PERCENT RATE ";Q
5315 IF Q=10 THEN Y=1:GOTO 5400
5320 IF Q=10.5 THEN Y=2:GOTO 5400
5330 IF Q=11 THEN Y=3:GOTO 5400
5332 IF Q=11.5 THEN Y=4:GOTO 5400
5334 IF Q=12 THEN Y=5:GOTO 5400
5336 IF Q=12.5 THEN Y=6:GOTO 5400
5338 IF Q=13 THEN Y=7:GOTO 5400
5340 IF Q=13.5 THEN Y=8:GOTO 5400
5350 IF Q=14 THEN Y=9:GOTO 5400
5352 IF Q=14.5 THEN Y=10:GOTO 5400
5354 IF Q=15 THEN Y=11:GOTO 5400
5356 IF Q=15.5 THEN Y=12:GOTO 5400
5358 IF Q=16 THEN Y=13:GOTO 5400
5360 IF Q=16.5 THEN Y=14:GOTO 5400
5370 IF Q=17 THEN Y=15:GOTO 5400
5372 IF Q=17.5 THEN Y=16:GOTO 5400
5382 IF Q=18 THEN Y=17:GOTO 5400
5390 GOTO 5300
5400 INPUT "AMOUNT OF LOAN ";A(C)
5410 REM   TO FIGURE PAYMENT AMOUNT
5420 P(C)=A(C)*Q(Y,I)
5425 P(C)=P(C)/100:REM TO PUT DECIMA
    LS IN THE RIGHT PLACES
5428 P(C)=P(C)/10
5450 IF C=3 THEN 5500
5490 GOTO 5010
5500 RETURN
6000 HOME:PRINT
6001 V5=V:B5=B
6010 PRINT "THIS SECTION WILL ALLOW ~
    YOU TO
6020 PRINT"CORRECT ANY DATA
6030 GOSUB 11000
6050 PRINT"1.  DATE ";E$
6060 PRINT"2.  ";A$
6070 PRINT"3.  ";M1$
6080 PRINT"4.  ";M2$
6100 PRINT"5.  PRICE ";PR
6110 PRINT"6.  EST LIFE FOR DEPRECIA
    TION ";L
6120 PRINT"7.  EST APPRECIATION/YEAR
    ";
6126 PRINT A
6130 PRINT"8.  CURRENT RENTS ";R
6140 PRINT"9.  ANTICIPATED RENTS ";A
    R
6160 PRINT"10. MONTHS OF OWNERSHIP T
    HIS YEAR ";M
6170 PRINT"11. EST TAXES + INSURANCE
    /MONTH ";T
6180 PRINT"12. EST EXPENSES/MONTH ";
    E
6190 PRINT"13. % LAND VALUE ";V5
6200 PRINT"14. % TAX BRACKET ";B5
6210 PRINT"15. DOWN PAYMENT  ";D9
6220 PRINT"16. % FURNISHINGS OF VALU
    E ";F
6225 GOSUB 11000
6300 PRINT"TO CHANGE, ANSWER THE NUM
    BER"
6310 INPUT "WHEN DONE, ANSWER -1";Q
6315 HOME:PRINT:PRINT
6320 IF Q=-1 THEN 6500
6330 ONQGOTO6350,6360,6365,6370,6390
    ,6400,6410,6420,6430,6440,
    6450,6460,6470,6480
6331 GOTO 6490
6350 INPUT "CORRECT DATE ";E$
6355 GOTO 6000
6360 INPUT "ADDRESS ";A$:GOTO 6000
6365 INPUT "MISC INFO ";M1$:GOTO6000

6370 INPUT "MISC INFO ";M2$:GOTO6000

6380 INPUT "ASKING/OFFERING PRICE ";
    PR
6382 IF PR<1 THEN 6380
6385 GOTO 6000
6390 INPUT "LIFE FOR DEPRECIATION ";
    L
6391 IF L<1 THEN 6390
6395 GOTO 6000
6400 INPUT "% APPRECIATION EXPECTED ~
    ";A
6405 GOTO 6000
6410 INPUT "CURRENT RENTS ";R:GOTO 6
    000
6420 INPUT "ANTICIPATED RENTS ";AR
6425 GOTO 6000
6430 INPUT "MONTHS OF OWNERSHIP THIS
     YEAR ";M
6432 IF M>12 THEN 6430
6434 IF M<0 THEN 6430
6436 GOTO 6000
6440 INPUT "EST TAXES + INSURANCE/MO
    NTH";T:GOTO6000
6450 INPUT "EST EXPENSES PER MONTH "
    ;E:GOTO 6000
6460 INPUT "PERCENT LAND VALUE ";V
6470 INPUT "TAX BRACKET ";B:GOTO 600
    0
6480 INVERSE:PRINT "REMEMBER - IF YO
    U CHANGE
6482 PRINT"YOUR DOWN PAYMENT, THE MO
    NTHLY PAYMENT SHOULD ALSO ~
    BE CHANGED":NORMAL:PRINT
```

```
6484 INPUT "DOWN PAYMENT";DP
6485 IF DP<1 THEN 6484
6486 IF DP>=PR THEN 6484
6487 GOTO 6000
6490 INPUT "FURNISHINGS % OF VALUE "
    ;F:GOTO 6000
6500 REM
6900 RETURN
7000 HOME:VTAB10:HTAB10:PRINT"----DO
    ING MATH----"
7002 V=100-V
7003 V=V/100
7004 B=B/100
7005 F=F/100
7010 R9=R*M :REM CURRENT RENTS THIS ~
    YEAR
7015 R9=INT(R9*10^2+.5)/100
7020 P(8)=P(9)*M: REM PAYMENTS THIS ~
    YEAR
7025 P(8)=INT(P(8)*10^2+.5)/100
7030 T9=M*T:REM TAXES Y-T-D THIS YEA
    R
7035 T9=INT(T9*10^2+.5)/100
7040 E9=E*M:REM EXPENSES Y-T-D THIS ~
    YEAR
7045 E9=INT(E9*10^2+.5)/100
7050 F1=R9-P(8)-T9-E9:REM F1=CASH FL
    OW THIS YEAR
7055 F1=INT(F1*10^2+.5)/100
7210 F2=(AR*12)-(P(9)*12)-(T*12)-(E*
    12)
7215 REM **F2=CASH FLOW 2ND YEAR
7220 F2=INT(F2*10^2+.5)/100
7300 REM FIGURE ASSET APPRECIATION
7310 A5=(PR*A)/100
7320 A5=A5/12
7330 REM A5=MONTHLY ASSET APPRECIATI
    ON
7340 A6=A5*12:REM FOR A FULL YEAR
7345 A5=A5*M:REM APPRECIATION FOR TH
    E 1ST YEAR
7350 A5=INT(A5*10^2+.5)/100
7360 A6=INT(A6*10^2+.5)/100
7400 REM FIGURE EQUITY BUILDUP
7410 REM P(8)=TOTAL PAYMENTS THIS YE
    AR
7420 REM T9=TAXES + INS THIS YEAR
7430 REM E9=EXPENSES TOTAL THIS YEAR

7440 REM F1=CASH FLOW 1ST YEAR
7450 REM F2=CASH FLOW 2ND YEAR
7500 EB=P(8)*E1(Y,I):REM EQUITY BUIL
    DUP 1ST YEAR
7505 EB=EB/100
7510 ET=(P(9)*12)*E2(Y,I):REM EQUITY
    BUILDUP 2ND YEAR
7515 ET=ET/100
8000 REM L IS PROPERTY VALUE
8010 REM V IS LAND VALUE %
8020 REM F=IS VALUE OF FURNISHINGS
8030 REM PR IS PRICE OF PROPERTY
8040 REM M IS MONTHS YOU OWN IT THIS
    YEAR
8050 REM B IS TAX BRACKET
8100 REM FIGURE 1ST YEAR TAX SAVINGS

8210 TS=PR*V:REM THIS IS THE NET PRO
    PERTY VALUE AFTER LAND IS ~
    DEDUCTED
8220 F5=PR*F:REM F4=VALUE OF THE FUR
    NISHINGS
8230 TS=TS-F5:REM TS IS NOW THE VALU
    E OF THE PROPERTY AFTER LA
    ND AND
8232 REM FURN ARE DEDUCTED
8240 TS=TS/L:REM THIS IS WHAT YOU CA
    N DEPRECIATE PER YEAR
8250 F5=F5/5:REM THIS IS THE AVERAGE
    DEP ON FURNISHINGS
8260 REM PART OVER 3 YEARS AND PART ~
    OVER 7=5 AVERAGE
8270 D5=F5+TS:REM THIS IS DEP FOR 1S
    T YEAR
8280 D6=D5
8290 D5=(D5/12)*M:REM THIS IS 1ST YE
    AR'S DEP, AND D6=2ND YEAR ~
    DEP
8300 TS=D5*B:REM THIS IS TAX SAVINGS
    1ST YEAR
8310 TT=D6*B:REM THIS IS TAX SAVINGS
    2ND YEAR
8400 REM RETURN ON INVESTMENT/EQUITY

8410 RO=F1+A5+EB+TS:REM THIS IS 1ST ~
    YEAR EQUITY TOTAL
8420 RE=F2+A6+ET+TT:REM THIS IS 2ND ~
    YEAR EQUITY BUILDUP
8430 RE=INT(RE*10^2+.5)/100
8440 RO=INT(RO*10^2+.5)/100
8500 TS=INT(TS*10^2+.5)/100
8510 F5=INT(F5*10^2+.5)/100
8520 D5=INT(D5*10^2+.5)/100
8530 TT=INT(TT*10^2+.5)/100
8540 D6=INT(D6*10^2+.5)/100
8550 EB=INT(EB*10^2+.5)/100
8560 ET=INT(ET*10^2+.5)/100
8900 RETURN
8999 V=20
9000 HOME:PRINT:INVERSE:PRINT TAB (1
    7)"INVEST                ~
        ":NORMAL:GOSUB11000
9001 PRINT:PRINT"YOU WILL OWN THIS P
    ROPERTY ";M:PRINT"MONTHS T
    HIS YEAR. THE CASH FLOW":P
    RINT
9002 PRINT"IS BASED ON CURRENT RENTS
    THE 1ST"
9003 PRINT"YEAR OF $";R;"PER MONTH, ~
    AND OF ANTICIPATED RENTS F
    OR THE 2ND YEAR OF"
9004 PRINT"$";AR;"PER MONTH.":PRINT:
    PRINT"YOUR DOWN PAYMENT IS
```

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Add $1.25 per order for shipping. We pay balance of UPS surface charges on all prepaid orders. Prices listed are on cash discount basis. Regular prices slightly higher. Prices subject to change.

KMMM Pascal for PET/CBM $85

A subset of standard Pascal with extensions.
- Machine language Pascal Source Editor with cursor oriented window mode
- Machine Language P-Code Compiler
- P-Code to machine language translator for optimized object code
- Run-time package
- Floating point capability
- User manual and sample programs

Requires 32K Please specify configuration.

EARL for PET (disk file based) $65

Editor, Assembler, Relocater, Linker

Generates relocatable object code using MOS Technology mnemonics. Disk file input (can edit files larger than memory). Links ,multiple object programs as one memory load. Listing output to screen or printer. Enhanced editor operates in both command mode and cursor oriented "window" mode.

RAM/ROM for PET/CBM

4K or 8K bytes of soft ROM with optional battery backup.

RAM/ROM is compatible with any large keyboard machine. Plugs into one of the ROM sockets above screen memory to give you switch selected write protectable RAM.

Use RAM/ROM as a software development tool to store data or machine code beyond the normal BASIC range. Use RAM/ROM TO LOAD A ROM image where you have possible conflicts with more than one ROM requiring the same socket. Possible applications include machine language sort (such as SUPERSORT), universal wedge, Extramon, etc.

RAM/ROM - - 4K	**$85**
RAM/ROM - - 8K	**120**
Battery Backup Option	**30**

SUPERSORT by James Strasma $35

Supersort is an excellent general purpose machine language sort routine for PET/CBM computers. Sorts both one and two dimensioned arrays at lightning speed in either ascending or descending order. Other fields can be subsorted when a match is found, and fields need not be in any special order. Sort arrays may be specified by name, and fields are random length. Allows sorting by bit to provide 8 categories per byte. The routine works with all PET BASICs, adjusts to any memory size, and can co-exist with other programs in high memory.

SuperGraphics

by John Fluharty **$30**

SuperGraphics provides machine language extensions to Commodore BASIC to allow fast and easy plotting and manipulation of graphics on the PET/CBM video display, as well as SOUND commands.

Animations that previously were too slow or impossible without machine language subroutines now can be programmed directly in BASIC. Move blocks (or rocketships, etc.), or entire areas of the screen with a single, easy to use BASIC command. Scroll any portion of the screen up, down, left, or right. Turn on or off any of the 4000 (8000 on 8032) screen pixels with a single BASIC command. In high resolution mode, draw vertical, horizontal, and diagonal lines. Draw a box, fill a box, and move it around on the screen with easy to use BASIC commands.

The SOUND commands allow you to initiate a note or series of notes (or even several songs) from BASIC, and then play them in the background mode without interfering with your BASIC program. This allows your program to run at full speed with simultaneous graphics and music.

SuperGraphics commands include GRAPHIC, TEXT, RVS, SET, DRAW, FILL, PLOT, MOVE, PRINT, CSET, CMOVE, DISPLAY, PUT, SWAP, PAUSE, and SOUND.

Please specify machine type and ROM version, disk or tape.

FLEX-FILE

for PET/CBM Computers

Self Calculating
DATA BASE
REPORT WRITER
MAILING LIST

FLEX-FILE is a set of flexible, friendly programs to allow you to set up and maintain a data base. Print files with a versatile Report Writer or a Mail Label routine. Programmers will find it easy to add subroutines to their own programs to make use of Data Base files.

RANDOM ACCESS DATA BASE

Record size limit is 250 characters. The number of records per disk is limited only by the size of each record and the number of records per disk is limited only by the size of each record and the amount of free space on the disk. File maintenance lets you step forward or backward through a file, add, delete, or change a record, go to a numbered record, or find a record by specified field. The Find command locates any record when you enter all (or a portion of) the desired key. Field lengths may vary from record to record to allow maximum packing of information. Files may be sorted by any field, and any field may be specified as a key. Sequential files from other programs may be converted to Flex-File format, and Flex-File records may be converted to sequential (WordPro, PaperMate, other word processors may also use Flex-File data). Maximum record size, fields per record, and order of fields may be changed at any time.

MAILING LABELS

With typical record size of 127 characters, each disk can handle over 1000 records (about 2800 with 8050 drive). Labels may be printed any number wide, and may begin in any column position. There is no limit on the number or order of fields on a label, and two or three fields may be joined together on one line (like first name, last name, and title). A "type of customer" field allows selective printing.

REPORT WRITER

Print any field in any column. For numeric fields, use decimal point justification (and round to any accuracy). Define any column as a series of mathematical functions performed on other columns. These functions include arithmetic operations and various log and trig functions. Pass results of operations such as running total from row to row. At the end of the report, print total and/or average for any column. Complete record selection, including field within range, pattern match, and logical functions can be specified individually or in combination with other parameters.

FLEX-FILE by Michael Riley $60

Please specify equipment configuration when ordering.

Low Cost Disk Drive for PET/CBM

PEDISK II from cgrs Microtech is a new disk system ready to plug into your large keyboard PET/CBM.

PEDISK II offers speed, reliability, IBM compatibility.

Complete system prices with DOS and cable:

5" 40 track, 1 drive, 143K	$525
5" 40 track, 1 drive, 286K	690
8" IBM 3740 format, 77 track, 250K	995

PROGRAM YOUR OWN EPROMS

Branding Iron for PET/CBM $79

EPROM Programmer with software for all ROM versions. Includes all hardware and software to program or copy 2716 and 2532 EPROMs.

CBM Software

Legal Time Accounting Package	445
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Complete CBM Business Software Package

Can be tailored to meet most business requirements.

Technician's Investment Analysis Package	500
Dow Jones Portfolio Management	129
Personal Tax Calculator	65
Tax Preparation System	445
Wordcraft 80 Wordprocessor Package	325
Pascal Development Package	235
Assembler Development Package	99
Intelligent Terminal Emulator	30
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FORTH for PET

BY L. C. Cargile and Michael Riley **$50**

Features include:
- full FIG FORTH model.
- all FORTH 79 STANDARD extensions.
- structured 6502 Assembler with nested decision making macros.
- full screen editing (same as when programming in BASIC).
- auto repeat key.
- sample programs.
- standard size screens (16 lines by 64 characters).
- 150 screens per diskette on 4040, 480 screens on 8050.
- ability to read and write BASIC sequential files.
- introductory manual.
- reference manual.

Runs on any 16K or 32K PET/CBM (including 8032) with ROM 3 or 4, and CBM disk drive. Please specify configuration when ordering.

Available soon:

Metacompiler for FORTH $30

simple metacompiler for creating compacted object code which can be executed independently (without the FORTH system).

PaperMate 60 COMMAND WORD PROCESSOR

by Michael Riley

Paper-Mate is a full-featured word processor for CBM/PET. Paper-Mate incorporates 60 commands to give you full screen editing with graphics for all 16K or 32K machines (including 8032), all printers, and disk or tape drives.

For writing text, Paper-Mate has a definable keyboard so you can use either Business or Graphics machines. Shift lock on letters only, or use keyboard shift lock. All keys repeat.

Paper-Mate text editing includes floating cursor, scroll up or down, page forward or back, and repeating insert and delete keys. Text block handling includes transfer, delete, append, save, load, and insert.

All formatting commands are imbedded in text for complete control. Commands include margin control and release, column adjust, 9 tab settings, variable line spacing, justify text, center text, and auto print form letter (variable block). Files can be linked so that one command prints an entire manuscript. Auto page, page headers, page numbers, pause at end of page, and hyphenation pauses are included.

Unlike most word processors, CBM graphics as well as text can be used. Paper-Mate can send any ASCII code over any secondary address to any printer.

Paper-Mate functions with 16/32K CBM/PET machines, with any printer, and with either cassette or disk.

To order Paper-Mate, please specify configuration.

Paper-Mate on disk or tape 40.00

BASIC INTERPRETER $200

Designed to support the CBM 8096 (8032 with add-on 64K board). A full interpreter implementation to automatically take advantage of the extra memory available to the 8032.

BPI General Ledger – 8032/8050 300
BPI Accounts Receivable – 8032/8050 300

Hayden Software

Complex Mathematics	12.70
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Jukebox Series for PET by L C Cargile
Excellent 4 part harmony music--write for list
Automated Simulations (EPYX) Fantasy Games

MICRO-REVERSI for PET by Michael Riley 10
super machine language version of Othello
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two excellent machine language maze programs

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```
    $";DP;" YOU'RE IN THE ";
9005 PRINT100*B" % TAX BRACKET.":PRI
    NT"THE ESTIMATED USEFUL LI
    FE FOR":PRINT"DEPRECIATION

9006 PRINT" IS ";L;" YEARS.":PRINT "
    THE FIRST YEAR DEPRECIATIO
    N IS $";D5;" AND THE
9007 PRINT" SECOND YEAR DEPRECIATION
     IS $";D6;":?:GOSUB 11000:
    ?
9009 PRINT"HIT ANY KEY TO CONTINE...
    ";:GET L$:HOME:Q5=5
9013 PRINT" RETURN ON INVESTMENT:"
9014 GOSUB11000:INVERSE:PRINT TAB (Q
    5)"YEAR 1","YEAR 2":NORMAL

9015 GOSUB11000:PRINT"CASH FLOW:"
9016 Z9=F1:GOSUB15000
9017 PRINT TAB (Q5)Z9$,
9018 Z9=F2:GOSUB15000
9019 PRINTZ9$:PRINT
9020 PRINT"ASSET APPRECIATION:"
9021 Z9=A5:GOSUB15000
9022 PRINT TAB (Q5)Z9$,
9023 Z9=A6:GOSUB15000
9024 PRINTZ9$:PRINT
9030 PRINT"EQUITY BUILDUP:"
9032 Z9=EB:GOSUB15000
9034 PRINT TAB (Q5)Z9$,
9036 Z9=ET:GOSUB15000
9038 PRINTZ9$:PRINT
9040 PRINT"TAX SAVINGS:"
9042 Z9=TS:GOSUB15000
9044 PRINT TAB (Q5)Z9$,
9046 Z9=TT:GOSUB15000
9048 PRINTZ9$
9055 GOSUB11000
9060 PRINT"GROSS RETURN:"
9062 Z9=RO:GOSUB15000
9064 PRINT TAB (Q5)Z9$,
9066 Z9=RE:GOSUB15000
9068 PRINTZ9$
9069 GOSUB20000
9071 G6=RO/DP:G6=INT(G6*10^2+.5)/100

9072 G7=RE/DP:G7=INT(G7*10^2+.5)/100

9073 G6=G6*100:G7=G7*100
9074 PRINT"RETURN ON EQUITY %":PRINT
    TAB(Q5))G6;"%",G7;" %"
9075 GOSUB 20000:PRINT"HIT ANY KEY T
    O CONTINUE...";:GET L$
9079 GOTO 10000
9080 V=V*100
9082 V=100-V
9083 B=B*100
9084 F=F*100
9100 V=INT(V*10^2+.5)/100
9110 F=INT(F*10^2+.5)/100
9120 B=INT(B*10^2+.5)/100
9130 GOTO10106
10000 REM MENU
10010 HOME:PRINT
10015 PRINT:PRINT
10017 INVERSE:PRINT TAB (17)"INVEST ~
                    ":NORMAL
    :PRINT
10020 PRINT"<1> TO SEE THE SAME DATA ~
    AGAIN"
10025 PRINT
10030 PRINT"<2> TO CHANGE OR PRINT TH
    E DATA"
10035 PRINT
10040 PRINT"<3> TO STOP NOW"
10050 PRINT
10060 INPUTQ
10070 IFQ=1THEN GOTO 9000
10080 IFQ=3THENPRINT"END OF";:INVERSE
    :PRINT"INVEST";:NORMAL:PRI
    NT"PROGRAM":END
10085 IFQ>3THEN10000
10086 IFQ<1THEN10000
10090 REM MENU
10100 HOME:PRINT
10105 GOTO9080
10106 PRINT
10108 PRINT:PRINT:INVERSE:PRINTTAB(17
    )"INVEST                ":N
    ORMAL:PRINT:PRINT
10110 PRINT"<1> CHANGE FINANCIAL DATA
    "
10115 PRINT
10120 PRINT"<2> CHANGE THE PAYMENT DA
    TA"
10122 PRINT
10125 PRINT"<3> PRINT THE DATA"
10126 PRINT
10127 PRINT"<4> STOP NOW"
10130 PRINT
10135 INPUTQ
10140 IFQ<1THEN10100
10142 ONQTOTO10150,10152,12000,10154
10150 GOSUB6000
10151 GOTO10155
10152 C=0:P(1)=0:P(2)=0:P(3)=0:GOSUB5
    000:REM C IS ZEROED TO RES
    TART COUNTER
10153 P(9)=0:GOTO2200:REM ZERO PAYMEN
    T AND THEN DO MATH TO ADD ~
    UP NEW PAYMENTS
10154 PRINT"END OF PROGRAM ":END
10155 GOSUB7000:REM MATH
10158 GOTO9000:REM PRINT
10160 GOTO10000
10165 GOSUB7000:REM MATH
10166 GOTO9000:REM PRINT
11000 PRINT"-----------------------
    -------"
11010 RETURN
12000 HOME:PRINT
12005 VTAB6
```

```
12010 FLASH:PRINT"TURN ON THE PRINTER
    ":NORMAL:PRINT
12015 PRINT:PRINT:GOSUB11000:PRINT:PR
    INT
12020 PRINT"ANSWER 1 TO CONTINUE..."
12022 PRINT"ANSWER 2 TO STOP......."
12024 PRINT:INPUTQ
12025 PRINT:PRINT
12026 IFQ=2THENPRINT"END OF ";:INVERS
    E:PRINT"INVEST;":NORMAL:PR
    INT"PROGRAM":END
12030 D$=CHR$(4)
12040 PRINTD$;"PR#1"
12050 PRINT""
12100 PRINT"       "
12110 FORCO=1TO200:NEXTCO
12130 PRINTTAB(5)E$
12135 PRINTTAB(5)"PROPERTY ANALYSIS R
    EPORT FOR ";A$
12140 PRINT"       "
12150 PRINTTAB(5)M1$:PRINTTAB(5)M2$
12170 PRINTTAB(5)"ASKING/OFFERING PRI
    CE ";
12171 Z9=PR:GOSUB15000:PRINTZ9$
12172 PRINT"       "
12179 PRINT"       "
12180 FORCO=1TO70:PRINT"*";:NEXTCO
12181 PRINT"       "
12190 PRINT TAB(5)"CASH FLOW ESTIMATE
    , BASED ON OWNING THIS PRO
    PERTY FOR";M;"MONTHS"
12200 PRINTTAB(5)"THE FIRST YEAR, 12
    MONTHS THE SECOND YEAR. FI
    RST YEAR CASH FLOW"
12210 PRINTTAB(5)"BASED ON CURRENT RE
    NTS OF ";R;"MONTHLY, AND T
    HE 2ND YEAR IS BASED"
12220 PRINTTAB(5)"ON ANTICIPATED RENT
    S OF ";AR;" PER MONT.  EST
    IMATED"
12222 PRINTTAB(5)"APPRECIATION IS ";A
    ;" %"
12230 GOSUB11000:PRINTTAB(5)"ALL FIGU
    RES ARE APPROXIMATE":GOSUB
    11000:PRINT"       "
12232 FORCO=1TO400:NEXTCO
12235 PRINTTAB(29)"1ST YEAR
      2ND YEAR"
12237 FORCO=1TO400:NEXTCO
12300 PRINTTAB(5)"MONTHLY RENTS
      ";
12310 Z9=R9:GOSUB15000
12320 Q9=LEN(Z9$)
12330 PRINTTAB(11-Q9)Z9$;
12340 Z9=AR*12:GOSUB15000
12350 Q9=LEN(Z9$)
12360 PRINTTAB(11-Q9)Z9$;
12370 PRINT"       "
12372 FORCO=1TO400:NEXTCO
12400 PRINTTAB(5)"MORTGAGE PAYMENTS
      ";
12410 Z9=P8:GOSUB15000
12420 Q9=LEN(Z9$)
12430 PRINTTAB(11-Q9)Z9$;
12440 Z9=P(9)*12:GOSUB15000
12450 Q8=LEN(Z9$)
12460 PRINTTAB(20-Q8)Z9$;
12470 FORCO=1TO400:NEXTCO
12500 PRINTTAB(5)"TAXES + INSURANCE
      ";
12510 Z9=T9:GOSUB15000
12520 Q9=LEN(Z9$)
12530 PRINTTAB(11-Q9)Z9$;
12540 Z9=T*12:GOSUB15000
12560 Q8=LEN(Z9$)
12570 PRINTTAB(20-Q8)Z9$;
12580 FORCO=1TO400:NEXTCO
12600 PRINTTAB(5)"MISC. EXPENSES
      ";
12610 Z9=E9:GOSUB15000
12620 Q9=LEN(Z9$)
12630 PRINTTAB(11-Q9)Z9$;
12640 Z9=E*12:GOSUB15000
12650 Q8=LEN(Z9$)
12660 PRINTTAB(20-Q8)Z9$;
12690 PRINT"       "
12695 FORCO=1TO400:NEXTCO
12700 PRINTTAB(5)"ESTIMATED CASH FLOW
      ";
12710 Z9=F1:GOSUB15000
12720 Q9=LEN(Z9$)
12730 PRINTTAB(11-Q9)Z9$;
12740 Z9=F2:GOSUB15000
12750 Q8=LEN(Z9$)
12760 PRINTTAB(20-Q8)Z9$;
12770 PRINT"       "
12780 FORCO=1TO400:NEXTCO
12785 PRINT"       "
12790 PRINT"       "
12795 FORCO=1TO400:NEXTCO
12800 PRINTTAB(5)"RETURN ON INVESTMEN
    T ANALYSIS"
12810 PRINT"       "
12815 FORCO=1TO400:NEXTCO
12820 PRINTTAB(40)"1ST YEAR";
12822 PRINTTAB(11)"2ND YEAR"
12830 PRINT"       "
12835 FORCO=1TO400:NEXTCO
12900 PRINTTAB(5)"CASH FLOW (FROM ABO
    VE)              ";
12910 Z9=F1:GOSUB15000
12920 Q9=LEN(Z9$)
12930 PRINTTAB(11-Q9)Z9$;
12940 Z9=F2:GOSUB15000
12950 Q8=LEN(Z9$)
12960 PRINTTAB(20-Q8)Z9$;
12970 FORCO=1TO400:NEXTCO
13000 PRINTTAB(5)"ASSET APPRECIATION
                 ";
13010 Z9=A5:GOSUB15000
13020 Q9=LEN(Z9$)
13030 PRINTTAB(11-Q9)Z9$;
```

```
13040 Z9=A6:GOSUB15000
13050 Q8=LEN(Z9$)
13060 PRINTTAB(20-Q8)Z9$;
13065 FORCO=1TO400:NEXTCO
13100 PRINTTAB(5)"EQUITY BUILDUP (APP
    ROXIMATE)       ";
13110 Z9=EB:GOSUB15000
13120 Q9=LEN(Z9$)
13130 PRINTTAB(11-Q9)Z9$;
13140 Z9=ET:GOSUB15000
13150 Q8=LEN(Z9$)
13160 PRINTTAB(20-Q8)Z9$;
13165 FORCO=1TO400:NEXTCO
13200 PRINT"              ":PRINTTAB(7)
    "YOUR ESTIMATED TAX SAVING
    S ARE"
13202 PRINTTAB(7)"BASED ON A TAX BRAC
    KET OF ";B5;" %"
13204 PRINTTAB(7)"AND A LIFE FOR DEPR
    ECIATION "
13213 PRINTTAB(7)"OF ";L" YEARS. DEPR
    ECIATION"
13215 PRINTTAB(7)"THE FIRST YEAR IS "
    ; INT (D5);" AND"
13217 PRINTTAB(7)"THE 2ND YEAR IS ";D
    6;" ."
13218 PRINTTAB(7)"THE FURNISHINGS ARE
     WORTH ";F
13219 PRINTTAB(7)"% OF THE PROPERTY C
    OST."
13224 PRINT"      ":FORCO=1TO400:NEXTC
    O
13225 PRINTTAB(5)"TAX SAVINGS       ~
                  ";
13230 Z9=TS:GOSUB15000
13240 Q9=LEN(Z9$)
13250 PRINTTAB(20-Q9)Z9$;
13255 Z9=TT:GOSUB15000
13260 Q8=LEN(Z9$)
13270 PRINTTAB(20-Q8)Z9$;
13300 FORCO=1TO70:PRINT"-";:NEXTCO
13305 PRINT"      "
13310 PRINTTAB(5)"YOUR RETURN ON INVE
    STMENT IS      ";
13320 Z9=RO:GOSUB15000
13330 Q9=LEN(Z9$)
13340 PRINTTAB(11-Q9)Z9$;
13350 Z9=RE:GOSUB15000
13360 Q8=LEN(Z9$)
13370 PRINTTAB(20-Q8)Z9$;
13380 PRINT"      "
13395 FORCO=1TO400:NEXTCO
13400 PRINTTAB(5)"YOUR DOWN PAYMENT W
    AS $ ";DP
13405 FORCO=1TO400:NEXTCO
13410 PRINTTAB(5)"YOUR % RETURN ON IN
    VESTMENT IS    ";
13430 Z9=100* (RO/DP):GOSUB15000
13440 Q9=LEN(Z9$)
13450 PRINTTAB(12-Q9)Z9$;" %";
13460 Z9=100* (RE/DP):GOSUB15000
13470 Q8=LEN(Z9$)
13480 PRINTTAB(18-Q8)Z9$;" %";
14800 D$=CHR$(4)
14810 PRINTD$;"PR#0"
14999 PRINT"END OF ";:INVERSE:PRINT"I
    NVEST;":NORMAL:PRINT"PROGR
    AM":END
15000 REM PRINTUSING ROUTINE
15005 IFZ9<0THEN16000
15010 REM Z9= VARIABLE TO BE CHANGED
15020 IF(100*Z9-INT(100*Z9))<.5THENZ9
    =INT(100*Z9)/100:GOTO15030

15022 Z9=(INT(100*Z9)+1)/100
15024 REM MOVE ALPHANUMERIC TO STRING
     VARIABLE
15030 Z9$=STR$(Z9)
15035 REM ADD DOLLAR SIGN
15045 REM ADJUST DECIMAL IF REQUIRED
15050 Z9=LEN(Z9$):IFZ9<=2THEN15200
15055 Y9$=RIGHT$(Z9$,3)
15060 IFY9$<="$99"THEN15080
15070 IFY9$=<".99"THEN15220
15080 Y9$=RIGHT$(Z9$,2)
15090 IFY9$<=".9"THENZ9$=Z9$+"0":GOTO
    15210
15200 Z9$=Z9$+".00"
15205 REM NOW TO ADD A COMMA, IF REQU
    IRED
15210 Z9=LEN(Z9$)
15220 IFZ9<8THEN15400
15230 Y9$=RIGHT$(Z9$,6)
15240 Y9$=","+Y9$
15250 Y9$=LEFT$(Z9$,(Z9-6))+Y9$
15255 REM Z9$ IS THE EDITED FIELD
15260 Z9$=Y9$
15265 REM Z9 WILL CONTAIN THE LENGTH ~
    OF THE EDITED FIELD
15267 Z9=Z9+1
15400 RETURN
15752 GOSUB11000:PRINT
16000 Z9$=STR$(Z9)
16010 REM
16020 RETURN
17000 HOME:PRINT:INVERSE:PRINTTAB(17)
    "INVEST             ":NORM
    AL:PRINT
17010 PRINT"THIS IS A REAL ESTATE ANA
    LYSIS"
17020 PRINT"PROGRAM, WHICH WILL FIGUR
    E CASH FLOW,"
17030 PRINT"EQUITY BUILDUP, ASSET APP
    RECIATION"
17040 PRINT"AND TAX SAVINGS FOR AN IN
    COME PROPERTY."
17050 PRINT
17060 PRINT"IF THE LOANS YOU HAVE, OR
     ARE GETTING"
17070 PRINT"FOR A PARTICULAR PROPERTY
     ARE FOR"
17080 PRINT"A DIFFERENT TERM, OR AT A
```

```
     DIFFERENT"
17090 PRINT"RATE THAN WHAT THE PROGRA
17070 PRINT"FOR A PARTICULAR PROPERTY
     ARE FOR"
17080 PRINT"A DIFFERENT TERM, OR AT A
     DIFFERENT"
17090 PRINT"RATE THAN WHAT THE PROGRA
    M ASKS FOR,"
17100 PRINT"INPUT THE ANSWER AS CLOSE
     AS POSSIBLE."
17105 PRINT
17110 PRINT"FOR INSTANCE, YOU CAN USE
     AN INTEREST"
17120 PRINT"RATE FROM 10 TO 18% IN .5
     STEPS"
17130 PRINT"IF YOUR LOAN HAPPENS TO B
    E AT 11.75%,"
17140 PRINT"USE THE CLOSEST ANSWER--1
    1.5%"
17150 PRINT
17152 PRINT:GOSUB11000:PRINT
17160 PRINT"HIT ANY KEY TO CONTINUE..
    .";:GETL$
17190 HOME:PRINT
17200 PRINT"IF YOU MAKE AN ERROR IN A
    NSWERING,"
17210 PRINT"JUST CONTINUE, AS YOU'LL ~
    HAVE THE "
17220 PRINT"CHANCE TO CORRECT YOUR DA
    TA IN A"
17230 PRINT"MOMENT."
17240 PRINT
17250 PRINT"ALSO, ONCE YOU HAVE THE D
    ATA INTO"
17260 PRINT"THE COMPUTER, YOU'LL BE A
    LLOWED TO"
17270 PRINT"CHANGE IT, AS YOU WISH.  ~
    "
17280 PRINT
17290 PRINT"SO, YOU MIGHT WANT TO SEE
     THE RESULTS"
17300 PRINT"OF AN INVESTMENT WITH $10
    ,000 DOWN,"
17400 PRINT"AND SEE WHAT HAPPENS IF Y
    OU PUT"
17410 PRINT"$15,000 DOWN.  OR IF YOU ~
    TAX BRACKET"
17420 PRINT"WAS A BIT HIGHER, OR IF T
    HE PAYMENTS"
17430 PRINT"STRETCHED OUT A BIT LONGE
    R, AND SO ON."
17440 PRINT
17450 PRINT"WHEN YOU HAVE THE RESULTS
     YOU WANT,"
17460 PRINT"YOU CAN ASK FOR A PRINTOU
    T.  ONCE  "
17470 PRINT"YOU GET A PRINTOUT OF THE
     INFORMATION,"
17480 PRINT"THE PROGRAM WILL END. "
17482 PRINT
17490 INVERSE:PRINT TAB (17)"INVEST" ~
                ":NORMAL
17800 RETURN
20010 RETURN
21000 REM
21142 HOME:VTAB6
21143 HTAB 16
21144 SPEED=255
21145 INVERSE:PRINT "INVEST          ~
       ":NORMAL:PRINT:PRINT:PR
    INT
21150 NORMAL
21160 PRINT
21165 GOSUB11000:PRINT
21170 PRINT"......A REAL ESTATE ANALY
    SIS PROGRAM"
21175 PRINT
21180 GOSUB11000
21190 PRINT
21200 PRINT"......GREGORY R. GLAU"
21210 PRINT"       P.O. BOX 1627"
21220 PRINT"       PRESCOTT AZ 86302"
21250 PRINT:GOSUB11000:PRINT
21280 PRINT
21300 PRINT"         HIT ANY KEY TO CO
    NTINUE...";:GETL$
21900 SPEED=255
22000 NORMAL
22010 RETURN
```

Program 2.

```
1 OPEN #1,4,0,"K:"
2 DIM E$(20),A$(80),M1$(80),M2$(80),P(10
),Z9$(90),Y9$(80)
60 READ TEMP:Q(Y,I)=TEMP
220 READ TEMP:E1(Y,I)=TEMP
440 READ TEMP:E2(Y,I)=TEMP
2000 ? "HIT ANY KEY TO CONTINUE...";:GET
 #1,TEMP
2004 PRINT "{CLEAR}{DOWN}"
2005 ? "|                  INVEST
     |":? "PLEASE ANSWER THE FOLLOWING
..."
2008 PRINT "|ANSWER 'END' TO STOP NOW|{2
 DOWN}"
2010 PRINT "TODAY'S DATE ";:INPUT E$
2030 PRINT "PROPERTY ADDRESS ";:INPUT A$
2032 ? "{CLEAR}"
2040 ? :? "MISC INFO (1)";:INPUT M1$
2050 ? "MISC INFO (2)";:INPUT M2$
2060 ? :? :? "ASKING/OFFERING PRICE";PR
2070 ? "{CLEAR}"
2076 ? "CONSULT WITH YOUR ACCOUNTANT - |
PLEASE|"
2081 ? "ESTIMATED LIFE FOR DEPRECIATION
IN YEARS";:INPUT L:?
2085 ? "{CLEAR}"
2089 ? "ESTIMATED APPRECIATION PER YEAR"
;:INPUT A
```

```
2090 ? "{CLEAR}"
2091 ? "CURRENT TOTAL RENTS PER MONTH";:
INPUT R
2100 ? "ANTICIPATED TOTAL RENTS PER MONT
H";:INPUT AR
2115 ? "PROPERTY THIS YEAR";:INPUT M
2120 ? "TAXES + INSURANCE PER MONTH";:IN
PUT T
2140 ? "ESTIMATED EXPENSES PER MONTH";:I
NPUT E
2147 ? "{CLEAR}"
2150 ? "% TAX BRACKED YOU'RE IN (30%=30)
";:INPUT B
2162 ? :? "DOWN PAYMENT";:INPUT DP
2200 ? "{CLEAR}"
2290 ? "DO YOU WANT TO CHANGE THIS <1=YE
S>";:INPUT Q
2410 ? :? "CORRECT PAYMENT TOTAL";:INPUT
 TEMP:P(9)=TEMP
3032 ? "{CLEAR}"
5000 ? "{CLEAR}":? :? "NOW WE HAVE TO FI
GURE YOUR":? "MONTHLY PAYMENTS FOR THIS
PROPERTY."
5001 ? "YOU CAN INPUT UP TO 3 PAYMENTS."
:?
5005 ? :? "|YOU MUST INPUT SOMETHING|"
5006 ? "|--EVEN IF YOU CHANGE IT LATER O
N|"
5007 ?
5250 ? "YEARS (15-20-25)";:INPUT TEMP:Y(
C)=TEMP
5310 PRINT "PERCENT RATE";:INPUT Q
5400 ? "AMOUNT OF LOAN";:INPUT TEMP:A(C)
=TEMP
6000 ? "{CLEAR}"
6310 ? "WHEN DONE, ANSWER-1";:INPUT Q
6315 ? "{CLEAR}":?
6350 ? "CORRECT DATE";:INPUT E$
6360 ? "ADDRESS";:INPUT A$:GOTO 6000
6365 ? "MISC INFO ";:INPUT M1$:GOTO 6000

6370 ? "MISC INFO ";:INPUT M2$:GOTO 6000

6380 ? "ASKING/OFFERING PRICE";:INPUT PR
6390 ? "LIFE FOR DEPRECIATION";:INPUT L
6400 ? "% APPRECIATION EXPECTED";:INPUT
A
6410 ? "CURRENT RENTS";:INPUT R:GOTO 600
0
6420 ? "ANTICIPATED RENTS";:INPUT AR
6430 ? "MONTHS OF OWNERSHIP THIS YEAR";:
INPUT M
6440 ? "EST TAXES + INSURANCE/MONTH";:IN
PUT T:GOTO 6000
6450 ? "EST EXPENSES PER MONTH";:INPUT E
:GOTO 6000
6460 ? "% LAND VALUE";:INPUT V
6470 ? "TAX BRACKET";:INPUT B:GOTO 6000
6480 ? "|REMEMBER-IF YOU CHANGE|"
6482 ? "|YOUR MONTHLY PAYMENTS, THE MONT
HLY|"
6483 ? "|PAYMENTS SHOULD ALSO BE CHANGED
.|":?
6484 ? "DOWN PAYMENT";:INPUT DP
6490 ? "FURNISHINGS % OF VALUE";:INPUT F
:GOTO 6000
7000 ? "{CLEAR}":POSITION 10,10:? "----D
OING MATH----"
9000 ? "{CLEAR}":POSITION 17,1:? "|INVES
T|":GOSUB 11000:? :? "YOU WILL OWN THIS
PROPERTY ";M:? "MONTHS THIS YEAR. THE CA
SH FLOW"
9001 ? "IS BASED ON CURRENT RENTS THE 1S
T"
9009 ? "HIT ANY KEY TO CONTINUE...";:GET
 #1,TEMP:? "{CLEAR}";:Q5=5
9014 GOSUB 11000:POKE 85,Q5:? "|YEAR 1|"
,"|YEAR 2|"
9017 POKE 85,Q5:? Z9$,
9034 POKE 85,Q5:? Z9$,
9044 POKE 85,Q5:? Z9$,
9064 POKE 85,Q5:? Z9$,
9074 ? "RETURN ON EQUITY %":POKE 85,10:?
 G6;" %",G7;" %"
9075 GOSUB 20000:? "HIT ANY KEY TO CONTI
NUE...":GET #1,TEMP
10010 ? "{CLEAR}"
10017 ? "|                INVEST
      |"
10080 IF Q=3 THEN ? "END OF |INVEST| PRO
GRAM":END
10100 ? "{CLEAR}"
10108 ? "{2 DOWN}|                    INVEST
            |{2 DOWN}"
12000 END
12026 IF Q=2 THEN ? "END OF |INVEST| PRO
GRAM":END
15055 Y9$=Z9$(LEN(Z9$)-3)
15080 Y9$=Z9$(LEN(Z9$)-2)
15090 IF Y9$(=".9" THEN Z9$(LEN(Z9$)+1)=
"0":GOTO 15210
15200 Z9$(LEN(Z9$)+1)=".00"
15210 Z9=LEN(Z9$)
15230 Y9$=Z9$(Z9-6)
15240 TEMP$=Y9$:Y9$=",":Y9$(2)=TEMP$
15250 TEMP$=Z9$(1,Z9-6):TEMP2$=Y9$:Y9$=T
EMP$:Y9$(LEN(Y9$)+1)=TEMP2$
17490 ? "|                INVEST
      |"
21142 ? "{CLEAR}"
21143 POSITION 16,6
21144 REM
21145 ? "|INVEST|":? :? :? :?
21300 ? "   HIT ANY KEY TO CONTINUE...";
```

```
:GET #1,A
21900 REM
22000 REM
```

Mr. Glau has offered to make disk copies of the program for Apple owners: send him $3 and a disk in an SASE mailer. ©

Developing A Business Algorithm

Keith Falkner
Venice, FL

The heart of a computer program is its algorithm procedure. This is the case in this program. The purpose of the program is to solve a simple and fairly common problem in business: if a customer wishes to lease a durable article, with a view toward buying it at the end of the lease, what should the rental payment be? As written, this program limits the term to 6 or 12 or 24 or 36 months, and includes consideration of an annual charge for insurance. These considerations were part of a specific user's business environment.

The program uses an algorithm to calculate the lease payment and then verifies its result by simulating the passage of time and showing that the expected result actually happens. This will be illustrated in detail later. What is more important is how the algorithm was developed.

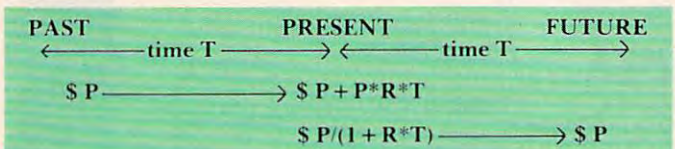
Creating An Interest Algorithm

Almost always, the idea behind an algorithm is very simple. This is certainly true here. The main idea is that interest is the product of principal, rate, and time. This is the simple formula which most of us have forgotten since high school.

Applying a simple formula can be a complex task, but is usually understandable in small pieces. For an example see Diagram 1, which merely illustrates that P dollars will grow to P + P * R * T dollars in T at rate R. This process can be treated in reverse: if money is to accumulate at interest in order to be worth P dollars at future time T at rate R, the present value of that money is P/(1 + R * T) dollars. These simple formulae are the heart of all interest calculations, however complicated they become.

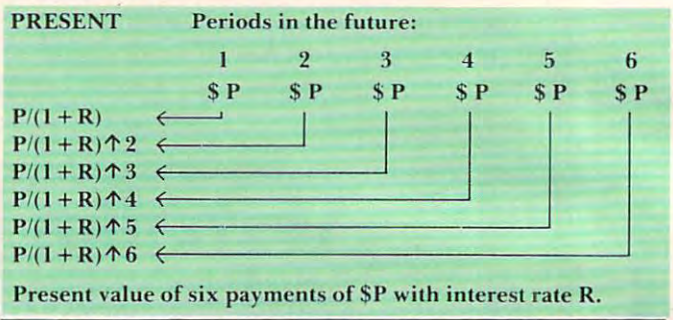
Diagram 2 shows the values of each of six payments of P dollars each, at intervals of unit time (that time which is the basis of the interest rate, e.g. 2% per month, unit time would be one month).

DIAGRAM 1



How money increases when the interest rate is R during time T.

DIAGRAM 2



Present value of six payments of $P with interest rate R.

The above is simple high school math. To add up the values of the six payments, we need another idea from high school. The sum of a geometrical progression of N terms, first A, ratio X:

$$S = A + A*X + A*X\uparrow 2 + A*X\uparrow 3 + \ldots + A*X\uparrow (N-1)$$
$$= A * \frac{X\uparrow N - 1}{X - 1}$$

By substituting $P/(1+R)\uparrow 6$ for A, and $(1+R)$ for X, we get:

$$S = \frac{P}{(1+R)\uparrow 6} * \frac{(1+R)\uparrow 6 - 1}{1+R-1}$$
$$= \frac{P}{R} * \left(1 - \frac{1}{(1+R)\uparrow 6}\right)$$

The value S above is the present value of what the customer will eventually pay in lease payments, six of them in this example. That money must equal the present value of the contract, which is the value of the article being leased, reduced by the value it will fetch after the lease is done, and increased by some fee for insurance.

Let's delve into the specific workings of the program. Table 1 identifies the variables used.

TABLE 1

Variable	Meaning
D	Fraction to buy it after lease
F	= 1 + R (for convenience)
I	Annual insurance premium factor
P	Payment each month of lease
Q	Optional price to buy after lease
R	Rate of return as % monthly
S	State sales tax rate
T	Number of months and payments
V	Value of the article being leased
W	Worth of contract (computed)
Z	Insurance factor (computed)

The program collects input values for I, R, S, T, and D; since I, R, and S will usually not change, the program knows standard values for these, which should be set to your standards, not those

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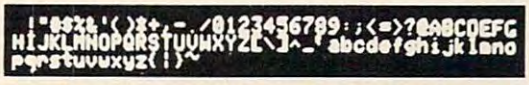
MAIL MERGE/UTILITY APPLE & ATARI

This menu driven program combined with **LETTER PERFECT** allows user to generate form letters and print mailing labels. With the Atari, you may **CONVERT ATARI DOS FILES,** or Visicalc files compatible for editing with **LETTER PERFECT.** Utility creates Data Base files for Letter Perfect.

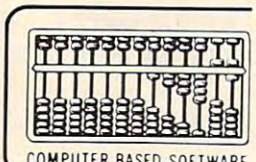
LJK DISK UTILITY APPLE $29.95

This menu driven program allows the user to manipulate a variety of different file types. Binary, Text, and Source files may be easily converted into each other. The program may be used with **APPLESOFT*, VISCALC***, and other programs. These program files may be readily adapted for multiple use including editing with **LETTER PERFECT** word processings.

LOWER CASE CHARACTER GENERATOR $34.95



Lower Case Character Generator for the Rev. 7, Apple II or II+ computers. When installed, this Eprom will generate lower case characters to the video screen. Lower case characters set has two dot true descenders. Installation instruction included. Manual includes listing of software for full support and complete instructions for shift key modification. Compatible with **LETTER PERFECT.**



COMPUTER BASED SOFTWARE

LJK ENTERPRISES INC.

LJK ENTERPRISES INC.
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actually shown in the listing.

Lines 140 to 170 calculate the insurance factor Z. For a six-month lease, Z is half the annual insurance factor I. For leases longer than a year, Z is I plus the present value of I for each future year of the lease.

Line 190 computes the total worth of the contract (the value of the article) plus the fee for insurance, minus the present value of the article's eventual selling price. That present value is expressed as D*V / F / F T. In plain English, that is the purchase-fraction D (for example .10 to buy at 10% of original price), times V the item's value, divided by F T to bring the future selling price into the present, further divided by F, so that the customer can buy the article, not on the day of the final payment, but a month later.

At last the payment P can be computed, since W (as calculated in line 190) is equal to the sum of the series of payments calculated above as S. The payment amount P is finally calculated in line 210, and is truncated to the last cent, *not* rounded to the nearest cent.

The loop in line 250 simulates the behaviour of the lease as time passes. Each month the indebtedness X is multiplied by F the interest factor, then a payment of P reduces that debt. Any debt remaining after all T payments have been made, represents the result of having ignored all the fractions of pennies which were dropped in line 230.

Well, you didn't think we were going to let the customer get away with fractions of pennies, did you? So the calculation in line 270 will show an amount slightly greater than the purchase-fraction D times the value V. Taxation laws may insist upon some minimum purchase fraction, and the above methods ensure that the final price will be at least D times V, and usually a few cents more.

The results of all this are promptly displayed on the screen. The value of the monthly payment is shown, and the eventual optional purchase price is shown, both before and after state sales tax.

Add this program to your bag of tricks, and you will have a new and potent way to attract investors. To verify that, just take a modest (nowadays) interest rate such as 2% per month, and calculate the investor's annual rate of return, which is (1+R) 12 – 1. I leave to you the task of exploiting that algorithm.

Program 1.

```
100 REM LEASE CALCULATION
110 REM WITH OPTION TO BUY
120 REM
130 GOSUB550
140 REM CALC INSURANCE
150 IFT=6THENZ=I/2:GOTO180
160 Z=I:IFT>12THENZ=Z+I/F^12
170 IFT>24THENZ=Z+I/F^24
180 REM CALC WORTH OF LEASE
190 W=V+V*Z-D*V/F/F^T
200 REM CALC PAYMENT
210 P=R*W/(1-F^-T)
220 REM ROUND TO LAST CENT
230 P=.01*INT(P*100)
240 REM CALC FINAL PRICE
250 X=W:FORN=1TOT:X=X*F-P:NEXTN
260 REM BUY IT 1 MONTH LATER
270 Q=X*F+D*V
280 REM PRINT RESULTS
290 X=P:GOSUB430
300 PRINT:PRINT"MONTHLY PAYMENT IS ~
    ...";TAB(25);Z$
310 PRINT:PRINT"AFTER ";T;" PAYMENT
    S, THE"
320 X=Q:GOSUB430
330 PRINT"PRICE WILL BE ...";TAB(25
    );Z$
340 X=Q+Q*S:GOSUB430
350 PRINT"TAX INCLUDED, THAT'S ..."
    ;TAB(25);Z$
360 END
370 REM NUMERIC INPUT:
380 REM PRESET X$, XH, & XL
390 PRINTX$;:INPUT"";X
400 IFX>XHTHENPRINT"TOO HIGH!":GOTO
    390
410 IFX<XLTHENPRINT"TOO LOW!":GOTO3
    90
420 PRINT:RETURN
430 REM ROUND & FORMAT MONEY:
440 Z=.01*INT(X*100+.5)+.001
450 Z$=STR$(Z):Z$=LEFT$(Z$,LEN(Z$)-
    1)
460 Z$=RIGHT$("          $"+Z$,14)
470 RETURN
480 REM ANSWER YES-OR-NO
490 REM PRESET X$
500 PRINTX$;:INPUT"";Z$:PRINT
510 Z$=LEFT$(Z$,1)
520 IFZ$="Y"THENOK=1:RETURN
530 IFZ$="N"THENOK=0:RETURN
540 PRINT"PLEASE ANSWER 'Y' OR 'N'.
    ":GOTO500
550 REM INITIALIZATION
560 FORK=1TO24:PRINT:NEXT
570 PRINTTAB(12)"LEASE WITH OPTION ~
    TO BUY."
580 PRINTTAB(12)"BY: KEITH FALKNER ~
    - 1981."
590 PRINT:PRINT:PRINT
600 X$="SKIP INSTRUCTIONS? ":GOSUB4
    80
610 IFOKGOTO750
620 PRINT:PRINT"YOU ARE LEASING AN ~
```

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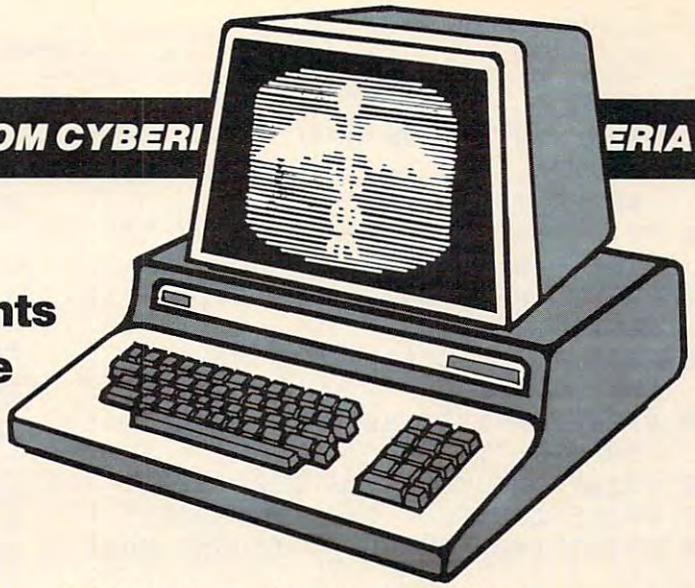

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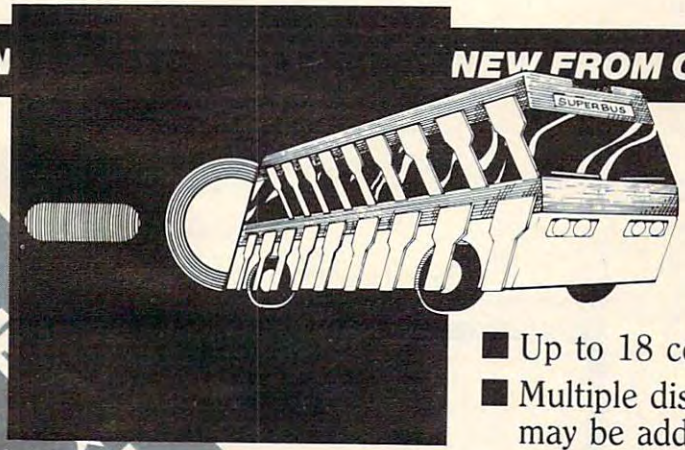

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```
    ITEM FOR A TERM OF"
630 PRINT"6, 12, 24, OR 36 MONTHS. ~
     AFTER THAT,"
640 PRINT"THE CUSTOMER CAN BUY THE ~
    ITEM FOR SOME"
650 PRINT"FRACTION OF ITS PRICE.":P
    RINT
660 PRINT"I CALCULATE THE MONTHLY P
    AYMENT."
670 PRINT:PRINT"I NEED TO KNOW SOME
     THINGS:":PRINT
680 PRINT"THE VALUE OF THE ITEM."
690 PRINT"THE COST OF INSURANCE."
700 PRINT"THE MONTHLY INTEREST RATE
    ."
710 PRINT"THE LENGTH OF THE TERM."
720 PRINT"THE LOCAL SALES TAX RATE.
    "
730 PRINT"THE PURCHASE FRACTION."
740 PRINT
750 X$="STANDARD SET-UP? ":GOSUB480
760 REM HERE IS THE STANDARD SETUP:
770 I=.02:REM 2% INSURANCE
780 R=.025:REM 2.5% / MONTH
790 S=.04:REM 4% FLORIDA TAX
800 IFOKGOTO900
810 PRINT"WHAT FRACTION OF THE ITEM
    'S VALUE IS"
820 PRINT"CHARGED EACH YEAR FOR INS
    URANCE?"
830 XL=0:XH=.2:X$="INSURANCE: ":GOS
    UB370:I=X
840 PRINT"WHAT IS THE MONTHLY INTER
    EST RATE?"
850 PRINT"(EXAMPLE: ENTER 3% AS .03
    )"
860 XL=.001:XH=.05:X$="INTEREST:  "
    :GOSUB370:R=X
870 PRINT"WHAT IS THE SALES TAX PER
    CENT?"
880 PRINT"(EXAMPLE: ENTER 8% AS .08
    )"
890 XL=0:XH=.3:X$="SALES TAX: ":GOS
    UB370:S=X
900 PRINT:PRINT"WHAT IS THE ITEM'S ~
    VALUE?"
910 XL=50:XH=50000:X$="VALUE      $"
    :GOSUB370:V=X
920 PRINT:PRINT"HOW MANY MONTHS? (6
     OR 12 OR 24 OR 36)"
930 XL=6:XH=36:X$="MONTHS:    ":GOSU
    B370:T=X
940 IFT=6ORT=12ORT=24ORT=36GOTO960
950 PRINT"I CAN'T HANDLE THAT!":GOT
    O920
960 PRINT"WHAT FRACTION OF THE ORIG
    INAL PRICE"
970 PRINT"WILL BUY THE ITEM AFTER T
    HE LEASE?"
980 XL=0:XH=.75:X$="FRACTION: ":GOS
    UB370:D=X
990 F=1+R:PRINT:PRINT"OK, HERE WE G
    O!":PRINT:RETURN
```

Program 2: Atari Version

```
105 DIM Z$(20),T$(20),X$(30)
300 PRINT :PRINT "MONTHLY PAYMENT IS ...
";:POKE 85,25:PRINT Z$
330 PRINT "PRICE WILL BE ...";:POKE 85,2
5:PRINT Z$
350 PRINT "TAX INCLUDED, THAT'S ...";:PO
KE 85,25:PRINT Z$
390 PRINT X$;:INPUT X
450 Z$=STR$(Z):IF LEN(Z$)>1 THEN Z$=Z$(1
,LEN(Z$)-1)
460 T$=Z$:Z$="          $":Z$(LEN(Z$)+1)=
T$:Z$=Z$(1,14)
500 PRINT X$;:INPUT X
510 Z$=Z$(1,1)
570 POKE 85,12:PRINT "LEASE WITH OPTION
TO BUY."
580 POKE 85,12:PRINT "BY: KEITH FALKNER
- 1981"
```

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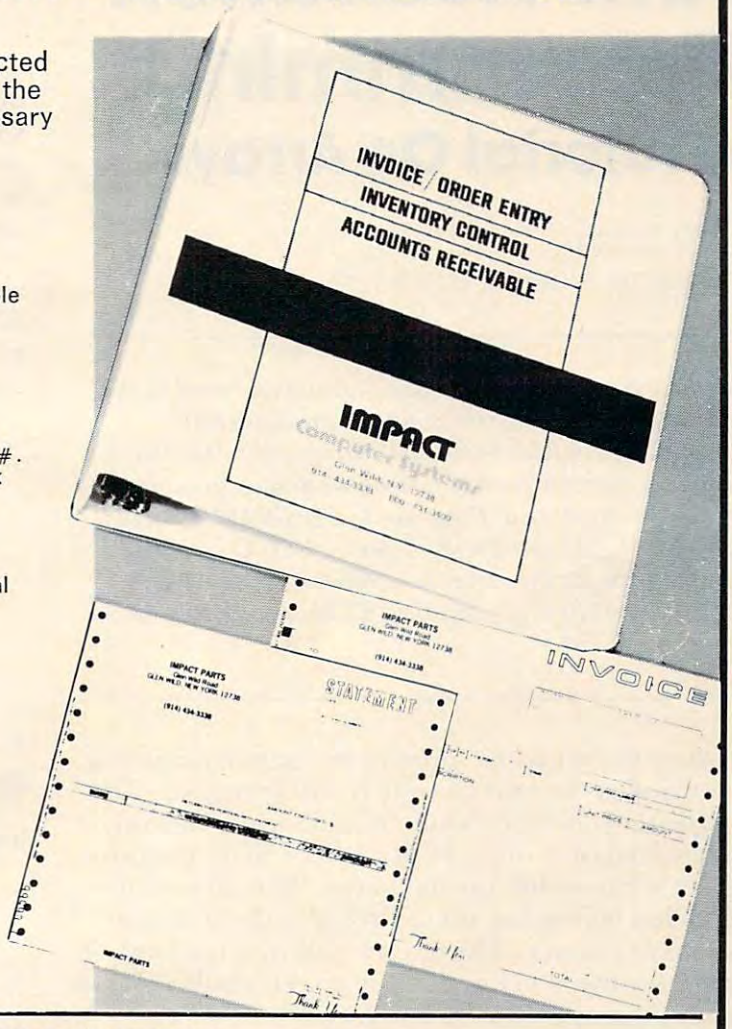

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Anti-Hesitation Programming:
A Tutorial On Arrays

M. R. Smith
Calgary, Alberta, Canada

Editor's Note: The delays discussed and corrected in this article are a problem common to Microsoft BASICs (Apple, PET/CBM, OSI, etc.). Because the Atari has a different variable storage format, no hesitation is observed using the structure of Program 1. Atari BASIC, though, is similar to Microsoft with respect to GOTO — it searches the program for the target from top to bottom. And the time-saving effect of relocating REMs can be seen on the Atari. — RTM

Have you ever had a series of hesitations or pauses occuring at the start of your BASIC program? It is particularly obvious when using loops or subroutines. First time into a FOR...NEXT loop, the program seems to hiccup and pause. Thoughts of the dreaded *infinite loop* occur, but then the program seems to recover. The second time into the loop, the response is so fast that the screen smokes. What causes this alteration in behaviour?

To demonstrate the effect, enter and run Program 1:

```
 1 REM PROGRAM #1
20 PRINT "LINE 20" : DIM A(500), B(500), C(500)
30 PRINT "LINE 30"
40 FOR H =1 TO 5: I =1
50 J = 1 : K = 1: PRINT "LINE 50"
60 NEXT I
70 FOR I = 1 TO 5: PRINT "LINE 70"
80 L = 1 : M = 1: P = 1 : PRINT "LINE 80"
90 NEXT I : STOP
```

You'll notice a pause between line 20 and line 30. More pauses occur before lines 50 and 80. However, the next four times that the program gets to these lines, there is no pause.

On adding just one statement, line 10, to this program, you'll notice a real difference.

```
 1 REM PROGRAM #2
10 H = 0 : I = 0 : J = 0 : K = 0 : REM INITIALIZE
   VARIABLES
20 PRINT "LINE 20" : DIM A(500), B(500), C(500)
30 PRINT "LINE 30"
40 FOR H = 1 TO 5 : I = 1
50 J = 1 : K = 1 : PRINT "LINE 50"
60 NEXT I
70 FOR I = 1 TO 5 : PRINT "LINE 70"
80 L = 1 : M = 1 : P = 1 : PRINT "LINE 80"
90 NEXT I : STOP
```

In this version, the pause before line 50 has disappeared. This change occurs because the simple variables, H, I, J and K, are names in line 10 of the program. This means that these variables are used before any of the arrays, A(500), B(500), C(500) are made.

To explain why all this is occurs, you have to understand how a BASIC interpreter stores things in the computer memory. In the middle of a program (say line 90 of Program 1), memory is split up like this:

```
----------BOTTOM
PROGRAM
----------
SIMPLE VARIABLES
----------
ARRAYS
----------
UNUSED
----------
CHARACTER ARRAYS
----------TOP
```

For each variable, array or string used in the program, there is a definite place reserved in memory.

Before we ran the program, things looked a lot simpler.

```
----------BOTTOM
PROGRAM
----------
UNUSED
----------TOP
```

After line 20 in Program 1, things were different yet again.

```
----------BOTTOM
PROGRAM
----------
A(500)
B(500)              ARRAYS
C(500)
----------
UNUSED
----------TOP
```

The first pause in the program, before line 30, occurred while the arrays were being set up. The second pause occurred when the variables H and I were used for the first time. After line 40, the memory allocation was like this.

```
----------BOTTOM
PROGRAM
----------
H
I            SIMPLE VARIABLES
----------
A(500)
B(500)       ARRAYS
```

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SYSTEM "ASSIGN 1 BASICIN"
Redirects input from keyboard to disk file named BASICIN.

LEGEND 1, "First," "Second"
Relegends function keys 1 and 2 to read "First" and "Second".

LTPEN F, X, Y
Sets F = 1 and X, Y to coordinates when lightpen picks a point.

GRIN NW$, X, Y
Displays crosshair and inputs X, Y location of its final position; NW$ contains the exit key.

DRAW .0645, 3*Y
Draw a vector from current location of graphic cursor to specified coordinates.

LIB "VGL," "IGL"
Select library extensions to be linked to BASIC.

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```
C(500)
----------
UNUSED
---------- TOP
```

To make room for the variable H, the BASIC interpreter had to first move the arrays A( ), B( ) and C( ) higher up in memory. Then it had to move these arrays again to find room for variable I. During line 50, the arrays needed to be moved twice more; first for variable J and then to place variable K. All this movement caused the second pause. The more there is to move and the more variables there to place, the longer the pause will be.

The second time around in the FOR...NEXT loop, places for the variables H to J were already available in memory, so no more pauses occurred. The pauses, however, started again when the arrays had to be moved three times to provide room for the variables L, M and P in line 80.

In BASIC, each time a simple variable is used for the first time, all the arrays then in existence have to be moved up in memory. This causes a pause in the execution of the program. If a large number of variables is introduced, these pauses can accumulate into a sizeable delay. To avoid the pauses, we have to initialize (that means establish) all simple variables before we introduce any arrays.

To understand how this improves things, consider the memory after line 20 in Program 2. It looked like this:

```
---------- BOTTOM
PROGRAM
----------
H
I              SIMPLE VARIABLES
J
K
----------
A(500)
B(500)         ARRAYS
C(500)
----------
UNUSED
---------- TOP
```

This is very different to the appearance of the memory after line 20 of Program 1. When the program reaches line 40, the variables H to J will have already been fitted into memory, so that the arrays will not need to be moved. Therefore the pauses will vanish. At line 80, new variables will again have to be placed in memory, which means a pause while all the arrays move over. You can see the advantage of predefining all the simple variables before the arrays.

Systematic Initialization

Taking a systematic approach to the initialization of variables in a program can prevent a lot of problems. Program 2, rewritten for systematic initialization, might look something like this:

```
 1 REM PROGRAM #2 NEW
10 GOSUB 60000 : REM DO INITIALIZATION
20 PRINT "LINE 20
30 PRINT "LINE 30
40 FOR H = 1 TO 5 : I = 1
50 = 1 : K = 1 : PRINT "LINE 50"
60 NEXT I
70 FOR I = 1 : PRINT "LINE 50"
60 NEXT I
70 FOR I = 1 TO 5 : PRINT "LINE 70"
80 L = 1 : M = 1 : P = 1 : PRINT "LINE 80"
90 NEXT I : STOP
59990 REM
60000 REM INITIALIZE SIMPLE VARIABLES
60010                    REM VARIABLES A - E
60020 H = 0 : I = 0 : J = 0 : REM VARIABLES F - J
60030 K = 0 : L = 0 : M = 0 : REM VARIABLES K - O
60040 P = 0                 : REM VARIABLES P - T
60050                       REM VARIABLES U - Z
60100 REM INITIALIZE ARRAYS
60110 DIM A(500), B(500), C(500)
60200 RETURN
```

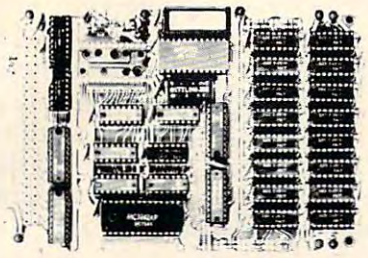
This does seem to overdo things for such a short program, but this approach does have advantages for long programs.

1) Use a subroutine for initialization.

There is an obscure advantage of doing initialization using a subroutine. You could put equivalent statements to 60000 - 60200 at the beginning of a program. The advantage lies in the way that the BASIC interpreter handles GOSUB and GOTO commands. When a GOSUB command occurs, most BASIC interpreters skip to the beginning of the program. They then look at every line number (including those of REM statements) trying to find the line number wanted. Suppose that statements which are used only once in a program are placed at its start. There would be a tremendous waste of time while the interpreter unsuccessfully looks at these lines each time it searches for the line number it wants. Placing these lines at the end of the program makes for a great and simple way of speeding up your programs. This is particularly true when a GOTO command is issued from the middle of a FOR...NEXT loop near the end of the program.

The effect can be demonstrated by using the following program.

```
 1 REM PROGRAM #3
10 PRINT "LINE 10"
20 REM
30 REM
.....keep inserting statements until you have about
    40 REM's
430 REM
440 FOR J = 1 TO 2500
450 GOTO 470
460 GOTO 480
```



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```
470 GOTO 460
480 NEXT J
490 PRINT "490"
```

This is a short timing loop involving three interlinked GOTO statements. Measure the time it takes for the program to go between the two PRINT statements using the second hand of your watch. Now remove the REM statements and place them at the end of your program. Time again and notice the difference.

On my APPLE, the timing was 28 seconds with the REM's at the beginning compared to eight seconds with the REM's at the end. Quite a time saving. Shifting the initialization statements of your program can have the same effect. This also works the other way. If you have a subroutine that you use often, then place that at the beginning of the program. That way the BASIC interpreter can find it quickly.

2) List the variables in groups.

The main advantage of grouping the variables (A to E, F to I, etc.) on separate lines is that it becomes easy to determine if a variable has already been used.

It is not as obvious as you might think to determine whether or not a variable has already been used in a program. Consider a long program which uses variable YES at its beginning, and variable YEAR near its end. Many BASIC interpreters consider (since these two variables have the same two starting letters) that they must both be equal to the variable YE. This means that, although you intended the two variables to be different, they are actually being treated as the same game by the interpreter. Spotting a conflict like this can absorb a lot of time. However, if you put all variables in one location, then you are more likely to spot possible conflicts in names.

Declaring (initializing) all the variables at the beginning of a program can decrease the number of strange pauses in the middle of a program. It also decreases the chance of accidentally getting two independent variables with the same name. ©

How Random Are Sequences Of Random Numbers?

Brian J. Flynn
Vienna, VA

Chance is a word void of sense; nothing can exist without a cause. — Voltaire

Editor's Note: RND is one of the more intriguing aspects of computers: how do you generate accidents in a world dedicated to logic? Though Mr. Flynn analyzes the TRS-80 RND here, his approach and methods are applicable to any RND analysis. — RM

You turn on a Model I TRS-80 and key in "PRINT RND (0)." The response is ".768709." You key in the same command. The response this time is ".781397." You do this again, and again, and again. Using a FOR NEXT loop, suppose you generate a "random" sequence of 1,000 numbers. Or perhaps you generate 10,000. Or maybe even 100,000. Have you ever wondered how such "random" sequences of numbers are?

Before performing a statistical experiment a short while ago, I wanted to make sure the TRS-80's random number generator was a good one. So I examined its degree of randomness using a few popular statistical tests and a few common sense indicators.

But before discussing these, first note that the phrase "a random number" is used popularly to denote a member of a "random sequence" of figures. Strictly speaking, however, the adjective "random" should modify only "sequence," unless we happen to be concerned with the digits which comprise a number. This is because 0.768709 is not any more or any less random than 0.5 or 0.372 or any other positive fraction. Each occurs with zero probability in the selection of one number from the infinitely dense continuum of fractions from 0 to 1.

Executions of RND (0) on the TRS-80 generate rational numbers between 0 and 1, inclusive. "Rational," in this case, does not mean *sensibility*, but rather means that the fraction is expressible as a ratio of two integers. For instance, 0.625 is equivalent to 5/8. And the "ratio-nal" number 0.768709, from above, equals 768709 divided by one million. Fractions generated by RND (0) are supposed to be distributed in roughly uniform fashion as in Figure 1. Almost as many fractions should fall between 0 and 0.1 as between 0.1 and 0.2, and so on.

How close to uniformity are distributions of TRS-80 fractions? From machine-off to machine-on position, 100,000 executions of RND (0) generate the spread shown in Table 1. Non-TRS-80 owners may want to use the BASIC program listed here to see how well the random number generators on their machines compare.

The distribution in Table 1 is highly, but not perfectly, uniform. Less than perfect uniformity, however, is desirable. For if exactly 10,000 figures fell into each category, then the mechanism that generated this spread would seem awfully mechanical, too good to be true. While a good random number generator may father a perfectly uniform distribution, the probability of this is very low.

Just how close to uniformity should the distribution of fractions be? The chi (pronounced "ki") square goodness-of-fit statistic provides an answer:

$$X^2 = \sum_{i=1}^{k} \frac{(0_i - E_i)^2}{E_i}$$

is the Greek capital letter sigma, for sum; k is the number of categories, also called cells or intervals; 0_i is the number of fractions observed in the i^{th} interval; and E_i is the number expected. In our case, $K = 10$ and $E_i = 100{,}000/10 = 10{,}000$.

Let's reveal the mystery of the formula. First, $0_i - E_i$ is the deviation of the expected from the actual number of observations for category "i." Next, this deviation is squared because $(0_i - E_i) = 0$. Finally, the squared deviation is divided by E_i to give equal importance to each category in cases where the E_i's are different from one another. To clarify this last point, let $E_1 = 500$ and $E_2 = 1{,}000$ for the two-interval case. If 0_1 and 0_2 are 10% higher than E_1 and E_2, respectively, then $(0_1 - E_1)^2 = (550-500)^2 = 2{,}500$ and $(0_2 - E_2)^2 = (1{,}100-1{,}000)^2 = 10{,}000$. The second squared deviation is four times the first. Now, weighting each squared deviation relative to expected number, $(0_1 - E_1)^2/E_1 = 2{,}500/500 = 5$ and $(0_2 - E_2)^2/E_2 = 10{,}000/1{,}000 = 10$. The second term is now only twice as large as the first, just as E_2 is twice as large as E_1.

$X^2 = 12.07$ for 100,000 executions of RND (0), grouped into 10 cells. As Figure 2 shows, 10% of all values in a chi-square distribution with nine degrees of freedom (number of cells minus one) are less than 4.2 and 10% are greater than 14.7. Our value does not fall within either of these ex-

treme percentiles. The sequence of fractions cannot, therefore, be accused of non-randomness on the basis of this test alone.

One test, however, is not conclusive evidence of randomness. The X^2 test performed on 100,000 numbers may suggest global randomness while hiding locally non-random behavior. For example, the distribution of the first 500,000 numbers generated by RND (0) may be skewed towards 0 while the distribution of the second 50,000 is skewed towards 1. The two distributions added together may appear uniform. To uncover such deception, the X^2 test is performed on each successive block of 10,000 fractions, and on each cumulative block. Table 2 shows that the TRS-80 random number generator produces an acceptable X^2 value in each case examined.

Batteries of statistical tests such as the chi-square will never prove that a random number generator is a good one, however. But they may diminish doubt, for each passed test boosts confidence in the quality of the generator. To strengthen or shatter this faith, sequences of TRS-80 fractions are now "RUNS" tested.

Let's explain this procedure using a list of Presidents of the United States and their political parties. We start with Franklin Pierce to avoid the Whigs and Federalists before him.

PRESIDENT		PRESIDENT	
Franklin Pierce	D	Woodrow Wilson	D
James Buchanan	D	Warren G. Harding	R
Abraham Lincoln	R	Calvin Coolidge	R
Andrew Johnson	R	Herbert Hoover	R
Ulysses S. Grant	R	Franklin D. Roosevelt	D
Rutherford B. Hayes	R	Harry S. Truman	D
James A. Garfield	R	Dwight D. Eisenhower	R
Chester Alan Arthur	R	John F. Kennedy	D
Grover Cleveland	D	Lyndon B. Johnson	D
Benjamin Harrison	R	Richard M. Nixon	R
Grover Cleveland	D	Gerald R. Ford	R
William McKinley	R	Jimmy Carter	D
Theodore Roosevelt	R	Ronald Reagan	R
William Howard Taft	R		

Are Democrats (D) and Republicans (R) randomly distributed here? Notice the string of six Republicans from Lindoln to Arthur. And notice that Grover Cleveland appears twice! Let's compare your guess to the probabilistic answer of the Runs Test. We first count the number of runs of Democrats or Republicans:

DD	RRRRRR	D R D	RRR	D	RR	DD	R	DD	RR	D	R
1	2	3 4 5	6	7	8	9	10	11	12	13	14

A run is a succession of identical symbols followed and preceded by the opposite symbol, or by no symbol at all. There are 14 runs in our sequence. The essence of the Runs Test is to determine if this number is "too many," or "too few," or "about right." "Too many" runs is best exemplified by a sequence where Democrats and Republicans perpetually alternate: D R D R D R ... and so on. It is highly unlikely that a random sequence will follow a pattern so mechanical. "Too few" runs, on the other hand, is exemplified in its most grievous form by a sequence of all Democrats or all Republicans: R R R R R R ... and so on. Again, it is highly unlikely that a random sequence will display this. The Runs Test formula (reference 2) is:

$$z = \frac{\left| \frac{2n_1n_2}{N} - R \right| + c}{\sqrt{\frac{2n_1n_2}{N} \times \frac{2n_1n_2 - N}{N^2 - N}}}$$, where

n_1 = the number of Democrats
n_2 = the number of Republicans
$N = n_1 + n_2$
R = the number of runs

This leaves "c," which is Yates' factor to make z's distribution better approximate a normal curve. Specifically,

$c = +0.5$ if $R < 2n_1n_2/N$ and $c = -1.5$ if $R > 2n_1n_2/N$

Actually, the z-formula is supposed to be used only if n_1 and/or n_2 is more than 20; a special table is used otherwise. For our example, however, the table and the formula give the same result. We march with z to demonstrate its use.

In calculating z, first note that $2n_1n_2/N = 2*10*17/27 = 12.5926$. With $R = 14$, $c = -1.5$. Therefore:

$$z = \frac{\left| \frac{2*10*17}{27} - 14 \right| - 1.5}{\sqrt{\frac{2*10*17}{27} * \frac{2*10*17-27}{27*27-27}}} = -0.04.$$

We reject with 95% confidence the assumption that a sequence is random whenever $z = 1.96$ or more. Since our calculated value is less than this, the Runs Test won't allow us to call the sequence of political parties non-random.

To "Runs" test a sequence of fractions, replace the "D's" and "R's" with "+'s" and "–'s." A "–" denotes a fraction below the expected median, 0.5, and a "+" denotes a fraction above it. For example, [.3 .7 .1 .2 .6] becomes [– + – – +]. Executing the Runs Test on 100,000 TRS-80 fractions, and on blocks therein, gives the results shown in Table 2. Each sequence appear random.

The computer program also generates four

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descriptive statistics useful in evaluating degree of randomness: mean and variance of the fractions, and covariance and correlation coefficient of successive fractions. The expected mean is 0.5, or the midpoint of the uniform distribution of Figure 1. The expected variance is 1/12; this can be derived using a bit of integral calculus. Finally, the remaining two statistics are expected to be zero since the elements of our sequence of numbers are supposed to be independent. Table 3 shows results for the first three statistics. All conform very closely to expectations.

The X^2 test, the Runs Test, and a small battery of descriptive statistics suggest that RND (0) is a decent random number generator. But our evidence can never be conclusive, and the next test that we subject the generator to may be the one that it fails. So:

> Be not too presumptuously sure in any business; for things of this world depend on such a train of unseen chances that if it were in man's hands to set the tables, still he would not be certain to win the game.
>
> Herbert

References:

1. **Knuth, Donald E.** *The Art of Computer Programming.* Vol. 2. Reading: Addison-Wesley Publishing Company, 1971.
2. **Langley, Russell.** *Practical Statistics Simply Explained.* New York: Dover Publications, Inc., 1970.

TABLE 1
Distribution Of The First 100,000 Fractions Generated By RND (0)

INTERVAL	TALLY	% OF TOTAL
0.1	9969	9.97
0.1 to <0.2	10084	10.08
0.2 to <0.3	9980	9.98
0.3 to <0.4	9904	9.90
0.4 to <0.5	9985	9.99
0.5 to <0.6	10099	10.10
0.6 to <0.7	10098	10.10
0.7 to <0.8	9938	9.94
0.8 to <0.9	9774	9.77
0.9	10169	10.17

Uniform Distribution Between 0 And 1

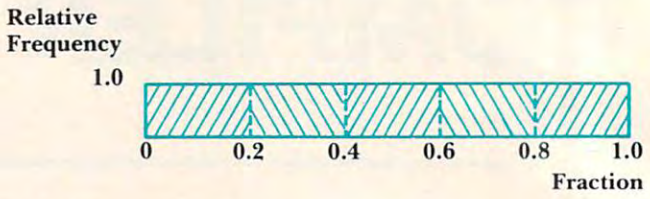

Figure 1.

Table 2. Test Results

Cumulative Number Of Fractions Generated	X^2 Values Block	X^2 Values Cumulative	"RUNS" Values Block	"RUNS" Values Cumulative
10,000	13.87	13.87	1.34	1.34
20,000	10.16	14.14	0.19	0.80
30,000	7.20	6.71	0.03	0.69
40,000	4.23	8.55	0.03	0.58
50,000	4.99	6.21	1.50	0.16
60,000	11.59	10.06	1.47	0.75
70,000	5.51	9.77	0.63	0.46
80,000	5.35	12.33	0.85	0.73
90,000	12.19	10.87	1.40	1.18
100,000	5.26	12.07	0.21	1.05

Table 3. Descriptive Statistics

Cumulative Number of Fractions Generated	Mean Block	Mean Cumulative	Variance Block	Variance Cumulative	Covariance Block	Covariance Cumulative
Expected Values	0.500		0.083		0.000	
10,000	0.498	0.498	0.085	0.085	-0.001	-0.001
20,000	0.499	0.499	0.083	0.084	0.001	-0.000
30,000	0.499	0.499	0.083	0.084	-0.001	-0.000
40,000	0.499	0.499	0.083	0.083	0.001	-0.000
50,000	0.502	0.500	0.083	0.083	-0.000	-0.000
60,000	0.503	0.500	0.083	0.083	0.001	0.000
70,000	0.504	0.501	0.084	0.083	-0.001	-0.000
80,000	0.501	0.501	0.084	0.084	0.001	-0.000
90,000	0.496	0.500	0.084	0.084	0.001	0.000
100,000	0.501	0.500	0.083	0.083	-0.000	0.000

Chi-Square Distribution With 9 Degrees Of Freedom

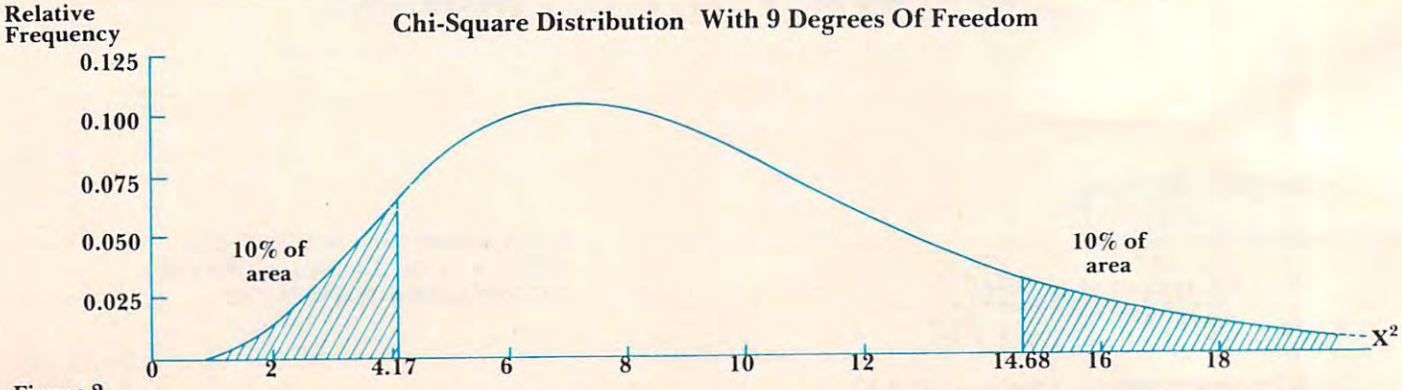

Figure 2.

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Program 1.

```
10  REM EXAMINING THE RANDOMNESS OF A SEQUENCE OF FRACTIONS
20  REM CHI-SQUARE TEST, RUNS TEST, DESCRIPTIVE STATISTICS
30  REM BRIAN J. FLYNN; WINTER 1980/81
40  REM MOD 1: INITIALIZE
50  GOSUB 1000
60  REM MOD 2: GENERATE RANDOM NUMBERS & TALLY STATISTICS
70  GOSUB 2000
80  REM MOD 3: PRINT DISTRIBUTION OF FRACTIONS
90  GOSUB 3000
100 REM MOD 4: PRINT TEST STATISTICS
110 GOSUB 4000
120 REM MOD 5: PRINT DESCRIPTIVE STATISTICS
130 GOSUB 5000
140 END
```

```
1000 REM MODULE 1
1010 REM VARIABLES
1020   REM NOTE: 'BLK' MEANS 'BLOCK.' 'CUM' MEANS 'CUMULATIVE.'
1030   REM        FOR EVERY 'BLK,' THERE IS A 'CUM' ANALOGUE.
1040   REM        N = TOTAL NUMBER OF FRACTIONS TO GENERATE
1050   REM        B = NUMBER OF FRACTIONS PER BLOCK
1060   REM        K = NUMBER OF CELLS FOR CHI-SQUARE TEST
1070   REM QBLK( ) = VECTOR OF CELL COUNTS
1080   REM        I = NUMBER OF FRACTIONS GENERATED
1090   REM       RN = RANDOM NUMBER
1100   REM     CELL = INTERVAL WHICH A FRACTION FALLS INTO
1110   REM     BBLK = NUMBER OF FRACTIONS FALLING BELOW 0.5
1120   REM     ABLK = NUMBER OF FRACTIONS FALLING ABOVE 0.5
1130   REM    SIGN$ = "-" OR "+" FOR FRACTION BELOW OR ABOVE 0.5
1140   REM     RBLK = NUMBER OF RUNS
1150   REM    SBLK$ = 'SIGN$' OF PREVIOUS FRACTION GENERATED
1160   REM SBLK(1) = SUM OF FRACTIONS
1170   REM SBLK(2) = SUM OF SQUARED FRACTIONS
1180   REM SBLK(3) = SUM OF PRESENT x PREVIOUS FRACTIONS
1190   REM     PBLK = VALUE OF PREVIOUS FRACTION
1200   REM    F$( ) = VECTOR OF OUTPUT FORMATS
1210   REM        L = LINE COUNT
1220   REM     XBLK = CHI-SQUARE STATISTIC
1230   REM     FBLK = CORRECTION FACTOR FOR RUNS TEST
1240   REM      NUM = NUMERATOR OF RUNS TEST STATISTIC
1250   REM      DEN = DENOMINATOR OF RUNS TEST STATISTIC
1260   REM     ZBLK = RUNS TEST STATISTIC
1270   REM       E1 = EXPECTED MEAN OF THE FRACTIONS
1280   REM       E2 = EXPECTED VARIANCE OF THE FRACTIONS
1290   REM       E3 = EXPECTED COVARIANCE OF SUCCESSIVE FRACTIONS
1300   REM       E4 = EXPECTED 1ST-ORDER SERIAL CORRELATION COEFFICIENT
1310   REM     MBLK = ACTUAL MEAN
1320   REM     VBLK = ACTUAL VARIANCE
1330   REM     CBLK = ACTUAL COVARIANCE
1340   REM     HBLK = ACTUAL CORRELATION COEFFICIENT
1350 REM # OF FRACTIONS, BLOCK SIZE, & # OF CHI-SQUARE CELLS
1360   DATA 100000,10000,10
1370   READ N,B,K
1380 REM EXPECTED VALUES
1390   DATA .5,.083,0,0
1400   READ E1,E2,E3,E4
1410 REM INITIALIZE
1420   DIM QBLK(K),QCUM(K)
1430   FOR J=1 TO K:QBLK(J)=0:QCUM(J)=0:NEXT
1440   FOR J=1 TO 3:SBLK(J)=0:SCUM(J)=0:NEXT
```

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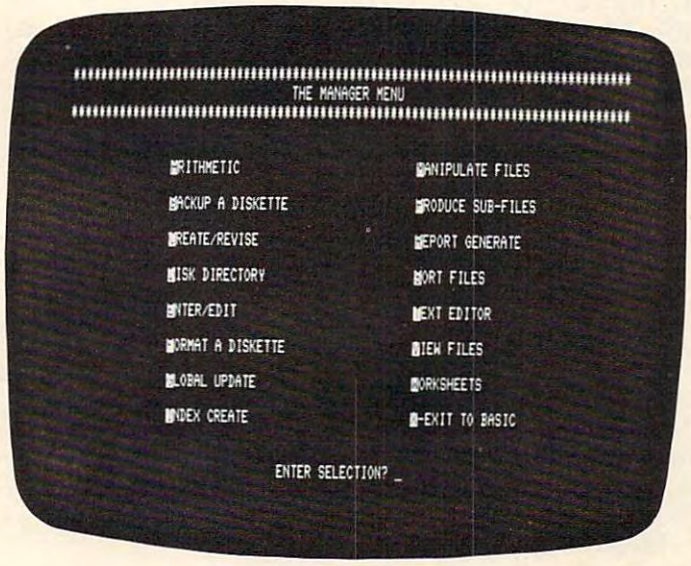

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```
1450   I=0:ABLK=0:ACUM=0:BBLK=0:BCUM=0:SBLK$=" ":SCUM$=" ":SIGN$=" "
1460   RBLK=0:RCUM=0:PBLK=0:PCUM=0
1470 REM HEADING
1480   CLS:PRINT TAB(7)"EXAMINING THE RANDOMNESS OF A SEQUENCE OF FRACTIONS"
1490   PRINT:PRINT"NOTES:"
1500   PRINT" 1. TOTAL NUMBER OF FRACTIONS TO GENERATE = ";N
1510   PRINT" 2. NUMBER TO PUT INTO EACH 'BLOCK'       = ";B
1520   PRINT" 3. NUMBER OF CELLS FOR CHI-SQUARE TEST   = ";K
1530   PRINT" 4. CHANGE LINE 1360 FOR DIFFERENT VALUES THAN THESE.
1540   PRINT
1550   PRINT"HIT 'ENTER' TO PROCEED."
1560   INPUT"READY ";Z
1570 RETURN
```

```
2000 REM MODULE 2
2010 REM RANDOM FRACTION
2020   CLS:PRINT"GENERATING FRACTIONS ...
2030   RN=RND(0):I=I+1
2040 REM CHI-SQUARE TALLY
2050   REM IDENTIFY THE CELL THAT THE FRACTION FALLS INTO
2060     CELL = INT(RN*K) + 1
2070   REM ADD TO CELL COUNT
2080     QBLK(CELL) = QBLK(CELL) + 1
2090     QCUM(CELL) = QCUM(CELL) + 1
2100 REM RUNS-TEST TALLY
2110   REM ADD TO COUNTS OF FRACTIONS FALLING BELOW/ABOVE MEDIAN
2120     IF RN<.5 THEN BBLK = BBLK + 1:BCUM = BCUM + 1:SIGN$ = "-"
2130     IF RN>.5 THEN ABLK = ABLK + 1:ACUM = ACUM + 1:SIGN$ = "+"
2140   REM ADD TO RUN COUNT, IF APPROPRIATE
2150     IF SIGN$ <> SBLK$ THEN RBLK = RBLK + 1
2160     IF SIGN$ <> SCUM$ THEN RCUM = RCUM + 1
2170   REM RECORD SIGN
2180     SBLK$ = SIGN$
2190     SCUM$ = SIGN$
2200 REM DESCRIPTIVE-STATISTICS TALLY
2210   REM SUM OF FRACTIONS
2220     SBLK(1) = SBLK(1) + RN
2230     SCUM(1) = SCUM(1) + RN
2240   REM SUM OF SQUARED FRACTIONS
2250     SBLK(2) = SBLK(2) + RN*RN
2260     SCUM(2) = SCUM(2) + RN*RN
2270   REM SUM OF CURRENT * PREVIOUS FRACTIONS
2280     SBLK(3) = SBLK(3) + RN*PBLK
2290     SCUM(3) = SCUM(3) + RN*PCUM
2300   REM PREVIOUS VALUE OF FRACTION NOW EQUALS CURRENT VALUE
2310     PBLK = RN
2320     PCUM = RN
2330 REM GENERATE ANOTHER FRACTION, IF APPROPRIATE
2340   IF I/B <> INT(I/B) THEN 2030
2350 RETURN
```

```
3000 REM MODULE 3
3010 REM FORMATS
3020   F$(1)="     NO. OF FRACTIONS IN 'BLOCK'       = ########"
3030   F$(2)="     NO. OF FRACTIONS IN 'CUMULATIVE' = ########"
3040   F$(3)="1. DISTRIBUTION OF FRACTIONS:"
3050   F$(4)="                                  BLOCK                    CUMULATIVE"
3060   F$(5)="     INTERVAL                TALLY  % OF TOT.        TALLY  % OF TOT.
3070   F$(6)="     ----------              -----  ----------       -----  ----------"
3080   F$(7)=">= #.### AND <#.###    #####     ###.##        #####     ###.##"
3090 REM HEADING
```

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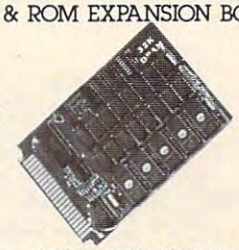

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```
3100   CLS
3110   LPRINT F$(3)
3120   LPRINT USING F$(1);B
3130   LPRINT USING F$(2);I
3140   LPRINT:LPRINT F$(4):LPRINT F$(5):LPRINT F$(6)
3150 REM DISTRIBUTION
3160   REM LINE COUNT
3170     L=7
3180   REM FIGURES
3190     FOR J=1 TO K
3210     LPRINT USING F$(7);(J-1)/K,J/K,QBLK(J),QBLK(J)*100/B,QCUM(J),QCUM(J)*10
0/I
3220     L=L+1
3230     NEXT J
3240     LPRINT:LPRINT:LPRINT
3250 RETURN
```

```
4000 REM MODULE 4
4010 REM FORMATS
4020   F$(3)="2. TEST STATISTICS:"
4030   F$(4)="     STATISTIC                BLOCK         CUMULATIVE"
4040   F$(5)="     ---------                -----         ----------"
4050   F$(6)="     CHI-SQUARE             ####.##           ####.##"
4060   F$(7)="     RUNS                   ####.##           ####.##"
4070 REM HEADING
4080   CLS
4090   LPRINT F$(3)
4100   LPRINT USING F$(1);B
4110   LPRINT USING F$(2);I
4120   LPRINT:LPRINT F$(4):LPRINT F$(5)
4130 REM CHI-SQUARE STATISTICS
4140   XBLK=0:XCUM=0
4150   FOR J=1 TO K
4160   XBLK = XBLK + (QBLK(J)-B/K)*(QBLK(J)-B/K)/(B/K)
4170   XCUM = XCUM + (QCUM(J)-I/K)*(QCUM(J)-I/K)/(I/K)
4180   NEXT J
4190   LPRINT USING F$(6);XBLK,XCUM
4200 REM RUNS-TEST STATISTICS
4210   REM YATES' FACTORS TO BETTER APPROXIMATE  A NORMAL DISTRIBUTION
4220     FBLK=0:FCUM=0
4230     IF RBLK < 2*ABLK*BBLK/B THEN FBLK = .5
4240     IF RBLK > 2*ABLK*BBLK/B THEN FBLK = -1.5
4250     IF RCUM < 2*ACUM*BCUM/I THEN FCUM = .5
4260     IF RCUM > 2*ACUM*BCUM/I THEN FCUM = -1.5
4270   REM STATISTICS
4280     NUM = ABS(2*ABLK*BBLK/B - RBLK) + FBLK
4290     DEN = SQR((4*ABLK*ABLK*BBLK*BBLK-2*B*ABLK*BBLK)/(B*B*B-B*B))
4300     ZBLK = NUM/DEN
4310     NUM = ABS(2*ACUM*BCUM/I - RCUM) + FCUM
4320     DEN = SQR((4*ACUM*ACUM*BCUM*BCUM-2*I*ACUM*BCUM)/(I*I*I-I*I))
4330     ZCUM = NUM/DEN
4340     LPRINT USING F$(7);ZBLK,ZCUM
4350     LPRINT
4360 REM DEGREES OF FREEDOM
4370   LPRINT"     NOTE: DEGREES OF FREEDOM FOR CHI-SQUARE TEST =";K-1
4380   LPRINT:LPRINT:LPRINT
4390 RETURN
```

```
5000 REM MODULE 5
5010 REM FORMATS
5020   F$(3)="3. DESCRIPTIVE STATISTICS:"
```

```
5030   F$(4)="                                        COVARIANCE OF          SERIAL"
5040   F$(5)="                                          SUCCESSIVE     CORRELATION"
5050   F$(6)="    VALUES          MEAN     VARIANCE      FRACTIONS     COEFFICIENT"
5060   F$(7)="    ------          ----     --------      ---------     -----------"
5070   F$(8)="     ###.###      ###.###        ###.###          ###.###"
5080 REM HEADING
5090   CLS
5100   LPRINT F$(3)
5110   LPRINT USING F$(1);B
5120   LPRINT USING F$(2);I
5130   LPRINT:LPRINT F$(4):LPRINT F$(5):LPRINT F$(6):LPRINT F$(7)
5140 REM EXPECTED VALUES
5150   LPRINT"  EXPECTED";
5160   LPRINT USING F$(8);E1,E2,E3,E4
5170 REM MEANS
5180   MBLK = SBLK(1)/B
5190   MCUM = SCUM(1)/I
5200 REM VARIANCES & COVARIANCES
5210   VBLK = (SBLK(2)-SBLK(1)*SBLK(1)/B)/(B-1)
5220   VCUM = (SCUM(2)-SCUM(1)*SCUM(1)/I)/(I-1)
5230   CBLK = (SBLK(3)-SBLK(1)*SBLK(1)/B)/(B-1)
5240   CCUM = (SCUM(3)-SCUM(1)*SCUM(1)/I)/(I-1)
5250 REM SERIAL CORRELATION COEFFICIENT
5260   HBLK = CBLK/VBLK
5270   HCUM = CCUM/VCUM
5280 REM 'BLOCK' RESULTS
5290   LPRINT
5300   LPRINT"      BLOCK";
5310   LPRINT USING F$(8);MBLK,VBLK,CBLK,HBLK
5320   LPRINT"       BIAS";
5330   LPRINT USING F$(8);MBLK-E1,VBLK
    -E2,CBLK-E3,HBLK-E4
5340 REM 'CUMULATIVE' RESULTS
5350   LPRINT
5360   LPRINT"CUMULATIVE";
5370   LPRINT USING F$(8);MCUM,VCUM,
    CCUM,HCUM
5380   LPRINT"       BIAS";
5390   LPRINT USING F$(8);MCUM-E1,VCUM
    -E2,CCUM-E3,HCUM-E4
5400   FOR J=1TO 15:LPRINT:NEXT J
5410 REM RESET 'BLOCK' VARIABLES &
    GENERATE MORE FRACTIONS, IF
    APPROPRIATE
5420   IF I = N THEN 5460
5430   FOR J=1 TO K:QBLK(J) = 0:NEXT J
5440   ABLK=0:BBLK=0:SBLK$=" ":SBLK(1)
    =0:SBLK(2)=0:SBLK(3)=0:RBLK=0:PBLK
    =0
5450   GOSUB 2020 :GOSUB 3020 :GOSUB
    4020 :GOTO 5020
5460 RETURN
```

TELECOMMUNICATIONS

Getting Outside The Computer

Michael E. Day
Chief Engineer
Edge Technology

Getting a computer to communicate with the outside world is not an easy task. In fact, many of the "internals" of the typical computer are devoted to the task of converting information from or to a form that the computer can understand.

Sometimes attached equipment (peripherals) is designed to meet the computer part way. This helps to reduce the circuitry and/or work that the computer needs to convert the information into or out of a form it can understand.

Keyboards are sometimes set up this way. Other times, due to the complexity of the work involved, a large amount of the work must be done by the computer.

Monitors, for example, can cause some difficulty since, if the computer is spending too much time "servicing" the attached devices, too little time is left to run the program. An example of an extreme case of this is the SINCLAIR ZX80 which actually spends all of its time servicing the monitor and keyboard. Because of this, it must stop servicing the display in order to run a program (causing the display to go blank). The ZX81 cures this problem by having a slightly improved display service routine which gives the computer a little time to squeeze in the program.

In order to solve this problem, IC manufacturers came up with a "Video Controller" IC. This little chip (a computer in its own right!) does all the service work for the computer, and allows the computer to do more important things like running your program.

The UART

When the computer is to communicate over the phone line, the same problem occurs. The computer can spend a large amount of time doing the required work, or we can bring in another device to do it for the computer. This is called the UART (Universal Asynchronous Receiver Transmitter) or USART (Universal Synchronous / Asynchronous Receiver Transmitter) depending on which flavor you like.

A UART accepts information from the computer in a form which the computer understands and converts it to the form necessary to transmit the information out of the computer. Additionally, it accepts information sent to the computer and converts it to a form which the computer uses.

Inside the computer, we deal with data in a form called *byte*. When this is translated to the form it takes on the outside it becomes a *character*. A *byte* is made up of eight *bits*, with *bit* being the simplest form of data representation inside a computer. A bit consists of nothing more than an ON or OFF condition. When a computer is using the information it works with all eight bits of the byte at once. This is called *parallel* operation since eight bits are used simultaneously. Since each bit has two possible conditions (*on* or *off*) and since we are working with eight bits at once, this means that by using these bits together we can represent two to the eighth (256) possible conditions.

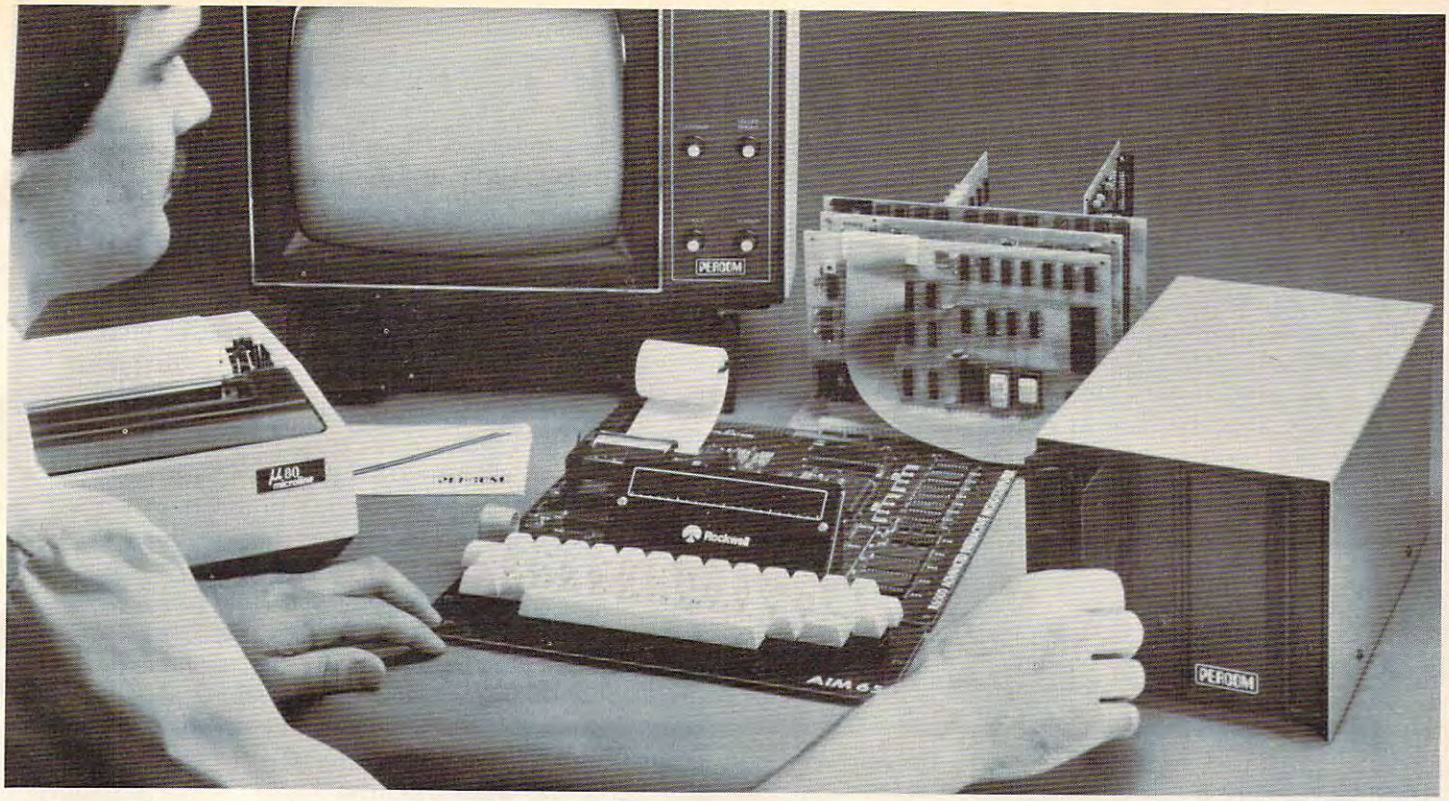
By taking some of these 256 states and defining them as representing something such as characters in the alphabet, we provide a means for the computer to work with information as we humans understand it.

Since the computer must know whether data is your information or its own, one of the bits is usually set aside to indicate this. This leaves us two to the seventh (128) possible things which we can represent as our own information. When using the computer to communicate to other equipment, the equipment generally requires certain "control codes" to perform some of its functions — returning the carriage on a printer or clearing the screen on a video terminal. Generally, 34 of the possible representations* are set aside for the purpose of controlling equipment. This leaves 94 possibilities left to represent all the characters in the alphabet (both uppercase and lowercase letters) the numbers (0 through 9) and some of the more commonly used symbols.

When we want to send this information over the phone lines, we run into a problem. The phone network is an entirely different environment, and is not at all compatible with computerized information.

Digital Into Audio

This is where the MODEM comes in. The MODEM changes the digital signals which the computer likes into the audio signals the phone network likes. (For this discussion we will assume that a BELL 103 compatible MODEM is being used in the originate mode.)



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  - Includes a motor inactivity time-out circuit.
  - Capable of handling up to four drives.
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- **Reliability assurance** – Drives are burned-in 48 hours, under operating conditions, to flag and remove any units with latent defects.
- **Full documentation** – Comprehensive hardware and software manuals are included with each system.

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System Requirements: AIM-65, KIM or SYM computer with expansion bus and four Kbytes RAM (min).

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When an *on* condition is sent to the MODEM, it transmits a 1270 Hz signal. When an *off* condition is sent to the MODEM, it transmits a 1070 Hz audio signal.

This allows us to send digital signals, but we still have a problem. The computer is dealing with 256 possible combinations at any one time, but the modem can only handle two conditions at any one time. This is what the UART is for. The UART takes a byte that the computer feeds it and breaks it down into bits that can be sent through the MODEM. In order to do this it takes the eight bits which make up the byte and transmits them one at a time. The timing of this is critical. The computer at the other end (the remote unit) that is receiving this information has to have some way to reconstruct this sequence back into the byte that the computer can understand. It must have a UART to do this. We can't just send the information whenever we feel like it.

Timing Is Critical

The first thing we have to do is define what a bit will be. This is defined as being an *on* or *off* condition for a specified period of time (This is referred to as the *bit time* or *bit rate*.) This way, the remote UART can know that, once it starts to receive the information, the first bit will be presented to it for one *bit time*. Then, the next bit will be presented to it for another *bit time*. This continues until the last bit has been sent.

We also must specify which bit is to be sent first. By taking the bits that make up a byte and labeling one of them as the Least Significant Bit (LSB), and another as the Most Significant Bit (MSB) we can define that we will send the LSB first followed by the next to the least significant bit until we reach the most significant bit which is the last one that gets sent. This allows the remote UART to know what order the bits are being sent and it can reconstruct a byte properly.

Since this is a time-dependent activity, we need to have a way to synchronize the two UARTs so that the one that is receiving the information is looking at the right bit at the right time. To do this, the UART adds an extra bit to the byte that is being sent called a *start bit*. When no information is being sent, the UART will send a continuous *on* signal to indicate that it is in an *idle* condition (sometimes referred to as a *marking* condition). When something is to be sent, the UART will send a single *off* bit to let the remote UART know that it should begin collecting bits.

Since the computer only uses seven bits to represent a character, the UART makes use of the eighth bit for itself. This is usually referred to as the *parity* bit. The parity bit is created by adding up the number of *on* bits in the character that is being sent and, if there are an even number of *on* bits in the character, the parity bit is turned *on*. If there is an odd number, it is turned off (assuming that the standard *even parity* convention is being used). This lets the remote UART know if the information sent was lost or damaged during transmission. The remote UART does this by adding up the *on* bits it receives and then compares this sum to the parity bit that the first UART sends it.

One Final Problem

Now we have only one final problem with which to deal. The remote UART knows that the transmission has begun when it receives the start bit, but what happens if the parity bit (which is the last bit sent) is an *off* bit like the start bit? The remote UART has to have some way of being able to recognize the next start bit. To do this, we have to insure that an *idle* condition always precedes the start bit so that there will always be an *on* condition prior to the *off* condition generated by the start bit. So, the UART adds one final bit to the information called the *stop bit*. The stop bit is always an *on* bit insuring that there is always an idle condition generated before the next is sent. This means that a sum total of ten bit times is required for the computer to send each character.

In the next column, I will discuss the interreaction of the UART and the computer with regard to timing.

* Note: the "space" as an alphabetic character does not exist. It is, in reality, a control function. It has come to be used and referred to as a *character* because it is simpler to represent this non-character condition in the context in which real characters are used. This is analogous to the number *zero* which is not really a number, but is used as one to represent the condition of nothingness. ©

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CARD GAMES

BRIDGE 2.0 (Available for all computers) — **Price: $17.95 Cassette/$21.95 Diskette**
An all-inclusive version of this most popular of card games. This program both BIDS and PLAYS either contract or duplicate bridge. Depending on the contract, your computer opponents will either play the offense OR defense. If you bid too high, the computer will double your contract! BRIDGE 2.0 provides challenging entertainment for advanced players and is an excellent learning tool for the bridge novice. See the software review in 80 Software Critique. Rated #1 by Creative Computing.

HEARTS 1.5 (Available for all computers) — **Price: $15.95 Cassette/$19.95 Diskette**
An exciting and entertaining computer version of this popular card game. Hearts is a trick-oriented game in which the purpose is not to take any hearts or the queen of spades. Play against two computer opponents who are armed with hard-to-beat playing strategies. HEARTS 1.5 is an ideal game for introducing the uninitiated (your spouse) to computers. See the software review in 80 Software Critique.

STUD POKER (Atari only) — **Price: $11.95 Cassette/$15.95 Diskette**
This is the classic gambler's card game. The computer deals the cards one at a time and you (and the computer) bet on what you see. The computer does not cheat and *usually* bets the odds. However, it sometimes bluffs! Also included is a five card draw poker betting practice program. This package will run on a 16K ATARI. Color, graphics, sound. See review in COMPUTE.

POKER PARTY (Available for all computers) — **Price: $17.95 Cassette/$21.95 Diskette**
POKER PARTY is a draw poker simulation based on the book, POKER, by Oswald Jacoby. This is the most comprehensive version available for microcomputers. The party consists of yourself and six other (computer) players. Each of these players (you will get to know them) has a different personality in the form of a varying propensity to bluff or fold under pressure. Practice with POKER PARTY before going to that expensive game tonight! Apple cassette and diskette versions require a 32 K (or larger) Apple II.

CRIBBAGE 2.0 (TRS-80 only) — **Price: $14.95 Cassette/$18.95 Diskette**
This is simply the best cribbage game available. It is an excellent program for the cribbage player in search of a worthy opponent as well as for the novice wishing to improve his game. The graphics are superb and assembly language routines provide rapid execution. See the software review in 80 Software Critique.

THOUGHT PROVOKERS

MANAGEMENT SIMULATOR (Atari, North Star and CP/M only) — **Price: $19.95 Cassette $23.95 Diskette**
This program is both an excellent teaching tool as well as a stimulating intellectual game. Based upon similar games played at graduate business schools, each player or team controls a company which manufacturers three products. Each player attempts to outperform his competitors by setting selling prices, production volumes, marketing and design expenditures etc. The most successful firm is the one with the highest stock price when the simulation ends.

FLIGHT SIMULATOR (Available for all computers) — **Price: $17.95 Cassette/$21.95 Diskette**
A realistic and extensive mathematical simulation of take-off, flight and landing. The program utilizes aerodynamic equations and the characteristics of a real airfoil. You can practice instrument approaches and navigation using radials and compass headings. The more advanced flyer can also perform loops, half-rolls and similar aerobatic maneuvers. Although this program does not employ graphics, it is exciting and very addictive. See the software review in COMPUTRONICS. Runs in 16K Atari.

VALDEZ (Available for all computers) — **Price: $15.95 Cassette/$19.95 Diskette**
VALDEZ is a computer simulation of supertanker navigation in the Prince William Sound/Valdez Narrows region of Alaska. Included in this simulation is a realistic and extensive 256 × 256 element map, portions of which may be viewed using the ship's alphanumeric radar display. The motion of the ship itself is accurately modelled mathematically. The simulation also contains a model for the tidal patterns in the region, as well as other traffic (outgoing tankers and drifting icebergs). Chart your course from the Gulf of Alaska to Valdez Harbor! See the software review in 80 Software Critique.

BACKGAMMON 2.0 (Atari, North Star and CP/M only) — **Price: $14.95 Cassette/$18.95 Diskette**
This program tests your backgammon skills and will also improve your game. A human can compete against a computer or against another human. The computer can even play against itself. Either the human or the computer can double or generate dice rolls. Board positions can be created or saved for replay. BACKGAMMON 2.0 plays in accordance with the official rules of backgammon and is sure to provide many fascinating sessions of backgammon play.

CHECKERS 3.0 (PET only) — **Price: $16.95 Cassette/$20.95 Diskette**
This is one of the most challenging checkers programs available. It has 10 levels of play and allows the user to change skill levels at any time. Although providing a very tough game at level 4-8, CHECKERS 3.0 is practically unbeatable at levels 9 and 10.

CHESS MASTER (North Star and TRS-80 only) — **Price: $19.95 Cassette/$23.95 Diskette**
This complete and very powerful program provides five levels of play. It includes castling, en passant captures and the promotion of pawns. Additionally, the board may be preset before the start of play, permitting the examination of "book" plays. To maximize execution speed, the program is written in assembly language (by SOFTWARE SPECIALISTS of California). Full graphics are employed in the TRS-80 version, and two widths of alphanumeric display are provided to accommodate North Star users. See review in onComputing.

LEM LANDER (32K Apple Disk only) — **Price: $16.95 Diskette**
Pilot your LEM LANDER to a safe landing on any of nine different surfaces ranging from smooth to treacherous. The game paddles are used to control craft attitude and thrust. This is a real-time high res challenge!

FOREST FIRE! (Atari only) — **Price: $16.95 Cassette/$20.95 Diskette**
Using excellent graphics and sound effects, this simulation puts you in the middle of a forest fire. Your job is to direct operations to put out the fire while compensating for changes in wind, weather and terrain. Not protecting valuable structures can result in startling penalties. Life-like variables are provided to make FOREST FIRE! very suspenseful and challenging. No two games have the same setting and there are 3 levels of difficulty.

NOMINOES JIGSAW (Atari, Apple and TRS-80 only) — **Price: $16.95 Cassette/$20.95 Diskette**
A jigsaw puzzle on your computer! Complete the puzzle by selecting your pieces from a table consisting of 60 different shapes. NOMINOES JIGSAW is a virtuoso programming effort. The graphics are superlative and the puzzle will challenge you with its three levels of difficulty. Scoring is based upon the number of guesses taken and by the difficulty of the board set-up. See review in ELECTRONIC GAMES.

MONARCH (Atari only) — **Price: $11.95 Cassette/$15.95 Diskette**
MONARCH is a fascinating economic simulation requiring you to survive an 8-year term as your nation's leader. You determine the amount of acreage devoted to industrial and agricultural use, how much food to distribute to the populace and how much should be spent on pollution control. You will find that all decisions involve a compromise and that it is not easy to make everyone happy.

CHOMPELO (Atari only) — **Price: $11.95 Cassette/$15.95 Diskette**
CHOMPELO is really two challenging games in one. One is similar to NIM; you must bite off part of a cookie, but avoid taking the poisoned portion. The other game is the popular board game REVERSI. It fully uses the Atari's graphics capability, and is hard to beat. This package will run on a 16K system.

SPACE LANES (Available for all computers) — **Price: $14.95 Diskette**
SPACE LANES is a simple but exciting space transportation game which involves up to four players (including the computer). The object is to form and expand space transportation companies in a competitive environment. The goal is to amass more net worth than your opponent. The economics include stock purchases and company mergers. Watch your wealth grow!

**ATARI, PET, TRS-80, NORTHSTAR, CP/M and IBM are registered tradenames and/or trademarks.*

***Except where noted, all model I software is available for the Model III. TRS-80 diskettes are not supplied with DOS or BASIC.*

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STARTREK 3.2 (Available for all computers) — **Price: $11.95 Cassette/$15.95 Diskette**
This is the classic Startrek simulation, but with several new features. For example, the Klingons now shoot at the Enterprise without warning while also attacking starbases in other quadrants. The Klingons also attack with both light and heavy cruisers and move when shot at! The situation is hectic when the Enterprise is besieged by three heavy cruisers and a starbase S.O.S. is received! The Klingons get even! See the software reviews in A.N.A.L.O.G., 80 Software Critique and Game Merchandising.

BLACK HOLE (Apple only) — **Price: $14.95 Cassette/$18.95 Diskette**
This is an exciting graphical simulation of the problems involved in closely observing a black hole with a space probe. The object is to enter and maintain, for a prescribed time, an orbit close to a small black hole. This is to be achieved without coming so near the anomaly that the tidal stress destroys the probe. Control of the craft is realistically simulated using side jets for rotation and main thrusters for acceleration. This program employs Hi-Res graphics and is educational as well as challenging.

SPACE TILT (Apple and Atari only) — **Price: $10.95 Cassette/$14.95 Diskette**
Use the game paddles to tilt the plane of the TV screen to "roll" a ball into a hole in the screen. Sound simple? Not when the hole gets smaller and smaller! A built-in timer allows you to measure your skill against others in this habit-forming action game.

MOVING MAZE (Apple and Atari only) — **Price: $10.95 Cassette/$14.95 Diskette**
MOVING MAZE employs the games paddles to direct a puck from one side of a maze to the other. However, the maze is dynamically (and randomly) built and is continually being modified. The objective is to cross the maze without touching (or being hit by) a wall. Scoring is by an elapsed time indicator, and three levels of play are provided.

ALPHA FIGHTER (Atari only) — **Price: $14.95 Cassette/$18.95 Diskette**
Two excellent graphics and action programs in one! ALPHA FIGHTER requires you to destroy the alien starships passing through your sector of the galaxy. ALPHA BASE is in the path of an alien UFO invasion; let five UFO's get by and the game ends. Both games require the joystick and get progressively more difficult the higher you score! ALPHA FIGHTER will run on 16K systems.

THE RINGS OF THE EMPIRE (Atari only) — **Price: $16.95 Cassette/$20.95 Diskette**
The empire has developed a new battle station protected by rotating rings of energy. Each time you blast through the rings and destroy the station, the empire develops a new station with more protective rings. This exciting game runs on 16K systems, employs extensive graphics and sound and can be played by one or two players.

INTRUDER ALERT (Atari only) — **Price: $16.95 Cassette/$20.95 Diskette**
This is a fast paced graphics game which places you in the middle of the "Dreadstar" having just stolen its plans. The droids have been alerted and are directed to destroy you at all costs. You must find and enter your ship to escape with the plans. Five levels of difficulty are provided. INTRUDER ALERT requires a joystick and will run on 16K systems.

GIANT SLALOM (Atari only) — **Price: $14.95 Cassette/$18.95 Diskette**
This real-time action game is guaranteed addictive! Use the joystick to control your path through slalom courses consisting of both open and closed gates. Choose from different levels of difficulty, race against other players or simply take practice runs against the clock. GIANT SLALOM will run on 16K systems.

TRIPLE BLOCKADE (Atari only) — **Price: $14.95 Cassette/$18.95 Diskette**
TRIPLE BLOCKADE is a two-to-three player graphics and sound action game. It is based on the classic video arcade game which millions have enjoyed. Using the Atari joysticks, the object is to direct your blockading line around the screen without running into your opponent(s). Although the concept is simple, the combined graphics and sound effect lead to "high anxiety".

GAMES PACK I (Available for all computers) — **Price: $10.95 Cassette/$14.95 Diskette**
GAMES PACK I contains the classic computer games of BLACKJACK, LUNAR LANDER, CRAPS, HORSERACE, SWITCH and more. These games have been combined into one large program for ease in loading. They are individually accessed by a convenient menu. This collection is worth the price just for the DYNACOMP version of BLACKJACK.

GAMES PACK II (Available for all computers) — **Price: $10.95 Cassette/$14.95 Diskette**
GAMES PACK II includes the games CRAZY EIGHTS, JOTTO, ACEY-DUCEY, LIFE, WUMPUS and others. As with GAMES PACK I, all the games are loaded as one program and are called from a menu. You will particularly enjoy DYNACOMP's version of CRAZY EIGHTS.

Why pay $7.95 or more per program when you can buy a DYNACOMP collection for just $10.95?

MOON PROBE (Atari and North Star only) — **Price: $11.95 Cassette/$15.95 Diskette**
This is an extremely challenging "lunar lander" program. The user must drop from orbit to land at a predetermined target on the moon's surface. You control the thrust and orientation of your craft plus direct the rate of descent and approach angle.

SPACE TRAP (Atari only, 16K) — **Price: $14.95 Cassette/$18.95 Diskette**
This galactic "shoot'em up" arcade game places you near a black hole. You control your spacecraft using the joystick and attempt to blast as many of the alien ships as possible before the black hole closes about you.

ADVENTURE

CRANSTON MANOR ADVENTURE (North Star and CP/M only) — **Price: $21.95 Diskette**
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Please specify 'TNT' versions when ordering.

ABOUT DYNACOMP

DYNACOMP is a leading distributor of small system software with sales spanning the world (currently in excess of 40 countries). During the past two years we have greatly enlarged the DYNACOMP product line, but have maintained and improved our high level of quality and customer support. The achievement in quality is apparent from our many repeat customers and the software reviews in such publications as COMPUTRONICS, 80 Software Critique and A.N.A.L.O.G. Our customer support is as close as your phone. It is always friendly. The staff is highly trained and always willing to discuss products or give advice.

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INTELINK (Atari only) — **Price: $49.95 Diskette**

This software package contains a menu-driven collection of programs for facilitating efficient two-way communications through a full duplex modem (required for use). In one mode of operation you may connect to a data service (e.g., The SOURCE or MicroNet) and quickly load data such as stock quotations onto your diskette for later viewing. This greatly reduces "connect time" and thus the service charge. You may also record the complete contents of a communications session. Additionally, programs written in BASIC, FORTRAN, etc. may be built off-line using the support text editor and later "uploaded" to another computer, making the Atari a *very* smart terminal. Even Atari BASIC programs may be uploaded. Further, a command file may be built off-line and used later as controlling input for a time-share system. That is, you can set up your sequence of time-share commands and programs, and the Atari will transmit them as needed; batch processing. All this adds up to saving both connect time and your time.

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DFILE (Atari and North Star diskettes only) — **Price: $19.95**

This handy program allows North Star and Atari disk users to maintain a specialized data base of all files and programs in the stack of disks which invariably accumulates. DFILE is easy to set up and use. It will organize your disks to provide efficient locating of the desired file or program.

FINDIT (North Star only) — **Price: $19.95**

This is a three-in-one program which maintains information accessible by keywords of three types: Personal (eg: last name), Commercial (eg: plumbers) and Reference (eg: magazine articles, record albums, etc). In addition to keyword searches, there are birthday, anniversary and appointment searches for the personal records and appointment searches for the commercial records. Reference records are accessed by a single keyword or by cross-referencing two or three keywords.

SHOPPING LIST (Atari only) — **Price: $12.95 Cassette/$16.95 Diskette**

SHOPPING LIST stores information on items you purchase at the supermarket. Before going shopping, it will remind you of all the things you might need, and then display (or optionally print) your shopping list and the total cost. Adding, deleting, changing and storing data is very easy. Runs with 16K.

TAX OPTIMIZER (North Star only) — **Price: $59.95 Diskette**

The TAX OPTIMIZER is an easy-to-use, menu oriented software package which provides a convenient means for analyzing various income tax strategies. The program is designed to provide a quick and easy data entry. Income tax is computed by all tax methods (regular, income averaging, maximum and alternate minimum tax). The user may immediately observe the tax effect of critical financial decisions. TAX OPTIMIZER has been thoroughly field tested in CPA offices and comes complete with the current tax tables in its data files. TAX OPTIMIZER is tax deductible!

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MISCELLANEOUS

CRYSTALS (Atari only) — **Price: $ 9.95 Cassette/$13.95 Diskette**

A unique algorithm randomly produces fascinating graphics displays accompanied with tones which vary as the patterns are built. No two patterns are the same, and the combined effect of the sound and graphics are mesmerizing. CRYSTALS has been used in local stores to demonstrate the sound and color features of the Atari.

NORTH STAR SOFTWARE EXCHANGE (NSSE) LIBRARY

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AVAILABILITY

DYNACOMP software is supplied with complete documentation containing clear explanations and examples. Unless otherwise specified, all programs will run within 16K program memory space (ATARI requires 24K). Except where noted, programs are available on ATARI, PET, TRS-80 (Level II) and Apple (Applesoft) cassette and diskette as well as North Star single density (double density compatible) diskette. Additionally, most programs can be obtained on standard (IBM format) 8" CP/M floppy disks for systems running under MBASIC. 5¼" CP/M diskettes are available for North Star and Osborne computer systems.

STATISTICS and ENGINEERING

DIGITAL FILTER (Available for all computers) — **Price: $39.95 Cassette/$43.95 Diskette**

DIGITAL FILTER is a comprehensive data processing program which permits the user to design his own filter function or choose from a menu of filter forms. The filter forms are subsequently converted into non-recursive convolution coefficients which permit rapid data processing. In the explicit design mode the shape of the frequency transfer function is specified by directly entering points along the desired filter curve. In the menu mode, ideal low pass, high pass and bandpass filters may be approximated to varying degrees according to the number of points used in the calculation. These filters may optionally also be smoothed with a Hanning function. In addition, multi-stage Butterworth filters may be selected. Features of DIGITAL FILTER include plotting of the data before and after filtering, as well as display of the chosen filter functions. Also included are convenient data storage, retrieval and editing procedures.

DATA SMOOTHER (Not available for Atari) — **Price: $19.95 Cassette/$23.95 Diskette**

This special data smoothing program may be used to rapidly derive useful information from noisy business and engineering data which are equally spaced. The software features choice in degree and range of fit, as well as smoothed first and second derivative calculation. Also included is automatic plotting of the input data and smoothed results.

FOURIER ANALYZER (Available for all computers) — **Price: $19.95 Cassette/$23.95 Diskette**

Use this program to examine the frequency spectra of limited duration signals. The program features automatic scaling and plotting of the input data and results. Practical applications include the analysis of complicated patterns in such fields as electronics, communications and business.

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This is a special software package which may be used to evaluate the transfer functions of systems such as hi-fi amplifiers and filters by examining their response to pulsed inputs. TFA is a major modification of FOURIER ANALYZER and contains an engineering-oriented decibel versus log-frequency plot as well as data editing features. Whereas FOURIER ANALYZER is designed for educational and scientific use, TFA is an engineering tool. Available for all computers.

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REGRESSION II (PARAFIT) (Available for all computers) — **Price: $19.95 Cassette/$23.95 Diskette**

PARAFIT is designed to handle those cases in which the parameters are imbedded (possibly nonlinearly) in the fitting function. The user simply inserts the functional form, including the parameters (A(1), A(2), etc.) as one or more BASIC statement lines. Data and results may be manipulated and plotted as with REGRESSION I. Use REGRESSION I for polynomial fitting, and PARAFIT for those complicated functions.

MULTILINEAR REGRESSION (MLR) (Available for all computers) — **Price: $24.95 Cassette/$28.95 Diskette**

MLR is a professional software package for analyzing data sets containing two or more linearly independent variables. Besides performing the basic regression calculation, this program also provides easy to use data entry, storage, retrieval and editing functions. In addition, the user may interrogate the solution by supplying values for the independent variables. The number of variables and data size is limited only by the available memory.

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ANOVA (Not available for PET/CBM) — **Price: $39.95 Cassette/$43.95 Diskette**

In the past the ANOVA (analysis of variance) procedure has been limited to the large mainframe computers. Now DYNACOMP has brought the power of this method to small systems. For those conversant with ANOVA, the DYNACOMP software package includes the 1-way, 2-way and N-way procedures. Also provided are the Yates 2^K-P factorial designs. For those unfamiliar with ANOVA, do not worry. The accompanying documentation was written in a tutorial fashion (by a professor in the subject) and serves as an excellent introduction to the subject. Accompanying ANOVA is a support program for building the data base. Included are several convenient features including data editing, deleting and appending.

BASIC SCIENTIFIC SUBROUTINES, Volumes 1 and 2 (Not available for Atari)

DYNACOMP is the exclusive distributor for the software keyed to the popular texts *BASIC SCIENTIFIC SUBROUTINES, Volumes 1 and 2* by F. Ruckdeschel (see advertisements in BYTE magazine). These subroutines have been assembled according to chapter. Included with each collection is a menu program which selects and demonstrates each subroutine.

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Collection #1: Chapters 2 and 3 - Data and function plotting; complex variables and functions.
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Collection #3: Chapters 5 and 6 - Random number generators (Poisson, Gaussian, etc.); series approximations.
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Collection #3: Chapter 3 - Functional approximations by iteration and recursion.
Collection #4: Chapter 4 - CORDIC approximations to trigonometric, hyperbolic, exponential and logarithmic functions.
Collection #5: Chapter 5 - Table interpolation, differentiation and integration (Newton, LaGrange, splines).
Collection #6: Chapter 6 - Methods for finding the real roots of functions.
Collection #7: Chapter 7 - Methods for finding the complex roots of functions.
Collection #8: Chapter 8 - Optimization by steepest descent.
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All eight collections are available for $99.95 (eight cassettes) and $129.95 (eight diskettes).
Because the texts are a vital part of the documentation, *BASIC SCIENTIFIC SUBROUTINES, Volumes 1 and 2* are available from DYNACOMP:

BASIC SCIENTIFIC SUBROUTINES, Vol 1 (319 pages): $19.95 + 75¢ postage
BASIC SCIENTIFIC SUBROUTINES, Vol 2 (790 pages): $23.95 + $1.50 postage

See reviews in KILOBAUD and Dr. Dobbs.

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In a nutshell, ROOTS simultaneously determines all the zeroes of a polynomial having real coefficients. There is no limit on the degree of the polynomial, and because the procedure is iterative, the accuracy is generally very good. No initial guesses are required as input, and the calculated roots are substituted back into the polynomial and the residuals displayed.

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Education

Friends Of The Turtle

David D. Thornburg
Innovision
Los Altos, CA

Welcome to a new Society – the Friends of the Turtle. A free membership in this society is available to all subscribers to this magazine, and our meetings will be held on these pages every issue. The goal of this society is to promote the type of computer graphics and robot environment that uses what is called "turtle geometry."

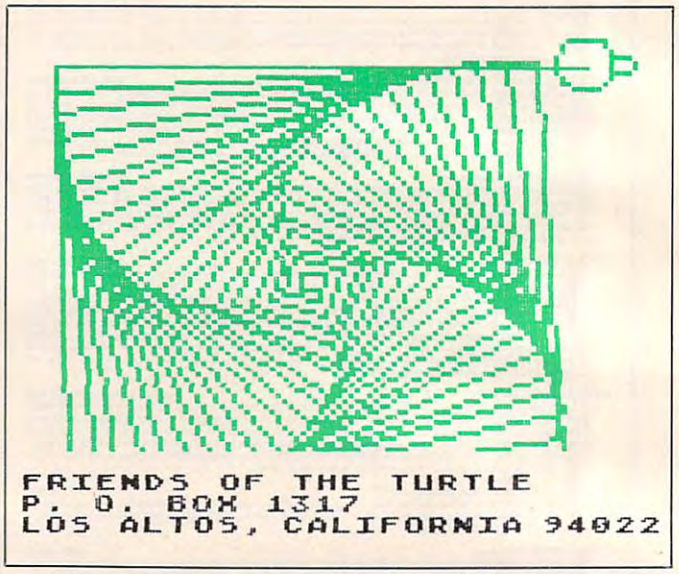
Turtle geometry is a key element in several user-friendly computer languages such as Atari PILOT, TI LOGO, and Apple LOGO. It may come as a surprise to some of you, but the types of graphics commands used in these languages are also obeyed by a programmable toy – the Milton Bradley Big Trak. Turtle geometry encourages exploration. It can be learned by first-time computer users of almost any age, and its power is so great that it can keep full-fledged computer wizards engrossed for years. The turtle is a graphics tool that makes it easy for you to get the computer to do what *you* want it to do.

In these pages we will share programs that illustrate many interesting ideas and developments in this field. Most of all, we will share beautiful designs that have come out of this computer environment.

Background – What Is A Turtle?

If you have ever played with a Milton Bradley Big Trak, or used computer languages like Atari PILOT, LOGO, or WSFN, you have encountered a very special device called a turtle. Basically, a turtle is a "robot" that can move around the floor (or display screen) in response to messages you send it. Display turtles often have "pens" with which they can leave traces of their path as they move. This makes the turtle a handy tool for drawing pictures.

The difference between turtle graphics and conventional coordinate graphics can be demonstrated by drawing a square in both systems.



In coordinate geometry, the pen is moved to various coordinates on a grid. To draw a square 40 units on a side, we could use these five steps:

GOTO 0,0 (put the pen at the origin)
DRAWTO 0,40 (draw the left vertical line)
DRAWTO 40,40 (draw the top horizontal line)
DRAWTO 40,0 (draw the right vertical line)
DRAWTO 0,0 (draw the bottom horizontal line)

This is illustrated below.

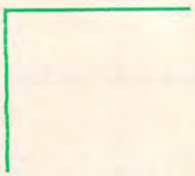
Figure 1a.

```
GOTO 0,0
```

Figure 1b.


```
DRAWTO 0,40
```

Figure 1c.



```
DRAWTO 40,40
```

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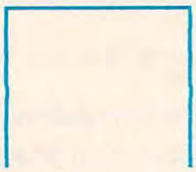
Figure 1d.



```
DRAWTO 40,0
```

Figure 1e.

```
DRAWTO 0,0
```

Next, let's see how a square would be drawn in turtle geometry. We make the turtle draw lines by giving a sequence of instructions like this:

REPEAT 4 (repeat the following commands 4 times)
FORWARD 40 (draw a line 40 units long)
RIGHT 90 (turn 90 degrees to the right)

Figure 2.

```
REPEAT 4
   FORWARD 40
   RIGHT 90
```

While the turtle commands that draw a square are much simpler than the commands in coordinate geometry, this is far from being their only power. The coordinate representation we showed only describes a square with vertical and horizontal sides. Suppose you wanted to draw a square tilted at some angle (say 30 degrees). How would you draw that in coordinate geometry?

In turtle geometry, the description of one square is just the same as that for any other square, independent of its orientation. To draw a square tilted at 30 degrees, you first must turn the turtle by 30 degrees before having it draw the square.

Figure 3.

```
RIGHT 30
REPEAT 4
   FORWARD 40
   RIGHT 90
```

The commands look like this:

RIGHT 30
REPEAT 4
FORWARD 40
RIGHT 90

The power of turtle geometry is so great that we cannot begin to touch it in this first column. If you want more information between now and the next "meeting," you should read "Picture This! PILOT's Turtle Graphics for Atari" in the May-June 1981, issue of *Recreational Computing*. Two important books on this topic have recently been published – *Mindstorms: Children, Computers, and Powerful Ideas* by Seymour Papert (Basic Books), and *Turtle Geometry: The Computer as a Medium for Exploring Mathematics* by Harold Abelson and Andrea diSessa (MIT Press). A new book (by the author), *Picture This!*, will be published by Addison Wesley in early 1982. This book focuses on the Turtle Language incorporated into Atari PILOT.

Why Do We Need Friends Of The Turtle?

As we said before, turtle geometry is being incorporated in many of the computer languages that are just now beginning to be available on low-cost personal computers. Each of the various implementations of this environment has its special features and limitations. To the extent that the graphics environments in all these implementations are similar to each other, Friends of the Turtle will be a place where we can explore the turtle world in a machine independent fashion. We will describe all sorts of interesting experiments to do with turtles (since experimenting is probably the best way to learn geometry anyway), share our programs, provide a "Rosetta Stone" for various dialects of turtle languages, keep track of recent developments in the field, and generally have a good time. This last point is the most important, since the turtle is a marvelous device to play with.

So, welcome to friends of the Turtle. Please write to me with your ideas and programs. If you are new to this field you should know that we will spend a great deal of time dealing with the basics.

Turtles are for everyone, and so is this society. Please write to me at the following address:

David D. Thornburg
Friends of the Turtle
P.O. Box 1317
Los Altos, CA 94022

Learning With Computers

Glenn M. Kleiman and Mary M. Humphrey
Teaching Tools: Microcomputer Services
P.O. Box 50065
Palo Alto, CA 94303

How might existing computer technology change schools in the near future?

In this column, we recount a hypothetical visit to the Charles Babbage School, circa 1985. Our tour guide was the principal, Ada Lovelace, who told us the school has been using computers since 1982.

At Babbage School, children move about a great deal, working individually and in groups on different lessons and projects. The children have a lot of flexibility in which lessons they do when, and in how they approach studying a given topic. Everyday attendance is not compulsory, and some children often take lesson disks home to work on their own computers. Teachers generally work with individuals or small groups of children. Ms. Lovelace told us the teachers spend most of their time tutoring and directing children's learning. The students have a lot of choice, but the teachers make sure that each child engages in a balanced variety of activities each week. Very little time is spent in record keeping or grading – computers take care of that. Since computers make truly individualized instruction possible, grading is not emphasized as it once was.

Many lessons are very different from those in schools of 1980. For example, nine-year-old Jane showed us a computer lesson on ecology and pollution. The computer showed a lake with a variety of plants and fish. It also provided information about the food chain and reproduction rates of the species within the lake. Jane then told the computer that a certain pollutant had entered the lake. The computer responded that the pollutant had killed 50% of the "glod" plants, and asked Jane to predict the effect of this on the other life in the lake over the next five years. Jane then compared her predictions to the actual effects calculated by the computer, finding that she had estimated much less damage than would have occurred.

This simulation certainly seemed to teach her the basic principles of an ecological system. Computer simulations are available at Babbage School for many science lessons. Ms. Lovelace told us that she hopes to get simulation programs to teach principles of economics and social psychology. She pointed out that software development has lagged behind hardware advances ever since she first worked with computers.

Lessons As Games

Other lessons take a more game-like format, often with two or more players. Competitive games requiring (and providing practice in) math and language skills are very popular. Several children were playing an adventure game in which they explore a complicated world created within the computer. They search through castles, caves, and mazes for treasures, while trying to avoid the dangers of creatures such as wizards, dragons, and gremlins. Lessons in reading comprehension, logic, and map reading were embedded within the game.

Ms. Lovelace said that some children spend a lot of time with these game-lessons, and that completing one adventure can take several weeks. Teachers can instruct the computer to modify the game as it is being played. They use this capability to introduce new vocabulary words and other educational material, and to encourage the children to do other lessons. For example, 12 year-old Jim (who told us that "adventure is a real classic computer game") often neglected his science lessons. A quick modification by one teacher added a wizard to the adventure. This wizard gave Jim instructions for finding a treasure which required knowledge about certain star constellations. We later saw Jim engrossed in an astronomy lesson.

Ms. Lovelace told us that the children learn a great deal by exploring environments simulated on the computer. For example, one program creates computer screen representations of gears, pulleys, wheels, levers and so on. The child can combine these simple machines on the screen to create devices to perform various jobs, such as moving heavy objects. The device created can be tested through computer simulations to see if it works as planned. The child can then modify and re-test the device, or build a new one.

Creating, testing, and modifying devices in this simulated environment produces an understanding of the principles of simple mechanical machines. Other programs available at Babbage School create environments in which children can explore geometry, physics, and simple computer operations. Ms. Lovelace expressed the hope that more such programs would be available soon since this type of learning makes abstract concepts more concrete and manageable for children. Also, children learn through active exploration, rather than just passively remembering information given

to them.

Writing And Typing Skills

Several students were engaged in writing projects. All the writing was done using word processing programs. The children easily entered and then revised their writing. Everything from correcting spelling errors and adding or deleting words to rearranging paragraphs was done quickly on the screen. Using word processors makes writing more enjoyable and children are willing to revise their own work many times – something they are reluctant to do when they have to rewrite by hand each time.

... teachers have time for individual tutoring ...

We expressed surprise that all the children knew how to type so well. Ms. Lovelace told us that they had learned from a computer program. The program presents typing drills and measures how long it takes to complete the drill on the computer keyboard. Later drills are designed to give practice with letters or letter combinations the child has typed incorrectly or too slowly. Since practice is directed at specific problems, learning is very rapid.

Some of the children were writing articles or stories for the school newspaper. One child told us he was writing a science fiction story about what the world would be like without any computers. When he finished his story, he stored a copy on disk so the newspaper editor could edit it later. We were told that, after being approved by the editor, the newspaper was automatically formatted and printed by the computer.

Other children were writing letters. They told us the letters were for their pen-pals in Japan. The letters were sent via electronic mail and the children expected to receive answers the next day. One child asked us why they were called "pen-pals." After we explained, another child added "it's like why we say 'dial the phone' – it's left over from the old days."

Speech Synthesis For A Blind Student

Later, we noticed a child wearing headphones attached to a small box next to a computer. The box was a speech synthesizer. At the push of a button, it would convert the text on the screen to speech. Ms. Lovelace told us that John has been blind since birth, but with the speech synthesizer, a special keyboard, and some other electronic devices, he is able to progress with his lessons very well. She emphasized that computers have been a tremendous help in educating children with all types of handicaps and in making it possible for handicapped children to work in regular classroom settings.

Many lessons were about computers themselves. Computer studies are a standard part of the curriculum. All the children learn how to control computers to permit creative work. For some, this consists of writing computer programs. One group of children was working on a math drill program to be used by younger children in the school. After testing it on some five-year-olds, they told us that it was "a neat program, but some of the instructions mixed up the little kids. It still has to be more user-friendly."

Other children used a computer to write music. The program allowed them to enter musical notation, listen to the music, alter its pitch and tempo, and change the notes. It was like a word processor for music. Their work was to be transmitted via a computer network, to be entered into a statewide computer music contest.

We also saw a group of three children working on a computer art project. Each child would take a turn adding something to the computer display by drawing on a board next to the computer. They simply outlined what they wanted to draw and it appeared on the screen. After something was placed on the screen, it could be easily colored, moved, rotated, made larger or smaller, or erased. With a great deal of animated debate (one of the teachers had to ask them to settle down) a picture was gradually taking form. Later, a large version was printed to hang on the classroom wall, and three small copies were printed for the artists to take home.

We asked the teachers about the discipline problems so prevalent in schools a few years ago. One teacher, who had been teaching for 20 years, said that many problems have been minimized since education had become truly individualized. Students and teachers feel less frustration and a greater sense of accomplishment since there is so much flexibility in the content and methods of teaching and learning.

Children with learning problems receive a great deal of specific help. Teachers have time for individual tutoring, while computers provide unlimited practice at a level and pace appropriate to

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each child. The problems that could lead to a child being labeled as "learning disabled" have been reduced. Debates among educators about such things as which is the best method of teaching reading have also decreased, since an optimal method can be used for each individual.

Is This Science Fiction?

Is Babbage School science fiction? Such a school doesn't exist today, but the technology to do everything we have mentioned does exist. We believe that Babbage School could be a reality within the next few years.

Will your school take advantage of computers and other technological innovations? The aim of our columns is to help you make good use of these new and powerful tools for teaching and learning. In each column, we will discuss a general issue about learning with computers, issues such as: what is computer literacy? How can computers facilitate the education of handicapped individuals? What training is required for teachers to make good use of computers?

We will also point out some articles, books, software, hardware, and sources of information you may find useful. Relevant to this column, there are many books about the influence of computers in the near future. We particularly recommend the following four:

1. *The Micro Millenium,* by Christopher Evans (Pocket Books, 1979). Discusses computers of the past, present, and future and their effects on society. Includes an account of the roles of Charles Babbage and Ada Lovelace in the history of computers.

2. *The Third Wave,* by Alvin Toffler (Bantam Books, 1980). Toffler's thesis, developed in some detail, is that our society is in the midst of a Computer Revolution, comparable in scope of its effects to the Agricultural Revolution (the first wave) and the Industrial Revolution (the second wave).

3. *The Electronic Cottage,* by Joseph Deken (William Morrow & Co., 1981). A wide-ranging discussion of things computers can do, how they work, and how they may change our everyday lives.

4. *Mindstorms: Children, Computers and Powerful Ideas,* by Seymour Papert (Basic Books, 1980). A detailed description of some computer-created environments for children to explore, and the effects on the children's understanding of mathematical concepts.

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Apple Addresses

Bill Grimm
Mountain View, CA

The Apple II uses three types of addressing depending upon the language being used. Apple's machine language uses hexadecimal addresses in the range from $0000 to $FFFF. Its Floating Point BASIC language uses decimal addresses in the range from 0 to 65535. Its Integer BASIC uses decimal addresses in the range from 0 to 32767 to -32767 to -1. This means that, if you want to address a particular memory location, you must choose the correct address for the language you are using. Since I program in all three languages and my references are a mixture from all three, I needed an address cross-reference program. So I wrote "Apple Addresses."

"Apple Addresses" can be used "as is" to convert one language's address to another's, and to give the high and low byte values which need to be POKEd into a BASIC program to store that address. Alternatively, you could extract the subroutines in Apple Addresses which convert between hex and decimal numbers and insert them in your own program. See the last paragraph of this article for more details.

The program begins by asking the user which of the six possible conversions he would like to make. This is followed by a request to select the way the results of the conversions are to be displayed. There are four possible displays:

1. single conversions displayed on the monitor one at a time.

2. single conversions printed out on a Silentype printer* one at a time.

3. a range of conversions displayed on the monitor.

4. a range of conversions printed out on a Silentype printer*.

*With slight program modifications other printers could be used.

Subroutines

"Apple Addresses" makes extensive use of subroutines. This helps in organizing the program as well as making it shorter and easier to debug. The controlling or EXECutive routine is called Apple Addresses – Exec. It starts on line 100 and goes to line 310. Since a picture is worth a thousand words, I made what I call a *balloon diagram* (Figure 1) to show how data flows through the program. These are the conventions I used to make the diagram;

1. Each balloon represents a subroutine. The name of the subroutine and the line numbers where it is located are placed in the balloon.

2. Data flows through a subroutine in the direction of the arrows on the outside of the balloon.

3. Data flows between subroutines in the direction of the arrows on the *strings*.

4. If conditions are placed on what data flows through a subroutine, these conditions are written in along the *strings*.

As an additional aid for understanding how the program works I have included the following variable descriptions list:

A( ) — each A(I) holds the decimal equivalent value of the Ith hexadecimal numeral in the hex number being created from a decimal number — appropriate numbers are then added to convert these to ASCII codes.

A$( ) — holds the characters represented by the ASCII codes in A( ).

CHOICE — holds the number of the conversion chosen — see lines 120 to 178.

DVL — holds the decimal value of the number being converted — may be either FP or INT decimal.

DVL$ — is the string equivalent of DVL and is used in the output routines.

FLAG — if FLAG = 1 then an invalid number was entered and the program returns to get a new number.

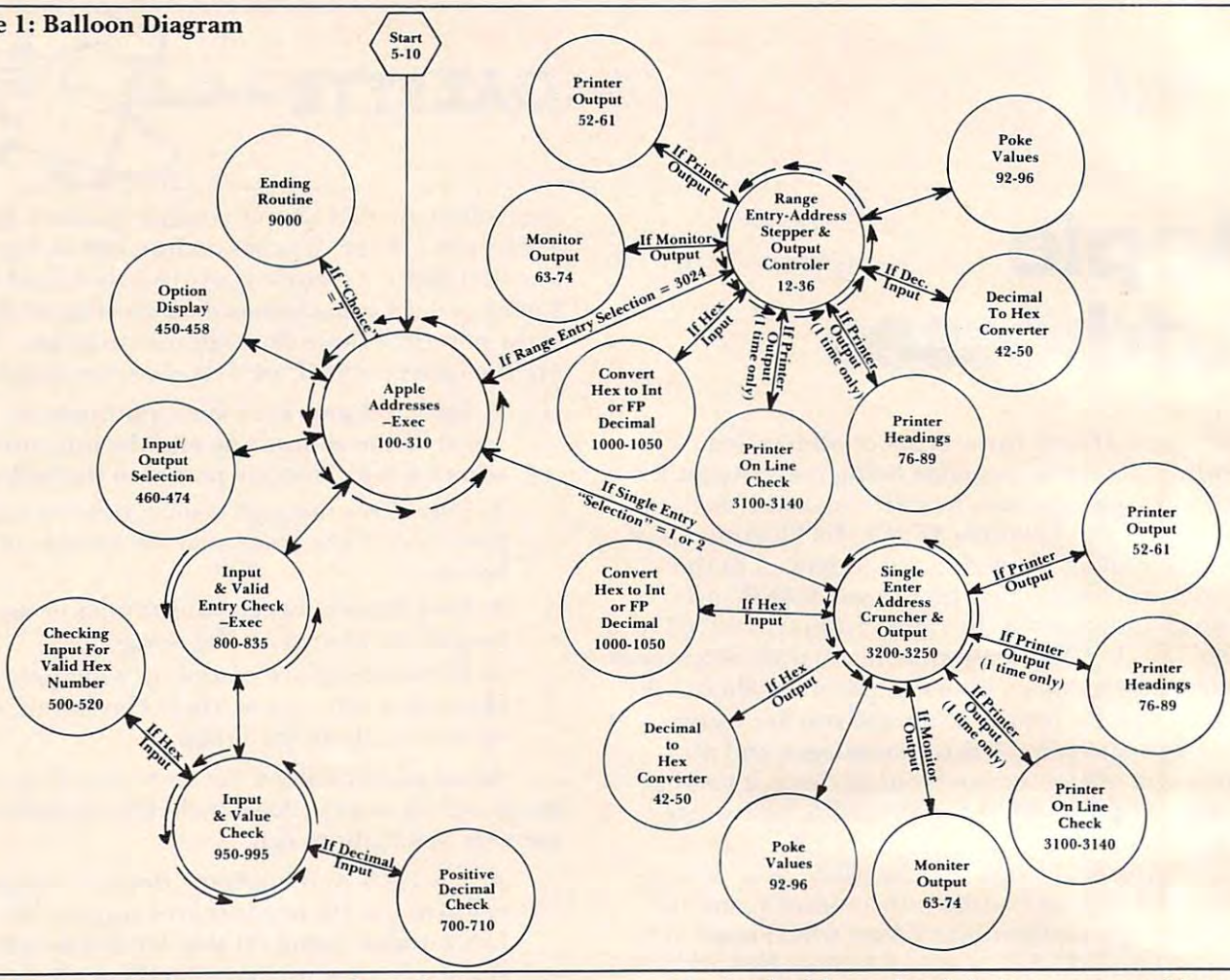
FRST — holds the FP BASIC address equivalent of the lowest address in the selected range.

FRST$ — holds the smallest address chosen — this address is then processed and stored in FRST.

HVL$ — holds the hex number selected or the hex number resulting from the conversion — if no hex numbers are involved then it holds the converted decimal number.

LST — holds the FP BASIC address equivalent

Figure 1: Balloon Diagram



of the largest address in the selected range.

LST$ — holds the largest address chosen — this address is then processed and stored in LST.

N — holds the decimal equivalent of each hex numeral in a hex number being converted to a decimal number.

PHI% — holds the number that would be POKEd into the high byte when placing the address into memory.

PLO% — holds the number that would be POKEd into the low byte when placing the address into memory.

POK — holds the address from which PLO% and PHI% are derived.

SELECT — holds the type of output selected — see lines 462 to 470.

STP — holds the positive decimal stepping interval chosen.

STP$ — holds the stepping interval chosen which is later changed and stored in STP.

TB — the horizontal tab value desired.

TN — holds the intermediate numbers of the decimal address that is being converted into a hex address. VTB — used to control the vertical tabbing of the monitor output.

Some Suggestions

I have found that the easiest way to debug a program while I am entering it is to first type in the EXEC program. Then, if I place return statements at all the branching locations, I can check the EXEC for bugs. Once the EXEC is free of bugs, I add one subroutine at a time in the order that the EXEC uses them, checking for bugs as I go.

If you have a need for subroutines which convert numbers from hex to decimal or from decimal to hex, two subroutines in this program may be of help. The first is called "decimal to hex converter" (lines 42 to 50). The input to this routine is TN which must hold a positive decimal number ‹65536. The output is HVL$ which holds the hex equivalent to the number in TN. The second is called "convert hex to INT or FP decimal" (lines 1000 to 1050). The input to this routine is HVL$ which must hold a hex number ‹ = $FFFF and choice. If choice = 1 then you get the positive decimal equivalent. Otherwise you get Int BASIC's equivalent. The output is a decimal number in DVL.

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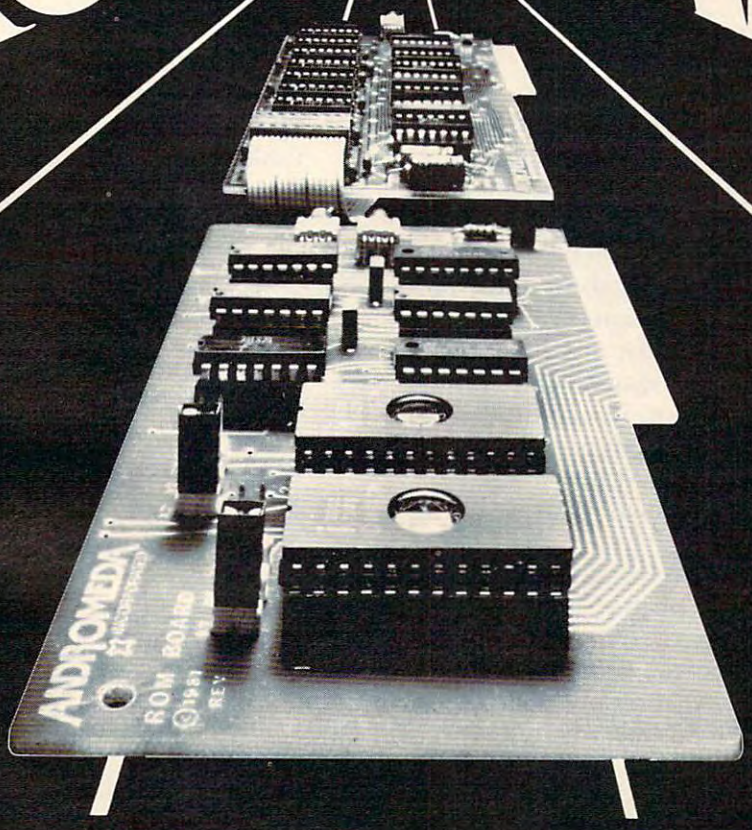

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More Apple Hi-Res Shape Writer

Chris Dupuy
Gonzales, LA

Countless hours spent plugging ones and zeros on graph paper are now history, thanks to Mr. Hennig's "Hi-Res Shape Writer." [**COMPUTE!** #14] Shload miseries are not missed and drawing shapes other than right angles are now a breeze.

After creating one star cruiser after another, I was soon struck with the harsh realization that I could not SAVE these cosmic creations on my cassette recorder. Unfortunately for me, I belong to the one percent club of Apple owners who cannot afford the luxuries of a disk drive. Undaunted with the PEEKs and POKEs ahead of me, I proceeded to write a routine that would put all the bytes from the shape table into trusty DATA statements.

The program is intended to be added to the original "Apple Hi-Res Shape Writer" by Doug Hennig. However, the routine used to POKE DATA in DATA statements can be adapted to other programs where the user does not want to be bothered with the rules of STOREing and RECALLing arrays.

Program Operation

REMark statements were omitted from the program in order to save valuable space, since memory size becomes a problem with complex shapes.

5–1084 Sets an array to the bytes POKEd into the shape table in original program.

13900–13906 Searches for the memory locations of the first blank DATA statement and sets Y equal to this.

13910–13970 POKEs Q to first item in DATA statement.

13930 Separates Q into individual digits.

13975 POKEs number of shape tables and reference numbers for shape tables.

14000–14075 POKEs bytes of shape table into the succeeding locations of the DATA statements.

14004 Searches DATA statement for a period (CHR$(46)), in order to find location to insert next value.

14550–14630 Demonstration program to verify information in DATA statements.

14572 Checks DATA statement to verify additional space on current statement. If not, then READ asterisks and jump to next DATA statement.

14700–14710 DELetes main portion of program and leaves demo program with DATA statements to be SAVEd.

15000–15005 DATA statements with 184 periods (quantity is at your discretion), and 4 asterisks.

Variables Used

Q Holds the number of bytes in the shape table.

V() Stores individual bytes of shape table.

Y Keeps track of the DATA statement memory locations.

R Used to check memory locations for a period.

F,FF Holds LENgth of strings and uses that value in FOR-NEXT statements.

T(),L() Arrays that hold the individual digits of bytes from shape table.

E$ User input.

X The location for bytes to be POKEd into shape table.

Y$ Stores the DATA being READ from demo program. String is used to prevent error message when asterisk is READ.

Hints And Changes

Those who have 32K Apples will encounter space problems when trying to run this longer program. DELeting the instructions, REMarks, disks subroutines, and combining statements will help avoid this obstacle.

Once all changes are made to your program, lines 13904 and 13906 may be DELeted. However, the memory location for the first DATA statement must be found. In machine language, the three bytes to look for are: 83 00 2E. The decimal location of 2E should then be set to Y in line 13900. Remember — if this change is done, no other changes can be made in the program (except for DATA statements), without the information being POKEd into the wrong locations. If searching for memory locations is too tedious, then you might want to experiment by raising the value in line 13900. Either one of these changes will save time in program execution.

Providing you have shaved off a good portion of the program, the value in line five may be raised to accomodate more complex shapes.

The major shortcoming in this program is the

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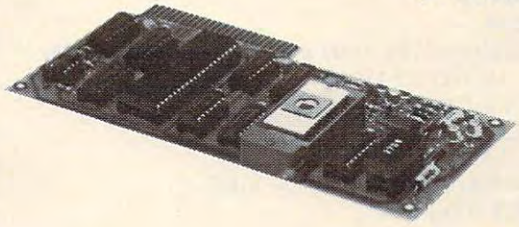

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inability to store more than one shape table at a time. Though a small amount of effort could change this, it would not be feasible if you are running low on memory. I hope this program brought some relief and enjoyment to you cassette owners out there.

```
5 DIM V(250)
1082 Q=Q+1
1084 V(Q)=X
13040 TEXT: HOME
13042 VTAB 10: HTAB 5
13045 PRINT "MEMORY LOCATIONS ARE BEING
      SCANNED"
13900 Y=3500
13904 IF PEEK(Y)=131 AND PEEK (Y+2)=46 THEN
      Y=Y+2: GOTO 13910
13906 Y=Y+1:GOTO 13904
13910 FF=LEN(STR$(Q))
13920 FOR X=1 TO FF
13930 T(X)=VAL(MID$(STR$(Q),X,1))
13940 POKE Y,T(X)+48
13945 Y=Y+1
13950 NEXT
13970 POKE Y,44
13975 POKE Y+1,49:POKE Y+2,44:POKE Y+3,48:POKE
      Y+4,44:POKE Y+5,52:POKE Y+6,44:POKE
      Y+7,48:POKE Y+8,44
13997 TEXT: HOME
13998 VTAB 10: HTAB 2
13999 PRINT "DATA IS NOW BEING POKED INTO
      MEMORY"
14000 FOR QQ=1 TO Q
14003 R=PEEK (Y)
14004 IF R<> 46 THEN Y=Y+1: GOTO 14003
14005 F=LEN(STR$(V(QQ)))
14010 FOR T=1 TO F
14019 L(T)=VAL(MID$(STR$(V(QQ)),T,1))
14040 POKE Y,L(T)+48
14050 Y=Y+1
14055 NEXT
14060 POKE Y,44
14070 Y=Y+1
14075 NEXT
14100 HOME
14500 PRINT "TYPE 'ESC' KEY TO DEMONSTRATE
      PROGRAM"
14510 GET E$: IF E$<> CHR$(27) THEN END
14550 POKE 232,0: POKE 244,64
14555 READ Q
14560 FOR X=16384 TO 16387+Q
14570 READ Y$
14572 IF Y$="*" OR Y$="**" OR Y$="***" OR Y$=
      "****" THEN 14570
14575 Y=VAL(Y$)
14580 POKE X,Y
14590 NEXT
14600 POKE 16388+Q,0
14610 HGR: SCALE=1: ROT=0
14620 HCOLOR=3
14630 DRAW 1 AT 140,80
14700 VTAB 22
14702 PRINT "TYPE 'ESC' TO FORM NEW PROGRAM"
14704 GET E$: IF E$<> CHR$(27) THEN END
14705 TEXT: HOME
14706 PRINT "PROGRAM IS NOW READY TO BE
      SAVED"
14710 DEL 5,14510
15000 DATA . . . . . ****
15001 DATA . . . . . ****
15001 DATA . . . . . ****
15002 DATA . . . . . ****
15003 DATA . . . . . ****
15004 DATA . . . . . ****
15005 DATA . . . . . ****
```

Lower Case With Unmodified Apple

Joseph Wrubel
Aberdeen, NJ

This article describes a program called LC.EDIT which can be used to build, modify, and print text files using both upper and lower case letters on an unmodified 48K APPLE II Plus. The editor supports most of the commonly used edit commands including find, locate, change, append, insert and delete. Also included are read and write disk commands.

Uppercase letters are entered by preceding them with a CTRL-A. Internally, the program adds 32 to the ASCII value of each lower case letter, thus setting up the string for output to the printer. On the screen, capital letters are converted to the inverse mode while the lowercase letters are converted back to uppercase for display only.

I purchased my APPLE II early in December 1980, and quickly realized that the BASIC language had changed a lot since I had used it last in 1968. The biggest change I noticed was the string handling ability of the new BASIC.

The first application program I decided to write required the use of strings. I quickly found the "write text" and "read text" programs on the master disk and as quickly decided I didn't like them. At work, I make use of text editors on PRIME and UNIVAC computers and find that each of them has certain features which the other doesn't support. So I backed myself into writing a text editor for my APPLE and decided to incorporate the features I liked best from each system.

The program is used the first time to create a text file. The procedure is to hit a carriage return when prompted for "FILE NAME." This puts the program in the input mode. Once the text is entered, a CR puts the program into the EDIT mode. The options available in the EDIT mode are described below. Note that a single letter followed by a space and then any needed parameters is the usual format within the program. In this version, capital letters are typed in by preceding them with a CTRL-A.

The edit options are as follows:

I — Insert new line behind the present line.

C — Change the first sub-string to the second sub-string in this line of text. Sub-strings are separated by /'s. Double //'s can be used to enter a new substring in front of the existing string or to delete the last part of the original string.

A — Append new string to the end of the original string on this line.

P — Print a number of lines. Options include printing all lines from the present position to the end of the file by typing P*.

S — Save file. It is saved with its original name if one has been previously entered. Otherwise, a file name is requested via a prompt. If you give a file name when using S, the new name is used. This is a way of making an image of a text file for backup or modification.

N — If alone the next line is displayed. N +/– NUMB moves the pointer back and forth within file limits.

L — Locate sub-string at any location in any line from the present line to the end of the file.

Q — Quit. Normal program exit.

F — Find sub-string at beginning of any line from the present line to the end of file.

R — Retype present line completely.

H — Help if you have forgotten how to use the program. Can be used at any time.

E — Enter new file name to be edited. Can be used to edit when finished with the first without having to re-run the program.

NN — NN is any valid line number in the file. This is a direct line number access to the entire file.

The program is well REMarked to help any new programmer understand not only what the program does, but also how it does it.

The printer I have is an EPSON MX-80, but I believe this program will work for any printer which supports lower case characters. Until the day this article was written, I had no idea that I could take advantage of the printer's lower case abilities, but my son persisted. This program was modified from my original upper-case only version in about four hours.

One necessary feature of this program is the amount of user error-checking which takes place. As of this writing, I am unaware of any way to make the program bomb. Most of the checks were installed originally, but a few were added when bomb-outs indicated an unexpected pitfall

such as typing "DELETE" instead of "D" to delete one line.

If anyone would like to save the effort of typing in the program send me a disk, $3, and an SASE mailer and I will provide a copy of this version and the upper-case only version. My mailing address is:

Joseph N. Wrubel
27 Norwood Lane
Aberdeen, NJ 07747

```
1  REM   **********************
2  REM   *                    *
3  REM   *  LC.EDIT PROGRAM   *
4  REM   *                    *
5  REM   *         BY         *
6  REM   *                    *
7  REM   *     J. N. WRUBEL   *
8  REM   *                    *
9  REM   *                    *
10  REM  *   REV. AUG 1981    *
11  REM  *                    *
12  REM  **********************
13  REM
15  HOME : DIM T$(500)
20  INPUT "FILE NAME :";Z$
24 D$ =  CHR$ (4): REM  CTRL-D
25  REM
26  REM ************************
27  REM  CR TO ENTER BUILD MODE
28  REM ************************
29  REM
30  IF  LEN (Z$) = 0 GOTO 1000
32  IF Z$ = "H" THEN 9400: REM LIST INSTRUCTIONS
34  REM
35  REM ************************
36  REM   LOAD FILE FROM DISK
37  REM ************************
38  REM
40  PRINT D$;"OPEN";Z$
50  PRINT D$;"READ";Z$
52  REM
53  REM ************************
54  REM  FIRST ELEMENT FROM DISK IS FILE LENGTH (NUMERIC)
55  REM
57  REM  REMAINDER OF FILE IS IN STRING FORMAT
58  REM ************************
59  REM
60  INPUT I
70  FOR J = 1 TO I
75  INPUT T$(J): NEXT
80  PRINT D$;"CLOSE";Z$
90 J = 1
100  REM ***********************
101  REM  MAIN REENTRY POINT FROM MOST PROGRAM OPTIONS
102  REM ***********************
103  REM
105  PRINT J;":";
110  GOSUB 250:R$ = T$
112  IF  LEN (T$) = 0 THEN W$ = "": GOTO 121
115 W$ =  CHR$ ( ASC ( LEFT$ (R$,1)) - 32)
116  REM
117  REM ***********************
```

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```
118  REM   CONVERT SINGLE LETTER ENTRY TO NUMERIC
119  REM ************************
120  REM
121  FOR W = 1 TO 13
130  IF W$ =  MID$ ("ICADPSNLQFRHE",W,1) THEN 190
140  NEXT
150  GOTO 1200: REM ENTRY WAS NOT A VALID LETTER
190  ON W GOTO 2000,3000,4000,5000,6000,7000,8000,9000,200,500,2500,9400
     ,750
200  PRINT "PROGRAM COMPLETE": END
210  GOTO 90: REM  CONTINUE RE-ENTRY
250  REM
251  REM ************************
252  REM INPUT STRING SUBROUTINE
253  REM ************************
254  REM
257 T$ = ""
260  GET A$: IF A$ =  CHR$ (13) THEN  PRINT A$;: RETURN
270  IF A$ =  CHR$ (8) AND  LEN (T$) > 1 THEN T$ =  LEFT$ (T$, LEN (T$) -
     1): PRINT A$;: GOTO 260
275  IF A$ =  CHR$ (8) THEN T$ = "": PRINT A$;: GOTO 260
280  IF A$ =  CHR$ (1) THEN  GET A$: INVERSE : PRINT A$;: NORMAL :T$ = T
     $ + A$: GOTO 260
290  IF A$ <  CHR$ (65) OR A$ >  CHR$ (90) THEN T$ = T$ + A$: PRINT A$;:
      GOTO 260
300  PRINT A$;:T$ = T$ +  CHR$ ( ASC (A$) + 32): GOTO 260
350  REM
351  REM ************************
352  REM PRINT A LINE SUBROUTINE
353  REM ************************
354  REM
360  FOR L = 1 TO  LEN (T$):B$ =  MID$ (T$,L,1)
370  IF B$ >  CHR$ (64) AND B$ <  CHR$ (91) THEN  INVERSE : PRINT B$;: NORMAL
     : GOTO 395
380  IF B$ >  CHR$ (96) AND B$ <  CHR$ (123) THEN B$ =  CHR$ ( ASC (B$) -
     32)
390  PRINT B$;
395  NEXT : PRINT : RETURN
450  REM
451  REM ************************
452  REM STRING DECODE SUBROUTINE
453  REM ************************
454  REM
460  FOR M = 3 TO  LEN (R$)
470  IF  MID$ (R$,M,1) >  CHR$ (95) AND  MID$ (R$,M,1) <  CHR$ (124) THEN
     R$ =  LEFT$ (R$,M - 1) +  CHR$ ( ASC ( MID$ (R$,M,1)) - 32) +  MID$
     (R$,M + 1)
480  NEXT : RETURN
500  REM ********************
501  REM  FIND STRING ROUTINE
502  REM ********************
503  REM
510  IF  LEN (R$) < 3 THEN 580
520 F$ =  MID$ (R$,3): REM  STRING TO BE FOUND
530  FOR K = J + 1 TO I
540  IF  LEFT$ (T$(K), LEN (F$)) = F$ THEN 570
550  NEXT
560  PRINT "NO FIND": GOTO 90
570 J = K: GOTO 6300
```

```
580  PRINT "YOU MUST ENTER STRING": GOTO 100
750  REM
751  REM **********************
752  REM  ENTER NEW FILE NAME
753  REM **********************
754  REM
755  HOME
760  IF  LEN (R$) < 3 THEN 20
770  GOSUB 450:Z$ =  MID$ (R$,3): GOTO 25
999  REM
1000  REM ********************
1001  REM   BUILD FILE MODE
1002  REM ********************
1003  REM
1005 I = 0:J = 0
1007  PRINT "INPUT"
1010  PRINT J + 1;":";
1020  GOSUB 250:T$(J + 1) = T$
1030  IF  LEN (T$(J + 1)) = 0 GOTO 1100
1040 J = J + 1:I = I + 1
1050  GOTO 1010
1090  REM
1091  REM ********************
1092  REM  ENTER EDIT MODE
1093  REM ********************
1094  REM
1100  PRINT "EDIT": GOTO 100
1200  REM
1201  REM ***********************
1202  REM CR TO ENTER INPUT MODE
1203  REM ***********************
1204  REM
1205  IF  LEN (R$) = 0 THEN 1500
1206  REM
1207  REM  **********************
1208  REM  VALIDATE LINE POINTER
1209  REM  **********************
1210 W =  VAL (R$)
1215  IF W < 1 OR W > I GOTO 1240
1220 J = W
1230 T$ = T$(J): GOSUB 350: GOTO 100
1240  PRINT "ILLEGAL ENTRY": GOTO 100
1500  REM
1501  REM  ********************
1502  REM        INPUT MODE
1503  REM  ********************
1504  REM
1505  REM  IF AT END OF FILE DO EASY WAY
1507  IF J = I GOTO 1007
1509  REM  THE HARD WAY
1510  PRINT "INPUT"
1515  PRINT J + 1;":";
1520  GOSUB 250
1530  IF  LEN (T$) = 0 GOTO 1100: REM   RETURN TO EDIT MODE
1540  FOR K = I TO J STEP  - 1
1550 T$(K + 1) = T$(K)
1560  NEXT
1570 T$(J + 1) = T$
1580 J = J + 1:I = I + 1
```

```
1590  GOTO 1515
2000  REM
2001  REM **********************
2002  REM   INSERT NEW LINE
2003  REM **********************
2004  REM
2005  IF  LEN (R$) < 3 THEN  PRINT "BAD I": GOTO 100
2010 I = I + 1
2020  FOR K = I - 1 TO J STEP  - 1
2030 T$(K + 1) = T$(K)
2040  NEXT
2050 T$(J + 1) =  MID$ (R$,3)
2060 J = J + 1
2070  GOTO 100
2500  REM
2501  REM ********************
2502  REM     RETYPE LINE
2503  REM ********************
2504  REM
2505  IF  LEN (R$) < 3 THEN  PRINT "BAD R": GOTO 100
2510 T$(J) =  MID$ (R$,3)
2520  GOTO 100
3000  REM
3001  REM **********************
3002  REM  CHANGE PART OF LINE
3003  REM **********************
3004  REM
3005  IF  LEN (R$) < 3 THEN  PRINT "BAD C": GOTO 100
3010 W$ =  MID$ (R$,3)
3020  IF  LEFT$ (W$,1) <  > "/" OR  RIGHT$ (W$,1) <  > "/" THEN 3060
3030  FOR K = 2 TO  LEN (W$) - 1
3040  IF  MID$ (W$,K,1) = "/" GOTO 3070
3050  NEXT
3060  PRINT "MISSING DELIMITERS": GOTO 100
3070 F$ =  MID$ (W$,2,K - 2)
3075 H =  LEN (T$(J))
3080  FOR M = 1 TO H
3090  IF  MID$ (T$(J),M,K - 2) = F$ GOTO 3120
3100  NEXT
3110  PRINT "NO FIND": GOTO 100
3120 G$ =  MID$ (W$,K + 1, LEN (W$) - K - 1)
3125  IF H - M + 1 -  LEN (F$) = 0 GOTO 3160
3127  IF K = 2 GOTO 3170
3128  IF M = 1 GOTO 3190
3130 T$(J) =  LEFT$ (T$(J),M - 1) + G$ +  RIGHT$ (T$(J),H - M + 1 -  LEN
     (F$))
3140  GOTO 6300
3160 T$(J) =  LEFT$ (T$(J),M - 1) + G$: GOTO 3140
3170 T$(J) =  MID$ (W$,3, LEN (W$) - 3) + T$(J): GOTO 3140
3190 T$(J) = G$ +  RIGHT$ (T$(J),H - M + 1 -  LEN (F$)): GOTO 3140
4000  REM
4001  REM **********************
4002  REM APPEND TO PRESENT LINE
4003  REM **********************
4004  REM
4005  IF  LEN (R$) < 3 THEN  PRINT "BAD A": GOTO 100
4010 T$(J) = T$(J) +  MID$ (R$,3)
4020  GOTO 6300
5000  REM
```

```
5001  REM ********************
5002  REM     DELETE LINE(S)
5003  REM ********************
5004  REM
5007 L =  LEN (R$)
5010  IF L > 1 GOTO 5050
5012  REM A "D" ALONE DELETES ONE LINE ONLY
5020  FOR K = J TO I
5030 T$(K) = T$(K + 1): NEXT
5040 I = I - 1:J = J - 1: GOTO 100
5050  IF L = 2 GOTO 5110
5055 N =  VAL ( MID$ (R$,3))
5060  IF N > I - J + 1 THEN 5100
5065  IF N = 0 THEN  PRINT "BAD D": GOTO 100
5070  FOR K = J TO I - N
5080 T$(K) = T$(K + N): NEXT
5090 J = J - 1:I = I - N: GOTO 100
5100  PRINT "DELETE TOO BIG": GOTO 100
5110  PRINT "ILLEGAL DELETE": GOTO 100
6000  REM
6001  REM ********************
6002  REM  PRINT SOME LINES
6003  REM ********************
6004  REM
6007  IF  LEN (R$) < 2 THEN 6300
6010 NUM$ =  MID$ (R$,2)
6020  IF NUM$ = "*" GOTO 6150
6030 NUM =  VAL (NUM$)
6035  IF NUM = 0 THEN T$ = T$(J): GOSUB 350: GOTO 100
6040  FOR K = J TO J + NUM - 1
6050 T$ = T$(J): GOSUB 350:J = J + 1
6060  IF J > I GOTO 6100
6070  NEXT
6075 J = J - 1
6080  GOTO 100
6100  PRINT "EOF:";I;" LINES"
6104  REM
6105  REM  THE END OF FILE WAS FOUND
6106  REM
6110  GOTO 90
6150  REM
6151  REM ********************
6152  REM  IS PRINTOUT WANTED
6153  REM ********************
6154  REM
6160  PRINT : INPUT "PRINTOUT?";PR$
6170  IF  LEFT$ (PR$,1) = "Y" THEN 6350
6180  IF  LEFT$ (PR$,1) = "N" THEN 6200
6190  PRINT : PRINT "TRY AGAIN": GOTO 6160
6200  FOR K = J TO I
6210 T$ = T$(K): GOSUB 350: NEXT
6220  GOTO 6100
6300 T$ = T$(J): GOSUB 350: GOTO 100
6350  REM
6351  REM ********************
6352  REM   PRINT ENTIRE FILE
6353  REM ********************
6354  REM
6360  PRINT D$;"PR#1": PRINT  CHR$ (9);"80N"
```

```
6370  FOR K = J TO I
6374  REM  IF PERIOD SKIP A LINE
6375  IF T$(K) = "." THEN  PRINT : GOTO 6385
6378  IF  LEFT$ (T$(K),4) = ".   " THEN T$(K) = " " +  MID$ (T$(K),2)
6380  PRINT T$(K)
6385  NEXT
6390  PRINT D$;"PR#0": GOTO 6100
7000  REM
7001  REM ********************
7002  REM       SAVE FILE
7003  REM ********************
7004  REM
7006  IF  LEN (R$) > 2 THEN  GOSUB 450:Z$ =  MID$ (R$,3)
7008  IF  LEN (Z$) <  > 0 THEN 7015
7010  PRINT : INPUT "FILE NAME ?";Z$
7012  IF  LEN (Z$) = 0 THEN 7010
7015  PRINT D$;"OPEN";Z$
7020  PRINT D$;"DELETE";Z$
7030  PRINT D$;"OPEN";Z$
7040  PRINT D$;"WRITE";Z$
7050  PRINT I
7060  FOR J = 1 TO I
7070  PRINT T$(J): NEXT
7080  PRINT D$;"CLOSE";Z$
7090  GOTO 90
8000  REM
8001  REM ***********************
8002  REM   RELATIVE MOVEMENT OF POINTER
8003  REM ***********************
8004  REM
8005  IF R$ <  >  CHR$ (110) THEN 8030: REM   A TRANSLATED "N"
8010 J = J + 1
8015  IF J > I THEN  PRINT "EOF:";I;" LINES": GOTO 90
8020 T$ = T$(J): GOSUB 350: GOTO 100
8030 V =  VAL ( MID$ (R$,2))
8040  IF V + J > I OR V + J < 1 GOTO 8100
8050 J = J + V
8060 T$ = T$(J): GOSUB 350: GOTO 100
8100  PRINT "MOVE TOO BIG": GOTO 100
9000  REM
9001  REM ***********************
9002  REM    LOCATE STRING
9003  REM ***********************
9004  REM
9007  IF  LEN (R$) < 3 THEN  PRINT "BAD L": GOTO 100
9010 F$ =  MID$ (R$,3)
9020  FOR K = J + 1 TO I
9030  FOR M = 1 TO  LEN (T$(K)) -  LEN (F$) + 1
9040  IF F$ =  MID$ (T$(K),M, LEN (F$)) GOTO 9070
9050  NEXT M: NEXT K
9060  PRINT "NO FIND": GOTO 90
9070 J = K: GOTO 6300
9400  REM
9401  REM ***********************
9402  REM        HELP USER
9403  REM ***********************
9404  REM
9405  HOME
9407  PRINT : PRINT  SPC( 9);"TEXT EDITING PROGRAM"
```

```
9410  PRINT : PRINT "EACH SINGLE CHARACTER INSTRUCTION SHOWN"
9415  PRINT "BELOW IS TO BE FOLLOWED BY A SPACE AND"
9420  PRINT "AND THEN ANY NEEDED PARAMETERS."
9425  PRINT : PRINT "TO START A NEW FILE, PUSH RETURN WHEN"
9430  PRINT "YOU ARE PROMPTED FOR THE FILE NAME."
9435  PRINT "YOU MAY THEN ENTER YOUR TEXT FILE LINE
9440  PRINT "BY LINE.  WHEN DONE, PUSH RETURN AGAIN"
9445  PRINT "TO ENTER THE EDIT MODE.
9450  PRINT : PRINT  SPC( 4);"** PUSH ANY KEY TO CONTINUE **"
9460  GET G$
9505  HOME
9510  VTAB 2: HTAB 10
9515  PRINT "TEXT EDITING PROGRAM"
9520  PRINT : PRINT "CODE     FUNCTION"
9525  PRINT : PRINT " I        INSERT NEW LINE OF TEXT"
9527  PRINT " ","BEHIND THE PRESENT LINE"
9530  PRINT : PRINT " C        CHANGE THE FIRST STRING TO "
9535  PRINT  SPC( 9),"THE SECOND, USE /'S TO"
9540  PRINT " ","SEPARATE STRINGS"
9545  PRINT : PRINT " A"; SPC( 7);"APPEND STRING TO END OF LINE"
9550  PRINT " ","LEAVE 1 SPACE BETWEEN"
9555  PRINT " ","THE A AND THE STRING"
9560  PRINT : PRINT " D"; SPC( 7);"DELETE 'N' LINES, IF N OMITTED,";
9565  PRINT " ","JUST THIS LINE IS DONE"
9570  PRINT : PRINT " P"; SPC( 7);"PRINT 'N' LINES FROM HERE"
9575  PRINT " ","USE P* TO LIST ALL"
9580  PRINT : PRINT  SPC( 6);"** PUSH ANY KEY TO CONTINUE **"
9585  GET G$
9590  HOME : PRINT : PRINT "CODE     FUNCTION"
9595  PRINT : PRINT " S"; SPC( 7);"SAVE FILE WITH NAME ENTERED"
9600  PRINT " ","IF NO NAME IS ENTERED"
9605  PRINT " ","USE ORIGINAL FILE NAME"
9610  PRINT : PRINT " N"; SPC( 7);"NEXT LINE +/- NUMB IS PRINTED"
9615  PRINT : PRINT " L"; SPC( 7);"LOCATE STRING FROM HERE"
9620  PRINT " ","TO END OF FILE"
9625  PRINT : PRINT " Q"; SPC( 7);"QUIT"
9630  PRINT : PRINT " F"; SPC( 7);"FIND STRING AT START OF ANY"
9635  PRINT " ","LINE FROM HERE TO END"
9640  PRINT : PRINT " R"; SPC( 7);"RETYPE PRESENT LINE"
9645  PRINT : PRINT " H"; SPC( 7);"HELP PROVIDED VIA THIS LIST"
9650  PRINT : PRINT  SPC( 7);"** PUSH ANY KEY TO CONTINUE **"
9651  GET G$
9653  HOME : PRINT : PRINT "CODE     FUNCTION"
9655  PRINT : PRINT " E"; SPC( 7);"NAME FILE TO BE EDITED"
9660  PRINT : PRINT "(CR)"; SPC( 5);"USE CARRIAGE RETURN TO
9665  PRINT  SPC( 9);"ENTER INPUT MODE"
9690  PRINT : PRINT : HTAB 5: PRINT "** PUSH ANY KEY TO CONTINUE **"
9695  GET G$: GOTO 100
```

COMPUTE! OVERVIEW:

Individual Tax Plan

The "Individual Tax Plan" program by Aardvark Software, Incorporated is a highly sophisticated piece of computer software for the Apple computer system (II or Plus) with at least 48K of RAM and two disk drives, DOS 3.3 or PASCAL. It also nicely lends itself to the computerist who, in essence, does not have a working knowledge of computers. As long as the manual is at least previewed, one will not have any trouble running this program.

It is a well-designed, easy to use system for comparing different filing alternatives in order to minimize the income tax liability for an individual taxpayer. It does an effective job of allowing a comparison of numerous different tax preparation schemes at one time. It does not, however, do all of the work and calculations necessary to complete a tax return. Perhaps a better name for the software package would have been "Individual Tax Comparison Scheme."

Up to five alternative tax preparation schemes may be entered at once. One alternative, for example, could include income averaging with schedule G while others could compare filing jointly vs. filing singly for a married couple. Side-by-side comparison of the calculated taxes for each of the alternatives is effectively done by the program. The program is only of value, however, after an individual has calculated many of the numbers that belong on the tax return. For example, tax credits is a single item to be entered. The taxpayer (or tax return preparer) must determine the tax credits for child care expenses and energy-saving expenses (each a percentage of actual expenses and each subject to dollar limitations and other limiting factors), and add them together. This sum is the value that is entered into the "Individual Tax Plan."

It should be stressed that this program is not oriented towards layman use, but towards the tax professional, who has had previous tax preparation exposure. To effectively use this powerful tool one must have a working knowledge of possible tax alternatives to pursue.

Updates

Should changes in federal tax law occur in a calendar year, Aardvark Software will make available revised programs reflecting these changes. Revisions will cost $50.00 and can be obtained from local Aardvark Software dealers. Annual updates reflecting changes in tax law and including program enhancements will be made available on or before November 1st of each calendar year.

Back-up copies of the included program and data disks are allowed using the standard Apple copy program. You should be able to save between 50 and 75 Tax Plan cases on each copy of the data diskette.

Using The Program

During operation of the program the user enters data for up to 74 categories, such as filing status, interest, charitable contributions, and "long term capital gains-post 6/8/81." Unfortunately, the documentation does not follow the program exactly in the identification of the different categories. Items 12 through 32 are misidentified, most of the numbers being off by one. Once the changes are marked on two of the four pages which identify the various categories, there is no difficulty finding the various items, but the problem should never have occurred.

For each category a value can be independently entered for each alternative, or programming options can be used to calculate values for different alternatives. For example, if $10,000 is entered for the first filing alternative, then the remaining alternatives are calculated by the program at 20% increments by simply entering "P20" for percent-20. Other options include "X" if only the next alternative is to be calculated on a percentage basis or "I" for "increment" if all subsequent alternatives are to differ from each other by a specific dollar amount.

After all of the data is entered, the program takes a few seconds to calculate the taxes for all of the alternatives. Any two alternatives (in any order) may be printed as hard copy for easy comparison of the alternatives in different columns. In a strange departure from the easy to use options, here "999" must be entered to indicate that the numbers of all of the desired options have selected. RETURN would have been far easier to use.

Flexibility

One of the strengths of this software package is the ease with which a user can move from one part of the program to another. From a main menu single digit numbers are used to reach further menus which identify specific activities. Several options are offered for moving from category to category for data entry. To "select" a specific category "S" can be typed followed by the number of the category. To move "forward" to the next category "F" is used and "B" is used to "back up." For many of