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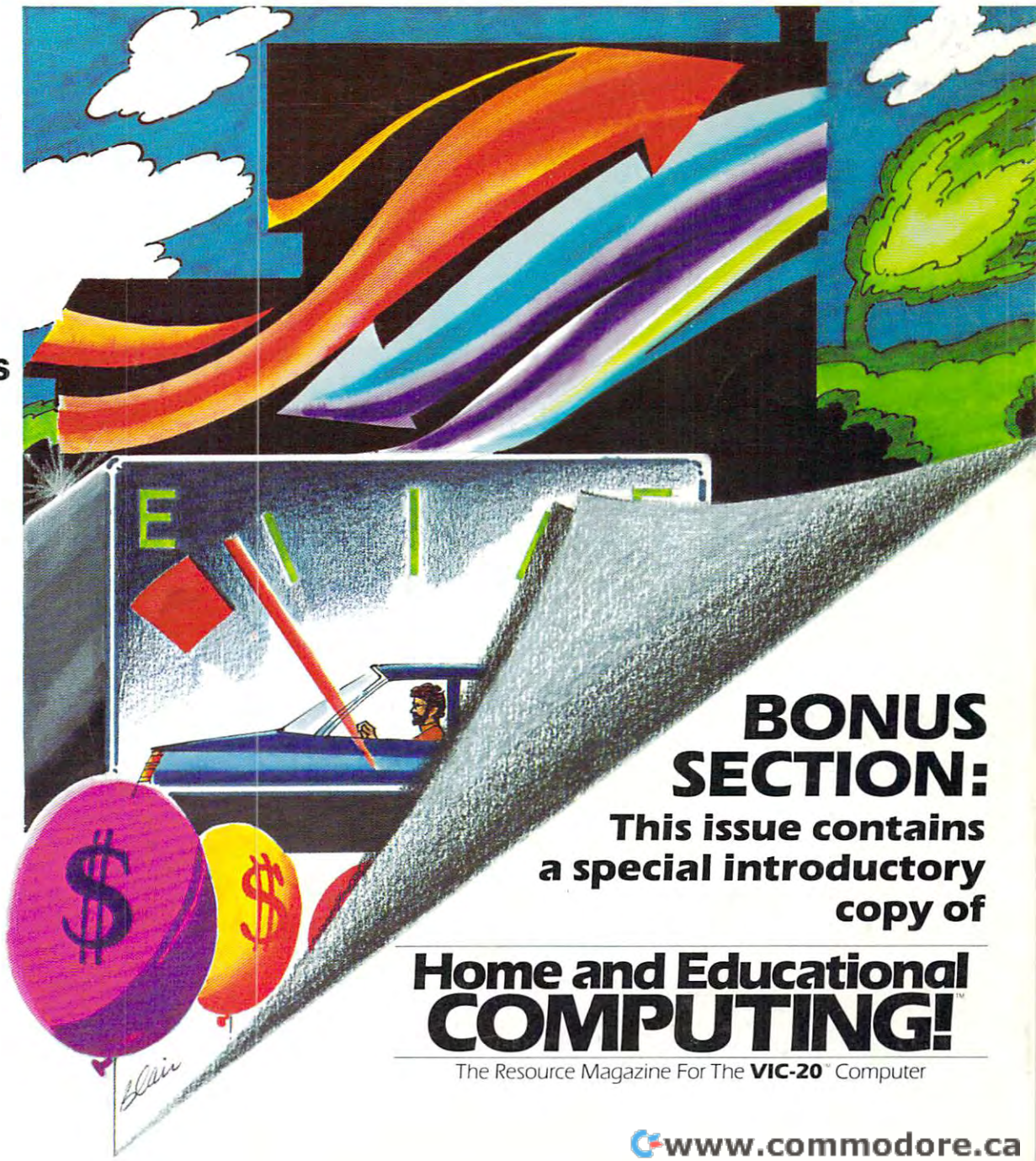

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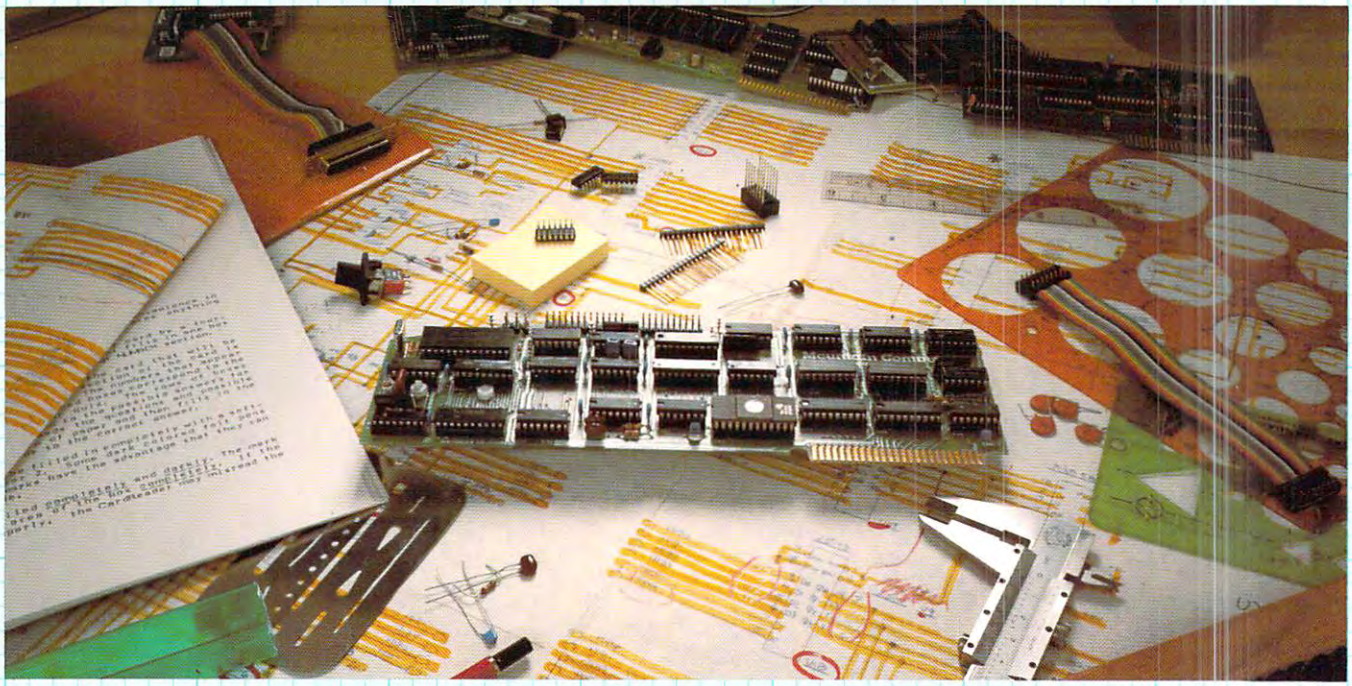

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Table of Contents

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COMPUTE!

The Editor's notes...

Robert Lock, Editor/Publisher

Backing-Up
Software Copyrights Revisited

We're starting to receive some interesting and well-thought-out responses to our series of editorials and guest commentaries on software copyrights. We're also receiving some responses that indicate a basic lack of knowledge regarding the legal aspects of copyright and copyrighted material. A recent example appears in a software catalog we received with some software for review. The vendor states, in the explanation regarding sources of software they're selling, ...this is to be done by offering both our own programs at a low cost, and by distributing for just a minimal fee the programs that are considered 'free domain', i.e. they have been given out in books and magazines, or through computer clubs and are considered available for free use by the public."

This indicates not only a basic misunderstanding of the copyright law, but a flagrant disregard of the strength of copyright.

The attitude is one we're seeing more frequently, and someone, at some point, will be caught by it. The "well I'm not trying to make much money at it" argument is irrelevant to the protection afforded by copyright.

"Free domain" by the way, is a term that doesn't exist. "Public domain" does — it simply refers to that body of materials that are not copyrighted. Books and magazines generally don't fall into that category.

The Fine Print

The following excerpts are taken from three legal memorandums prepared for the National Audio-Visual Association Materials Council. The information is quite clear, and should answer many questions you might have had regarding the state of copyright and software protection. These materials are reprinted by permission of the NAVA Materials Council, 3150 Spring Street, Fairfax, VA 22031. Copyright © 1981, National Audio-Visual Association, Inc.

"... a copyright proprietor of materials utilized in such systems [computer and microcomputer systems] retains all of those rights inherent in a copyright, being more specifically: the right to reproduce copies and/or duplications of such works; the right to control distribution of such works whether by sale, lease, rental, loan or any other form of dissemination; the right to use such works for purposes of adaptive or derivative creation; the right to perform or license others to perform such works publicly, with or without commercial gain; and the right to display or publicly show or exhibit such works. This bundle of rights is in no way diminished simply because a copyrighted work is utilized in conjunction with computer-like systems, which entails that a cassette or diskette cannot be reproduced or distributed without prior authorization of the copyright owner."

"The only extent to which there may be limitations on these rights are those concerning 'fair use' ... A school system, for example, may not purchase a cassette or diskette and simply reproduce unlimited copies to be disseminated around its various locations. It may make, perhaps *one copy* under "fair use" exemptions in the event that the original is lost, destroyed or becomes worn. If, however, the school system desires to have several such cassettes or diskettes in circulation, then it must purchase, rent or lease the additional copies.

"Particularly because today's technology allows copying to be done more easily, more quickly and less expensively than ever before, users of audio-visual and microcomputer software should be aware of the fact that they are still violating the law when they copy without permission of the copyright owner any copyrighted materials..."

"Unauthorized copying and distribution of video cassette software, subject only to the narrow confines of 'fair use' is illegal and can be prosecuted both civilly and criminally on a case by case basis."

Finally, the counsel for NAVA, reviews a December 12, 1980 amendment to the copyright code:

"What does the new law provide? Section 7(b) of Pub. L. 96-517 states:

> *"(b) Section 117 of title 17 of the United States Code is amended to read as follows:*
>
> *§117. Limitations on exclusive rights: Computer programs*
>
> *Notwithstanding the provisions of section 106, it is not an infringement for the owner of a copy of a computer program to make or authorize the making of another copy or adaptation of that computer program provided:*
>
> *(1) that such a new copy or adaptation is created as an essential step in the utilization of the computer program in conjunction with a machine and that it is used in no other manner, or*
>
> *(2) that such new copy or adaptation is for archival purposes only and that all archival copies are destroyed in the event that continued possession of the computer program should cease to be rightful.*
>
> *Any exact copies prepared in accordance with the provisions of this section may be leased, sold, or otherwise transferred, along with the copy from which such copies were prepared, only as part of the lease, sale, or other transfer of all rights in the program. Adaptations so prepared may be transferred only with the authorization of the copyright owner."*

"We do not believe that the above language changes our opinion (as expressed in our earlier statements) that the owner of a properly copyrighted, adequately "noticed" and otherwise copyrightable work is afforded adequate protection from illegal copying or other types of infringement... The above language, however, while admittedly over-riding the "bundle of rights" provisions of Section 106 of the 1976 Act, does not on its face diminish the power of the owner of a computer program copyright to control the duplication, distribution or transference of his works, *except* as to the narrow scope of duplication indicated above..."

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Ask The Readers

Robert Lock And Readers

Well group, here's the first installment. You'll find more questions than answers in this first column, but we expect to balance that out over the next few columns. Thanks for the tremendous response!

"Please (provide) the address of one manufacturer with the company name of 'Giltronix' — they manufacture a RS-232 switch. Thank you." Roy Partridge

---

"One of the many programming techniques Atari has neglected to mention is how to generate pure graphics modes without using the command GR.X. This would be most desirable when writing Assembly programs without the use of BASIC. I have purchased the Atari Hardware Manuals and found nothing to solve this problem. Any help you can give me will be greatly appreciated." Tracy Principio

---

"I would like to see an article in your magazine on television interference generated by microcomputers and how users or the computer manufacturers have solved this problem. I own an Apple II with 48K RAM, disk, and printer. It sits idle because it disrupts television channels 2 and 5. I had my computer modified by my local Apple dealer but the modification did not help one bit. Am I the only person who has made the mistake of buying an Apple II Computer and who lives in an apartment and can't use it and has virtually wasted $3,000 in cash? To sell my Apple seems to be the only solution but I stand to lose a lot of money to replace the system. I have tried getting help from Apple after the modification was made in vain. Just sign me: My Apple II: It does not compute!"

Comments on interference? With the FCC currently working on applying new standards, we'd be interested in some definitive comment.

"I am building a robot and have run into a problem with the speed control circuit for the motorized wheels. I have been using the book "How To Build A Computer Controlled Robot" for reference, without much success. This is due to the fact that I am forced to use Radio Shack parts, which are always being updated, and therefore I have trouble finding good replacements.

The robot uses two motorized wheels which draw seven amps each at twelve volts. The two wheels have separate Reverse/Forward controls, connected to the Micro., so that it might turn by putting one wheel in forward and one in reverse. The speed must also be Micro. controlled by use of on/off cycles. However the speed for each wheel does not have to be separately controlled. I need a design that uses up-to-date Radio Shack parts, and is easy to build." A Subscriber

---

"I am ten years old and have an Atari 800. I have a problem with a program I am writing and would like to have some help. I have an airplane flying on the screen, but I need something to simulate motion. One solution is to make the land scroll, or to make mountains and hills appear to pass you. I don't know how to do this, and if someone could write a few lines for this I would appreciate it. This is in graphics 8." Joseph Daniels

---

COMPUTE! *is printing more and more advertising for modems to connect my home computer to a communication net. Why should I invest in a modem? What exactly, do the various 'nets' offer? Any examples of actual PET/Apple use? What exactly, can I do with a modem — at what costs; at what actual experience speeds? What are the disadvantages — what can a modem not do? Any value to a modem if not net connected?*

Surely many of Compute's readers, as well as some of your advertisers, would like a thorough research of the Modem investment question from the user's viewpoint." Jim Sercile

Good news, Jim. With the addition of Richard Mansfield to our staff you'll see us doing ever expanding and more responsive "keeping up." We'll be starting telecommunications columns in both **COMPUTE!** Magazine and **Home and Educational Computing!** Magazine (our new VIC-20 magazine) sometime before Fall. We're **very** interested in hearing from reader/users on all the points in Jim's letter.

"I recently purchased an ATARI 800 computer. Inside are an ATARI 16K module and a Microtek 32K module, giving me a total of 48K RAM. However, when I ran: PRINT FRE (0), it came back with the number 37,902.

How do you account for the missing 11K? The computer store where I bought it seemed to think that it was normal to receive such a sum due to the operations of the computer. I really don't think it should use up that much RAM. Please inform me as to what the situation is. Thank you." Dennis Gallagher

I wonder if Atari, Inc. will be surprised that Dennis' 48K system came with two manufacturer's RAM boards ... hum? I was. Anyhow, when you ran **PRINT FRE(0)**, your 37,902 indicates there's nothing wrong. That's exactly what you have *left* as free memory in a 48K system, after Atari takes up the RAM it needs for "overhead" — the operating system, screen memory, BASIC, etc.

"I have an Apple II Plus, and was wondering if you could direct my letter — or me — to an Apple User's Group Tape Exchange.

If not, I'll understand — but if there is one around you know about, I'd sure like to hear from them!

I've read all your issues — and am glad to see more and more Apple news all the time!" Dave Wright

---

The following answers and questions are excerpted from that of a reader suggesting a column such as this one; our issue announcing this column had not yet reached him. Small world, right?

"The advantage, I think, of a questions column or columns, is that of eliciting contributions from persons willing to respond to a declared need to know, but uncertain about submitting unsolicited contributions. For instance, the Apple Manuals are not very forthcoming about HIMEM, and I wasn't at all sure that HIMEM set low to protect hex data in high memory wouldn't result in string garbage overwriting the arrays. In fact, it doesn't and I have a little program designed to show what happens. But maybe everyone else already knows. It's not the sort of thing I'd submit without a prompt. Similarly, FRE(0) is virtually instantaneous: Does it really do a garbage collection? Answer: No, it simply resets the garbage pointer.

Of course, as well as being willing to supply answers to questions, should I happen to know them, what I really want is to be able to submit questions, such as 'Has anybody figured out how to fix the bug in DRAW?' " R. R. Hiatt

---

"In the September-October 1978 Volume 1, Issue 6 of PET USER NOTES, there was described a program called "Index" by David Wilcox which allowed the original PET to locate by fast-forward any program on your tape, thereby saving much hunting time. However, this does not work on the new 4.0 machine. Would appreciate knowing what modifications are needed ..." A Reader ©

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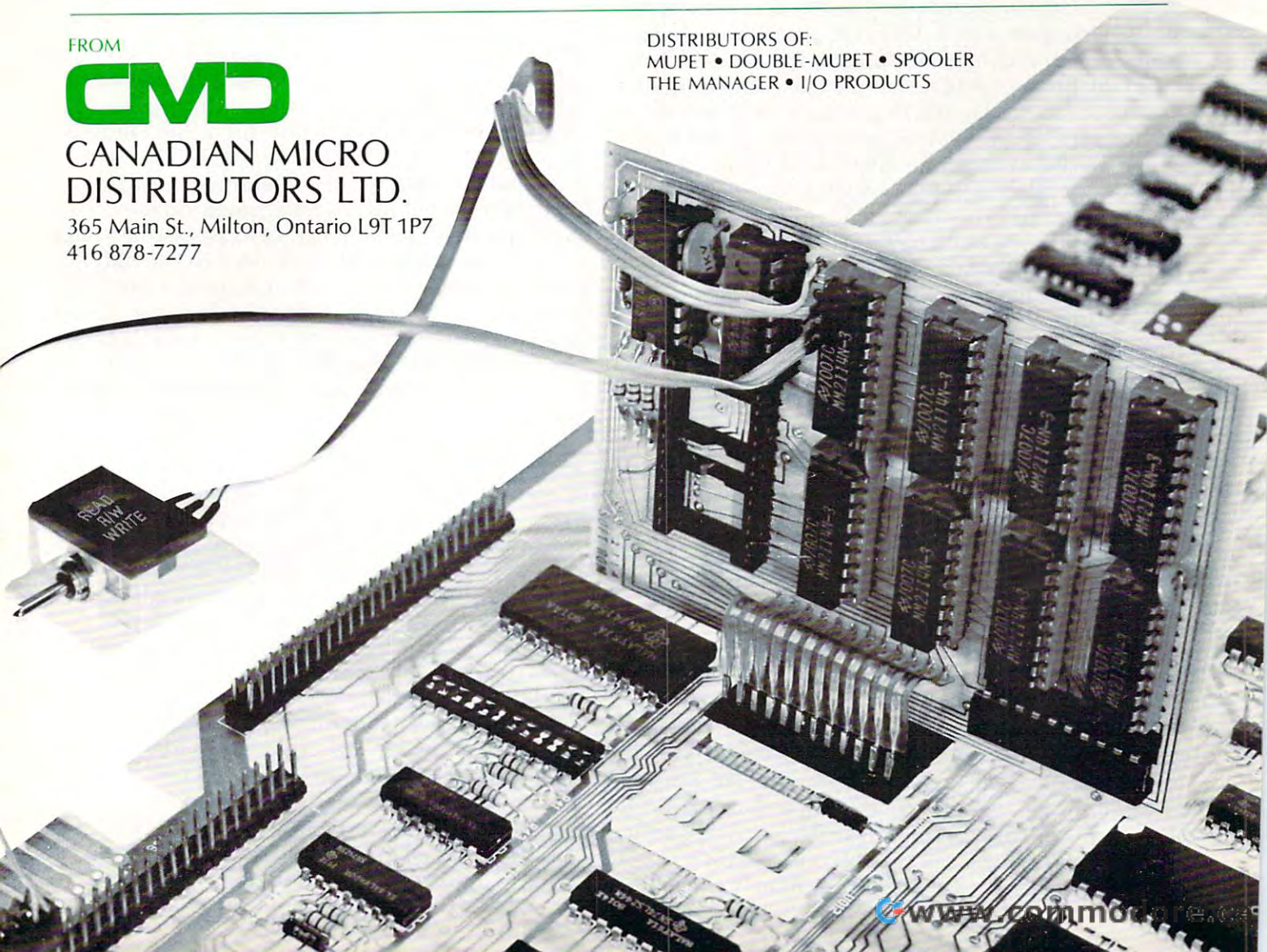

Computers And Society

Some Speculations On The Well-Played Game ...

David D. Thornburg
Los Altos, CA

For starters this month, those of you who use BASIC might like to enter and run this program:

```
10 PRINT "DO YOU PLAY GAMES ON YOUR
   COMPUTER?"
20 INPUT A$
30 IF A$<> "YES" THEN GOTO 10
40 PRINT "I'M NOT SURPRIZED!"
50 END
```

What is the point? Simply that you probably answered YES the first time through.

I have never seen a computer system yet which didn't have games on it. Over the years games have appeared on every electronic computational device from the pocket calculator to the massive computer systems connected to the Department of Defense's ARPA net. The creation of mechanized games is so natural that I wouldn't be surprised if I found out that Charles Babbage, in the 1840's, would have had Ada Byron write some game programs if they had ever finished building his Analytical Engine.

I don't expect that this comes as a surprise to most of you, since the small computers used by most readers of **COMPUTE!** provide extraordinarily versatile environments in which to play games.

There are several reasons for exploring this issue this month. As someone who, through workshops and conferences, has the pleasure of interacting with thousands of people every year, I hear comments about computer technology from many sources — hobbyists, educators, parents, children, business people, etc. More and more often I hear comments which disturb me. These comments include:

"The trouble with personal computers is that they are just toys."

"Why would I buy a computer made by _____; after all, it's just a game machine."

"I don't want personal computers in my classroom. All that the kids do on them is play games all day long."

Now I have no problem countering any of these arguments by showing that any personal computer can be used for much more than "playing games." Any of you can probably list at least ten non-game-related activities appropriately carried out by personal computers.

But that isn't the point I want to make. What I want to do is pause and ask: "What is wrong with playing games?"

Think about this yourself for a minute. Many people are expressing the view that games are somehow less valuable applications of computer technology than, for example, a program which provides drill in irreducible fractions.

Well, I'm sorry folks, but I just don't buy it.

Those of you experiencing the joy of having small children in the house have the opportunity to see a new living being develop into a conscious self-aware human being who acquires a tremendous amount of linguistic, computational, and social skill by the time he or she is four years old. The skills which are a significant fraction of the total skills that the child will acquire over his or her entire lifespan.

What is wrong with playing games?

And yet, what is it that children do during their first four years? By what magic do they accomplish so much? They play games, that's what.

It may look like "Peek-A-Boo" to you, but to an infant this game is a way of helping a child discover that he or she is separate from the parent and from the environment. It becomes a tool for the development of a self concept.

As children grow older they continue to play games. This activity continues into adulthood, with ever newer and more complex games replacing games which have been "outgrown." Game playing spans all cultures and is traceable into the darkest reaches of human history. Playing games is an intrinsic part of the human experience.

Does this mean that I think children should be playing Asteroids *instead* of learning Analytical Geometry? No, of course not. But on the other hand, I reject the hypothesis that you'll grow hair on your hands if you play Space Invaders too much.

And what this all brings me to is the guest commentary by Mr. Alfred D'Attore which appeared in **COMPUTE!** two months ago.

Mr. D'Attore suggested that computers should be used in the classroom for "drill". In his words, drill is supposed to turn students off. He goes on to say that, realistically, there isn't any other way to

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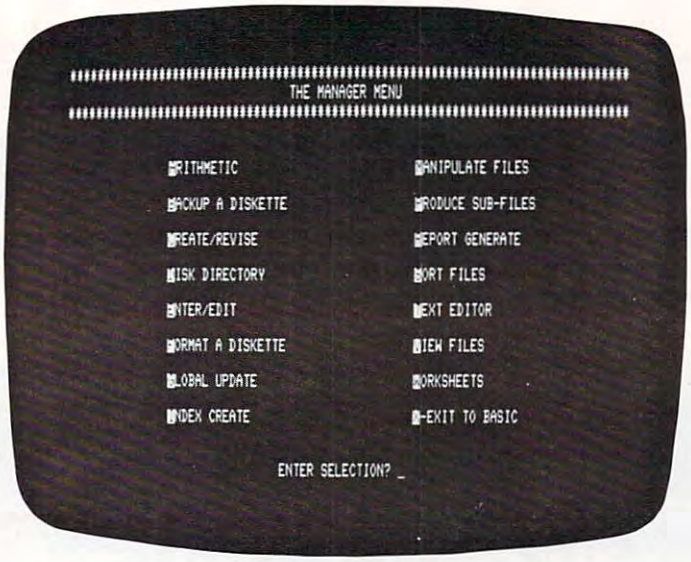

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acquire these basic skills. His experience is that children benefit from drill – disciplined, repeated, old-fashioned drill. The alternative to this is the use of computers for "endless, ever-present games."

I'll bet that I can list quite a few games in my library which provide tremendous opportunity for math drill, but which do it in a way in which the acquisition of these computational skills becomes a necessary part of winning the game. I am contrasting this type of game environment with the "sugar coated" CAI drill programs which intersperse rote computational drill with "cutesy" graphics (happy faces when you get the right answer, etc.). No, what I am talking about is the kind of game which gives more opportunities for the acquisition of computational skills than many so-called drill programs, but which are as appealing as many of the traditional computer games which Mr. D'Attore would prefer *not* seeing in schools.

An acquaintance of mine, Thomas Malone, wrote his Ph.D. thesis on this very topic. His work (entitled: "What Makes Things Fun to Learn? A Study of Intrinsically Motivating Computer Games") is concerned with the study of what it is that glues kids to the computer for hours on end. Perhaps, by finding the key to unlock the secret of traditional computer games, he would be able to generate a set of design criteria useful to those interested in writing intrinsically motivating educational programs.

Working with many children in several schools, Tom tried out several modifications of some popular computer games. He tested children's interest in the games when they consisted of pure non-interactive drill, and when the games were successively enhanced by the addition of performance feedback, scoring, constructive feedback, fantasy, sound, and graphics. He learned a lot from these experiments. For example, he found that the best goals are often practical or fantasy goals (like reaching the moon in a rocket) rather than simply goals of using a skill (like doing arithmetic problems). He found that fantasies often make programs more interesting if they are relevant to the skills being used. He found that constructive feedback is important for educational programs. He found that sound and graphics are important — especially to the extent that they can extend the representational system which the program creates.

A sheet full of computer generated raw addition problems fails to meet all of these criteria, in my estimation.

There is much to be said for thinking of games in a larger context as well. One person who has devoted much effort to this task is games designer and philosopher Bernard DeKoven, author of the (unfortunately out of print) book, **The Well Played Game** (write Anchor Press/Doubleday to see if they plan to reissue it!). This book deals with the sensation of "wellness" which we feel when a game is really working for all the players.

The common thread which binds all members of the play community is this quest for the well-played game — the feeling that, whatever our skills, we are playing well. It doesn't matter if we are playing chess or volleyball, the whole reason we participate in games is to gain a connection with the magical feeling we get when the game is working for us. When we are in this state, we are not playing for the score (although score can be important); we are not having to win (although winning can be important); we are playing to maintain this feeling of excellence in our connection with the game and with whomever we are playing at the time.

... they help us to maintain our self concept and our relationship with others.

Because of this, games take on even more importance in the sense that they help us to maintain our self concept and our relationship with others. As Bernie shows, play is important for everyone, adult and child alike. Through games we become a community. Through well-played games we are able to acknowledge our own and each other's genuine claim to excellence.

With this view in mind, think of your own experience with games. When you remember a game do you remember the score, or do you remember that terrific play when you almost dropped the ball and faked out your opponent to pull off a perfect shot from halfway across the court? Or the time when the invaders were on the bottom row of the screen and you knocked them all out to get a bonus? Or the time your partner made a grand slam in your first perfectly bid hand?

Whatever the game, whether the players number from one to a hundred or more, we who play have a common goal — playing well. This feeling is the ultimate motivator. It, more than anything else, makes us want to excel — makes us forget anything else we are doing — and provides us with more incentive for acquiring skills than any rote drill environment could ever provide.

Is my computer a game machine? You bet it is!

Next month ...

In August I will describe a few exceptional games which I have found to be quite useful in skills acquisition. ©

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Third, you have a choice of voices, male, female, child, accents, etc. this unprecendented flexibility offered by COGNIVOX is a must in the personal computer environment. Voice synthesizers and the "talking chips" do not offer this flexibility and therefore we feel they are not suitable for use with personal computers. In addition, voice output quality can be poor, especially for synthesizers. In that respect, VIO-1002 is clearly superior to anything else on the market and it is a must if voice quality is important (for example, business applications).

Some specifications

COGNIVOX can be trained to recognize words or short phrases drawn from a vocabulary of up to 32 entries chosen by the user.

Training COGNIVOX to your vocabulary is easy. All you have to do is repeat the words three times at the prompting of the computer.

If you would like to have COGNIVOX respond to more than 32 words, you can have two or more vocabularies of 32 words and switch back and forth between them using a word.

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All COGNIVOX units are complete Voice I/O peripherals ready to plug in and use. They come assembled and tested and they include microphone, cassette with software and manuals. VIO units include built-in speaker and amplifier (yes, CB2 is also connected for music and sound effects).

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Easy to use.

All you need to get COGNIVOX up and running is to plug it in and load one of the programs supplied. Load the demo program and start talking to your computer right away. Or load one of the games and discover the magic of voice control.

It is easy to write your own talking and listening programs too. A single statement in BASIC is all that you need to say a word or to recognize a word. Full instructions on how to do it are given in the manual.

Works with all versions.

COGNIVOX will work with all versions of the PET/CBM line. Old, new and newer ROMs. At least 16K of RAM is required (SR-100P will work with 8K of RAM).

If you have a disk system, you can use it to save vocabularies. Instructions are given in the manual.

Many uses.

With COGNIVOX your imagination is not the limit as the saying goes. It is the starting point. Cognivox is a super toy, an educational tool, an aid to handicapped, a data entry device while hands and eyes are busy, a foreign language translator, a sound effects generator, a telephone dialing device, an answering machine, a talking calculator. Using the IEEE 488 port you can control by voice instruments, plotters, test systems. And all these devices can talk back to you, telling you their readings, alarm conditions, even their name.

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To order by mail, give us the model number of the unit you wish to order, the make and model of your computer and your name and address. Enclose a check or money order and make sure to include $5 for shipping and handling. CA residents please add 6% tax. You may also order by phone and charge it to your Master Charge or VISA. Our phone number is (805) 685-1854 9AM to 5PM PST, Monday through Friday. Foreign orders are welcome, please add 10% for air mail shipping and handling. Payments must be in US funds. COGNIVOX is backed by an 120-day limited warranty against manufacturing defects.

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Guest Commentary

The "World Computer"

Marvin De Jong
The School Of The Ozarks
Pt. Lookout, MO

Editor's Note: Most of you are familiar with Marvin's work in the area of problem solving with machine language. We felt this commentary raised some interesting questions. Comments? RCL

From My Soapbox

A few days ago I sat down by my friendly personal computer to load a cassette tape. The tape contained a program intended for educational use at the elementary school level. The loading instructions were complex. Two hours, three tape recorders, and two computers later, I had succeeded only in obtaining the company logo on the video monitor. A phone call to the marketing firm brought the helpful remark "we've never had that problem before." My experience with tapes makes me doubt that statement. If a professional computer user with several computers and tape recorders cannot get a program to run, what do you think will happen in a third grade situation when 20–30 howling kids are left to themselves?

The computer industry, including software vendors, must recognize that entertainment grade cassette instrumentation is completely unsuitable for transporting or storing computer programs. At least that is true in the context of an educational environment.

I am quite happy with our new computer. It has the latest disk operating system. Of course, since most of the disks that are commercially available have a different format, I must boot two disks to use one. My dealer is having difficulty finding the right lower-case adapter for the word-processing system I requested because I have the very latest revision for this computer and disk system. I also just received a complimentary copy of a book containing a disk with a lot of very nice programs on it, for my particular brand of computer. Unfortunately, most of them won't work because they were written for a different version of BASIC. Is this planned obsolescence?

The problems mentioned above were acceptable nuisances when the industry was in its infancy. The same problems are no longer acceptable. A third grade teacher is not a computer expert, and the computer will soon be gathering dust in a corner if it is not easy to load and run programs. Furthermore, the educational system in this country is already in financial difficulty. The tremendous expense involved in operating and/or upgrading different systems will stifle the use of computers at many levels.

Perhaps up until now, industry competition has been fruitful, but competition and cooperation need not be mutually exclusive forces in terms of progress. Why not think about a "world computer," designed for personal and educational use? This computer would be designed by people from (say) "the big four" personal Computer manufacturers (Tandy, Apple, Commodore, and Atari). Each of the four could market their version, but all versions would be completely hardware, software, and graphics compatible. They would all load the same *disks*. They would *not* have cassette I/O, but they would come complete with one disk drive. Color might be optional. Printer interfaces would be compatible and networking would be supported.

Try to imagine the impact of such a development on personal computing, particularly in the educational world. It is difficult to think of a single negative effect. Computer manufacturers would still be able to manufacture their own "other" computers for specific applications, but an inexpensive computer with vast amounts of software would be available to many more individuals than is now the case.

Where would personal transportation be now if automobile manufacturers had produced a world car with universal parts available everywhere? Probably they would not be in financial trouble, and the use of a car would probably not be confined to a *small* percentage of the world's population. ©

The Beginner's Page

Richard Mansfield
Assistant Editor

When you first see BASIC, many of the ideas and techniques of programming are pretty straightforward. GOTO 100 is easy enough. You are telling the computer to jump from wherever it might be in a program to the instructions on line 100. PRINT "LARRY" is not too hard to grasp. (The word PRINT is used because BASIC, in the early days, sent program results — "output" — to a teletype machine instead of a TV. PRINT used to describe what it did exactly. Now, perhaps, another word would be more correct, but it's too late to change things at this point.

In general, though, BASIC words are more or less like what they mean in English. And ideas such as "less than" or "more than" are pretty familiar concepts. Its just a matter of learning the words and punctuation of BASIC and you're *programming* (telling the computer what you want it to do).

But some BASIC words are not so simple. RND, ON GOTO, VAL, GOSUB, STR$, DIM, DATA, are words which refer to ideas generally found only in the computing world. They take some getting used to and some practice. The best way to understand these *computer* words is to work with them in short programs and watch what they do. What effects do they have? How are they useful in getting jobs done?

Probably the most difficult BASIC word (or "statement") to quickly understand is ON GOTO. It usually appears something like this: 10 ON A GOTO 500, 600, 700. We know that GOTO means to jump to a certain line number. But here we are giving the computer three choices of line numbers to jump to. How will it decide? The decision depends "ON A." "A" in this line is a variable. That means that it is just like a box and what's in BOX A could be any number. The contents of the box we call "A" vary — sometimes A is 15 and sometimes A is 233.001 and so forth. A is *variable*, it changes whenever something in the program causes it to change.

The ON GOTO statement makes the computer look up A to see what is "in" A. If A is the number one, then the computer will GOTO the first line number in the list (500). If A is three, then we will GOTO line 700. We only put three line numbers in our program (500, 600, 700) so A had better not be a 5 or a -12. It must be one, two, or three. We could have written: 10 ON B GOTO 40, 50, 60, 70. In this case, the computer would look up variable "B" to see which number between one and four was "in" B. Then it would GOTO the correct line number.

Let's try a short program to illustrate this idea (this sort of programming is called "multiple branching"):

```
10 INPUT A
20 IF A < 1 OR A > 3 THEN GOTO 10
30 ON A GOTO 500,600,700
500 PRINT "WE WENT TO LINE 500"
501 END
600 PRINT "WE WENT TO LINE 600"
601 END
700 PRINT "WE WENT TO LINE 700"
```

INPUT makes the computer stop and wait for something to be typed in from the keyboard (followed by a carriage return). Line 20 is a common programming technique which checks to see if wrong, *illegal*, things were typed in. Since we don't want any numbers except one through three (that's all we provided for in our list on line 30) — we have the computer go back to line 10 for another INPUT if the first one was illegal.

We had to put two END's in or the program would have just gone on to print each message in turn. END stops everything, as you would expect. This "multiple branching" is very often used when you want to allow a choice among different parts of a program. Let's say that you have a program which is really several programs in one. It can do four different things, play four different card games. Common programming practice would begin such a program with a listing of the options. It would say, "Please choose: 1. Poker 2. High-card 3. Bridge 4. Patience." When this *menu* came onto the screen, the user would type in a number between one and four. This is perfect for the ON GOTO statement.

A similar statement is ON GOSUB, but we'll deal with the important topic of *subroutines* in the future. For now, try an experiment. See what would happen with our short multiple branching program if you typed in 1.5 as input instead of an integer (whole number).

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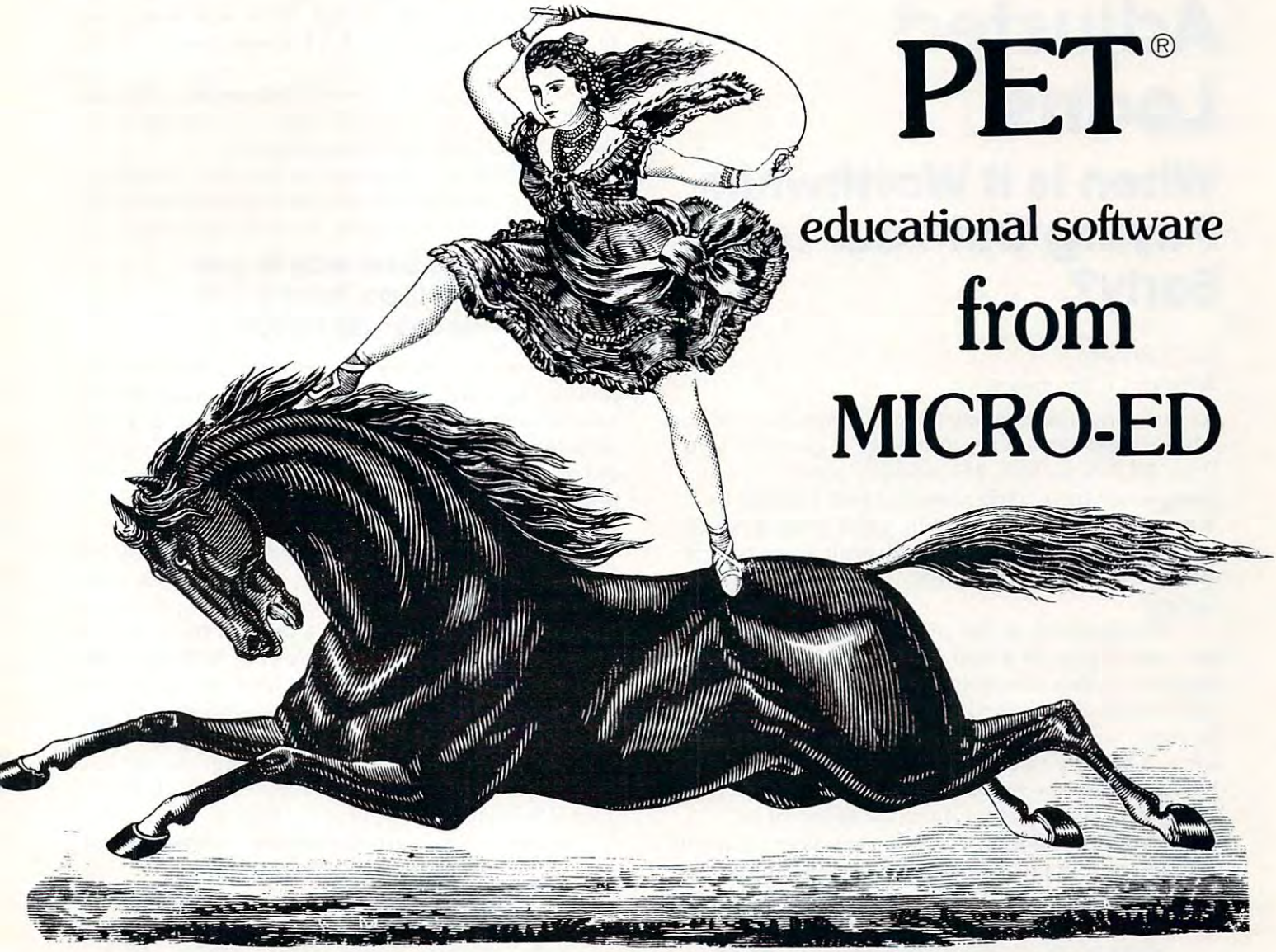

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Inflation Adjusted Loans

When Is It Worthwhile Paying Out Your Loan Early?

M. R. Smith
Alberta, Canada

In June, my house mortgage comes up for renewal. The interest rate on my mortgage is going to jump from 10.75% to 16%. My monthly payments are going to go from $463 principal plus interest to around $680. Since this is one great jump already, I wondered if it would be worthwhile increasing it another $50 a month in order to pay the loan off earlier?

The purpose of this program is to find out the best way to pay off a loan, taking into account inflation, which affects both your salary and the value of the dollar used to pay back your loan. It has been written in a general, machine independent form. The only change needed is in line 13010. Forms of this line for the Apple, PET and TRS-80 are given. The input has been designed to be quasi-foolproof and will accept a carriage return to indicate no change in value. The program investigates the interaction of changes in your salary, the dollar you use and the monthly payments.

Many people realize that paying out a loan early can result in a big saving in the amount of money you have to pay to the bank. Even a small amount of increased payment can make a very large saving appear. If, for example, you have a $50,000 loan at 16% interest, being paid back at $680/month. Over the length of the loan you will have to pay the bank $201,960. Paying back at $710/month, a mere $30 increase, results in a saving of more than $51,000. The table below shows the savings that occur for a number of monthly payments.

Payment Per Month	Total Paid Out	Saving	Loan Paid In
$680	$201,960	–	25 yrs
$710	$150,520	$51,440	17.7 yrs
$740	$129,500	$72,460	14.6 yrs
$770	$117,040	$84,920	12.6 yrs
$800	$108,800	$93,160	11.2 yrs

The purpose of this program is to investigate whether or not these enormous savings are real. After all, inflation means that 10 years down the line you are paying with really deflated dollars. Is it worthwhile to pay out your loan early when your early payments are made in non-inflated dollars? I have always presumed that there was some optimum monthly payment. Pay back too much, too early, then you put a strain on your budget and waste money by paying in non-inflated money. Pay back too little then you waste money by paying for too long. What is this optimum payment?

In addition, suppose you find that paying out early is a good idea, what is the best amount to pay a

... the best way to pay off a loan, taking into account inflation ...

month? Now the answer to this question will depend on what you can afford to pay. If you pay out a large amount each month then you will have little left to pay for other luxuries like food. It is therefore important to determine the impact of the payments on your monthly take-home pay.

As an example, suppose that a loan for $50,000 at an interest rate of 16% per year has been taken out. The net (after tax) income is $3,000 per month and expected to increase at a yearly rate of 12% to counteract inflation. The following table indicates what would happen to both the total cost of the payment and the inflation-adjusted payment. The percentage of the salary that goes into the loan is also indicated. The percentage over the length of the loan and the percentage in the first year are both shown. This information is graphed in Figure 1.

Monthly Payment	Total Payment	Inflation Adjusted Payment		% Of Income Used	
		10%	15%	Average	First Year
$680	$201,960	$81,268	$60,588	8.0%	22.6%
$710	$150,520	$76,301	$59,777	10.8%	23.6%
$740	$129,500	$73,321	$59,190	12.7%	24.6%
$770	$117,040	$71,217	$58,750	14.4%	25.6%
$800	$108,800	$69,709	$58,467	15.8%	26.6%

It can be seen from the graph that the line indicating total amount repaid drops very rapidly as the monthly payment increases. However, the lines for the inflation-adjusted total repayments are very flat, especially for the 15% inflation rate. The 10% inflation rate shows a large drop for the first increase in monthly payment, but it too is fairly flat. However, the average percentage of your salary spent on the loan rapidly increases as your monthly payments increase (column 5). This is because when you pay off very quickly, you are paying in non-inflated dollars and your salary is lower.

From these figures, it seems that it makes sense to pay a little extra a month. Paying a great deal extra only puts a strain on your budget with little overall saving.

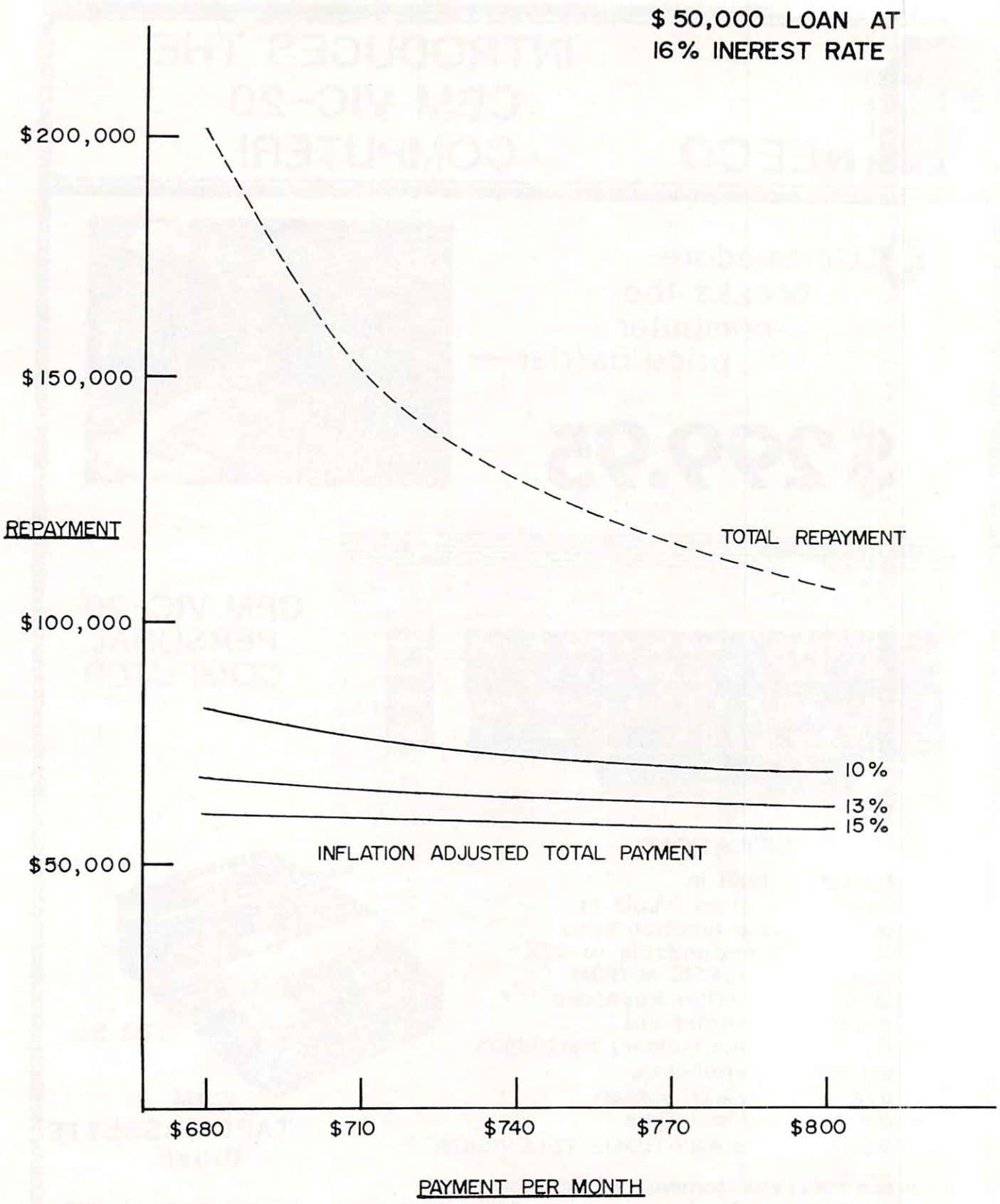

Figure 1

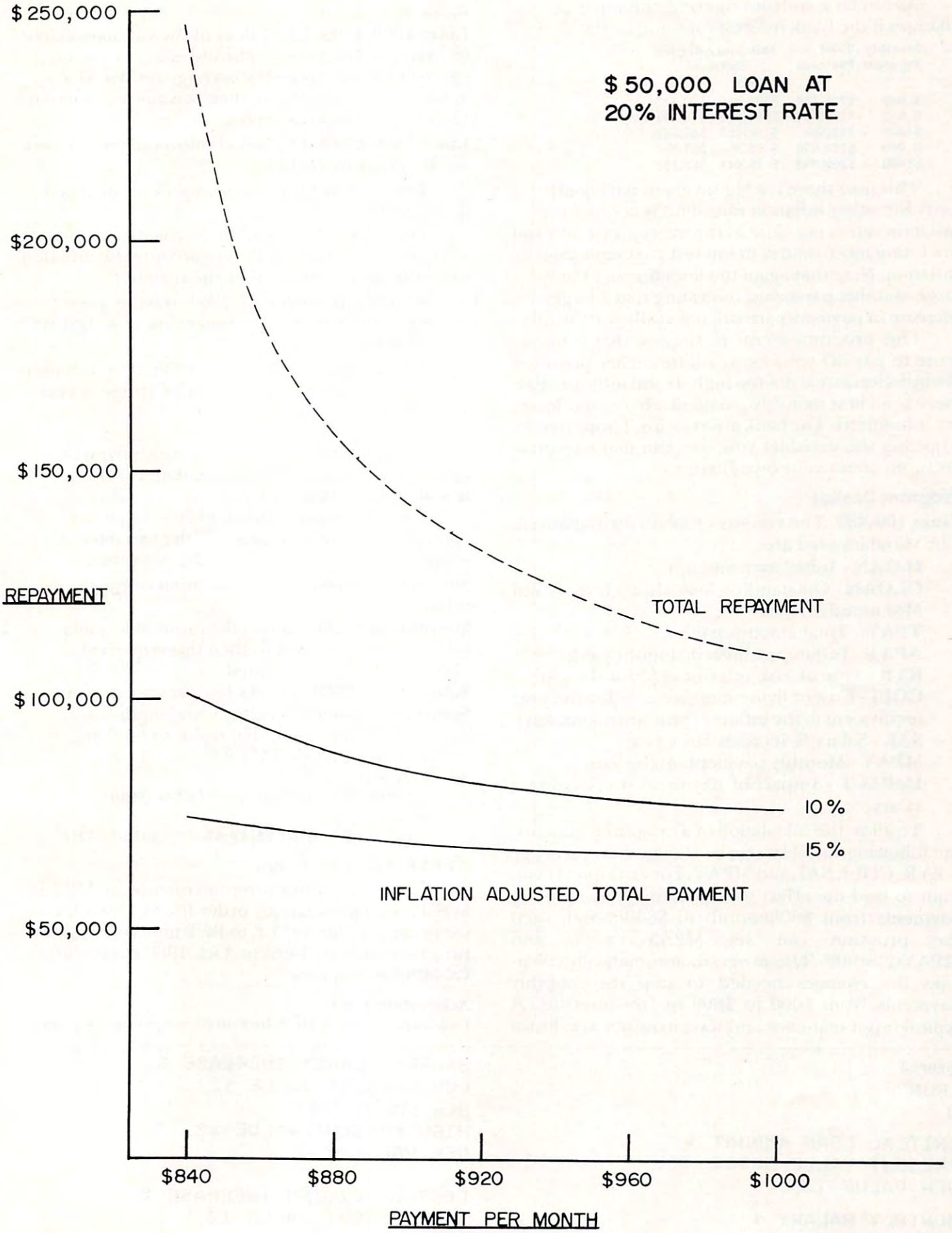

Figure 2

As can be seen from figure 2, the situation changes if the bank interest rate shifts to 20%.

Monthly Payment	Total Payment	Inflation Adjusted Payment 10%	15%
$ 840	$246,120	$100,049	$74,727
$ 880	$156,640	$ 87,888	$70,721
$ 920	131,560	$ 82,423	$68,622
$ 960	$118,080	$ 78,974	$67,200
$1000	$109,000	$ 76,443	$66,132

This time there is a big saving in paying off early for either inflation rate. This is because the inflation rate is not close to the interest rate and you are losing more money in interest payments than in inflation. Note that again the lines become flat for large monthly payments, indicating that a large increase in payments are still not really worthwhile.

This program seems to suggest that it makes sense to pay off your loans a little earlier provided the inflation rate is not too high. It also indicates that there is no best monthly payment where your losses are minimized. The bank always wins. I hope that by adjusting the variables you, too, can make sensible decisions about your own finances.

Program Design

Lines 100-490. The various variables are initialized. The variables used are:

ILOAN - Initial loan amount.
OLOAN - Outstanding loan after YR years and MM months.
TPAY - Total amount paid.
APAY - Inflation adjusted amount paid.
RYR - Rate of loan interest as % for the year.
COLI - Cost of living increase as % for the year (equivalent to the inflation rate approximately).
SAL - Salary % increase for a year.
MPAY - Monthly payment on the loan.
IMPACT - Impact of payments on remaining salary.

To allow the calculation of a range of payments, the following variables can be changed over a range :- RYR, COLI, SAL and MPAY. For example: If you want to find the effect of increasing your monthly payments from $600/month to $800/month then the program can set MPAY(1)=600 and MPAY(2)=900. The program automatically calculates the changes needed to step the monthly payments from $600 to $800 in five intervals. A typical input sequence and screen output are shown in fig. 3.

Lines 1000-1300. The values of the variables can be changed in this section. The old value can be accepted by simply pressing carriage return. If a value of zero (0) is input, then this value is queried. However, it can be accepted.

Lines 2000-2590. The actual calculation of the various totals are made here.

The interest for the new month is calculated in line 2310.

The monthly payment is calculated in line 2370. It is adjusted to take into account the inflation since the start of the loan by the formula:

Monthly payment in 1981 buying power = monthly payment x actual value of a 1981 dollar at this time.

Actual value of a dollar = 100/(100 + inflation rate) all raised to the power of (present year – 1981).

The impact value of the monthly payment is calculated in line 2390. It is calculated as the fraction of a month's salary.

The subroutines 10000, 11000, 12000 and 13000 take in the new values of the variables. A simple carriage return retains the old value.

Subroutine 10000 - allows the input of ranges of values.
Subroutine 11000 - allows the input of a single value. If the value is zero then this is queried. However, it can be accepted.
Subroutine 12000 - checks for a yes/no answer.
Subroutine 13000 - gets the actual input line.

There is one statement that needs to be changed when using a PET or TRS-80.

For a PET:
```
13010 GET A$: IF A$ = "" THEN 13010
```
For a TRS-80:
```
13010 A$ = INKEY$: IF A$ = "" THEN 13010
```

APPLE And PET Users:

For a copy of this program on tape in APPLESOFT, send me a money order for $15.00. PET users can use the APPLE to PET tape conversion program listed in the Sept./Oct. 1980 edition of **COMPUTE!** magazine.

Acknowledgements
I would like to thank Mr. John Post for preparing the graphs.

Figure 3

```
 RUN
]

INITIAL LOAN AMOUNT $
PRESENT VALUE 50000
NEW VALUE <CR>

MONTHLY SALARY $
PRESENT VALUE 2000
NEW VALUE 3000 <CR>

SALARY YEARLY INCREASE %
LOW PRESENT VALUE 12
NEW VALUE <CR>
HIGH PRESENT VALUE 12
NEW VALUE <CR>

COST OF LIVING INCREASE %
LOW PRESENT VALUE 12
NEW VALUE <CR>
HIGH PRESENT VALUE 12
```

```
NEW VALUE <CR>

MONTHLY PAYMENT RATE $
LOW PRESENT VALUE 650
NEW VALUE <CR>
HIGH PRESENT VALUE 800
NEW VALUE <CR>

LOAN INTEREST RATE YEARLY %
LOW PRESENT VALUE 16
NEW VALUE <CR>
HIGH PRESENT VALUE 16
NEW VALUE <CR>

PRINT OUT END-OF-YEAR TOTALS? Y/N N
<CR>

LOAN $50000  INTEREST RATE 16%
INFLATION 12%  SALARY $3000/MONTH
SALARY INCREASE 12%

CAN'T BE DONE @ $650/MONTH

AFTER 24 YRS 9 M @ $680 /MONTH
TOTAL $201960   ADJUSTED $71545
IMPACT FACTOR 8

AFTER 17 YRS 8 M @ $710 /MONTH
TOTAL $150520   ADJUSTED $68765
IMPACT FACTOR 10

AFTER 14 YRS 7 M @ $740 /MONTH
TOTAL $129500   ADJUSTED $66981
IMPACT FACTOR 12

AFTER 12 YRS 8 M @ $770 /MONTH
TOTAL $117040   ADJUSTED $65685
IMPACT FACTOR 14

AFTER 11 YRS 4 M @ $800 /MONTH
TOTAL $108800   ADJUSTED $64762
IMPACT FACTOR 15
```

```
]LIST

10  REM
11  REM      CALCULATION OF WHEN TO PAY OUT YOUR LOAN
12  REM
13  REM  M.R.SMITH  MARCH 1981
14  REM
15  REM    304, 86TH AVENUE SE,
16  REM    CALGARY, ALBERTA,
17  REM    CANADA T2H 1N7
18  REM
100  REM   ******************************
110  REM
120  REM   INITIALIZE VARIABLES
130  REM
140  REM   ILOAN = INITIAL LOAN
150  REM   OLOAN = OUTSTANDING LOAN
160  REM
170 ILOAN = 50000:OLOAN = ILOAN
180  REM
190  REM  TPAY = TOTAL PAYMENTS
200  REM  APAY = INFLATION ADJUSTED TOTAL PAYMENTS
210  REM   IMPACT = SALARY IMPACT FACTOR
220  REM
230 TPAY = 0:APAY = 0:IMPACT = 0
240  REM
250  REM  RYR(1) = % RATE YEARLY INTEREST (LOW)
260  REM  RYR(2) = % RATE YEARLY INTEREST (HIGH)
270  REM  RYR(3) = STEP
280  REM
290 RYR(1) = 16:RYR(2) = 16
300  REM
310  REM  COLI(1) = % COST OF LIVING INCREASE YEARLY (LOW)
320  REM  COLI(2) = % COST OF LIVING INCREASE YEARLY (HIGH)
330  REM  COLI(3) = STEP
340  REM
350 COLI(1) = 12:COLI(2) = 12
```

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ALL TIME SUPER STAR BASEBALL Sample Lineup		SUPER STAR BASEBALL Sample Lineup	
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L. Gehrig	J. Foxx	W. Stargell	H. Aaron
J. DiMaggio	H. Greenberg	W. Mays	L. Brock
J. Jackson	R. Hornsby	P. Rose	R. Carew
G. Sisler	H. Wilson	O. Cepeda	H. Killebrew
S. Musial	B. Terry	C. Yazstremski	R. Allen
T. Cobb	M. Mantle	W. McCovey	R. Leflore
W. Mays	H. Aaron	R. Jackson	R. Zisk
C. Young-P	W. Johnson-p	G. Brett	B. Madlock
		R. Guidry-P	T. Seaver-p

Performance is based on the interaction of actual batting and pitching data. Game can be played by one or two players with the computer acting as a second player when desired. Players select rosters and lineups and exercise strategic choices including hit and run, base stealing, pinch hitting, intentional walk, etc. Highly realistic, there are two versions, ALL TIME SUPER STAR BASEBALL, and SUPER STAR BASEBALL featuring players of the present decade. Each includes about 50 players allowing nearly an infinite number of roster and lineup possibilities.

***Both Games $24.95**

SWORD OF ZEDEK

Fight to overthrow Ra, The Master of Evil. In this incredible adventure game, you must confront a host of creatures, natural and supernatural. To liberate the Kingdom, alliances must be forged and treasures sought. Treachery, deceit and witchcraft must be faced in your struggles as you encounter wolves, dwarves, elves, dragons, bears, owls, orcs, giant bats, trolls, etc. Each of the twelve treasures will enhance your power, by making you invisible, invulnerable, more eloquent, more skillful in combat, etc., etc., as you explore the realms of geography, both on the surface and underground. Dungeons, temples, castles, mountains, etc., are all a part of the fantastic world of Ra. Each game is unique in this spectacular and complex world of fantasy. $24.95

ISAAC NEWTON

Perhaps the most fascinating and valuable educational game ever devised - ISAAC NEWTON challenges the players (1-4) to assemble evidence and discern the underlying "Laws of Nature" that have produced this evidence. ISAAC NEWTON is an inductive game that allows players to intervene actively by proposing experiments to determine if new data conform to the "Laws of Nature" in question. Players may set the level of difficulty from simple to fiendishly complex.

In a classroom setting the instructor may elect to choose "Laws of Nature" in accordance with the complete instruction manual provided.

For insight into some of the basic principles underlying **ISAAC NEWTON** see *Godel, Escher, Bach* by Douglas R. Hofstadter, Chapter XIX and Martin Gardner's "Mathematical Games" column in **Scientific American**, October, 1977 and June, 1959. $24.95

TIME TRAVELER

The best of the adventure games. Confronts player with complex decision situations and the demand for real time action. Using the Time Machine, players must face a challenging series of environments that include; The Athens of Pericles, Imperial Rome, Nebuchadnezzar's Babylon, Ikhnaton's Egypt, Jerusalem at the time of the crucifixion, The Crusades, Machiavelli's Italy, the French Revolution, the American Revolution, and the English Civil War. Deal with Hitler's Third Reich, Vikings, etc. At the start of each game players may choose a level of difficulty. . . the more difficult, the greater the time pressure. To succeed you must build alliances and struggle with the ruling powers. Each game is unique. $24.95

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*Programs for APPLE or TRS-80 are on ☐ **disk or** ☐ **cassette, *please specify.***

All programs require 16K ● TRS-80 programs require LEVEL II BASIC ● APPLE programs require Applesoft BASIC

Krell Software

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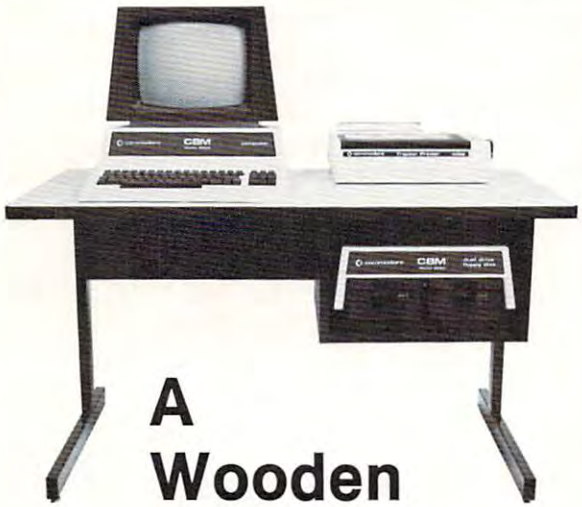
21 Milbrook Drive, Stony Brook, NY 11790
(516) 751-5139

```
360  REM
370  REM  MPAY(1) = MONTHLY PAYMENT (LOW)
380  REM  MPAY(2) = MONTHLY PAYMENT (HIGH)
390  REM  MPAY(3) = STEP
400  REM
410 MPAY(1) = 650:MPAY(2) = 800
420  REM
430  REM  SAL(0) = MONTHLY SALARY
440  REM  SAL(1) = % RATE OF SALARY INCREASE PER YEAR (LOW)
450  REM   SAL(2) = % RATE OF SALARY INCREASE PER YEAR (HIGH)
460  REM  SAL(3) = STEP
470  REM
480 SAL(0) = 2000:SAL(1) = 12:SAL(2) = 12
490  REM
500  REM  SUBROUTINES
510  REM
520  REM  DUMMY AND DUMMY() ARE VARIABLES USED IN SUBROUTINES
530  REM  CARRIAGE RETURN ALONE RETAINS OLD ANSWER
540  REM
550  REM  GOSUB 10000 - GET A RANGE OF VARIABLES
560  REM  GOSUB 11000 - GET A VARIABLE
570  REM  GOSUB 12000 - GET A YES/NO ANSWER
580  REM  GOSUB 13000 - GET THE INPUT LINE
990  REM  GET THE NEW VALUES
992  REM
1000  PRINT : PRINT : PRINT "INITIAL LOAN AMOUNT $"
1010 DUMMY = ILOAN: GOSUB 11000:ILOAN = DUMMY
1020  REM
1030  PRINT : PRINT "MONTHLY SALARY $"
1040 DUMMY = SAL(0): GOSUB 11000:SAL(0) = DUMMY
1050  PRINT : PRINT "SALARY YEARLY INCREASE %"
1060 DUMMY(1) = SAL(1):DUMMY(2) = SAL(2): GOSUB 10000
1070 SAL(1) = DUMMY(1):SAL(2) = DUMMY(2):SAL(3) = DUMMY(3)
1080  REM
1090  PRINT "COST OF LIVING INCREASE %"
1100 DUMMY(1) = COLI(1):DUMMY(2) = COLI(2): GOSUB 10000
1110 COLI(1) = DUMMY(1):COLI(2) = DUMMY(2):COLI(3) = DUMMY(3)
1120  REM
1130  PRINT "MONTHLY PAYMENT RATE $"
1140 DUMMY(1) = MPAY(1):DUMMY(2) = MPAY(2): GOSUB 10000
1150 MPAY(1) = DUMMY(1):MPAY(2) = DUMMY(2):MPAY(3) = DUMMY(3)
1160  REM
1170  PRINT "LOAN INTEREST RATE YEARLY %"
1180 DUMMY(1) = RYR(1):DUMMY(2) = RYR(2): GOSUB 10000
1190 RYR(1) = DUMMY(1):RYR(2) = DUMMY(2):RYR(3) = DUMMY(3)
1200  REM
1210  PRINT "PRINT OUT END-OF-YEAR TOTALS? Y/N ";
1220  GOSUB 12000:EOY$ = YN$
1990  REM
1991  REM  ACTUAL CALCULATIONS
1992  REM
2000  REM    LOOP ON INTEREST RATES - ADJUST TO MONTH AND FRACTION
2010  FOR RYR = RYR(1) / 1200 TO RYR(2) / 1200 STEP RYR(3) / 1200
2020  REM
2030  REM   COST OF LIVING LOOP - ADJUST TO FRACTION
2040  FOR COLI = COLI(1) / 100 TO COLI(2) / 100 STEP COLI(3) / 100
2050  REM  AV IS ACTUAL VALUE OF A STARTING DOLLAR AT END OF YEAR
2060 AV = 1 / (1 + COLI)
2070  REM
```

```
2080  REM     SALARY INCREASE LOOP - ADJUST TO FRACTION
2090  FOR SAL = SAL(1) / 100 TO SAL(2) / 100 STEP SAL(3) / 100
2100  REM
2110  PRINT : PRINT "LOAN $";ILOAN;"  INTEREST RATE "; INT (RYR * 12
   000 + 0.5) / 10"%"
2120  PRINT "INFLATION " INT (COLI * 1000 + 0.5) / 10"%  ";
2130  PRINT "SALARY $";SAL(0)"/MONTH"
2140  PRINT "SALARY INCREASE " INT (SAL * 1000 + 0.5) / 10"% "
2150  REM
2160  REM    MONTHLY PAYMENT LOOP
2170  FOR MPAY = MPAY(1) TO MPAY(2) STEP MPAY(3)
2180  REM  INITIAL VARIABLES
2190 OLOAN = ILOAN: REM  LOAN AMOUNT
2200 TPAY = 0: REM  TOTAL PAY
2210 APAY = 0: REM  ADJUSTED PAYMENT
2220 IMPACT = 0: REM  SALARY IMPACT
2230  REM  CAN'T BE DONE IF INTEREST INCREASE ABOVE REPAYMENTS
2240  IF OLOAN * RYR < MPAY THEN 2270
2250  PRINT : PRINT "CAN'T BE DONE @ $"; INT (MPAY * 100) / 100;"/MO
   NTH": GOTO 2530: PRINT
2260  REM  LOOP OVER A MAX OF 50 YEARS
2270  PRINT : FOR M = 1 TO 6000
2280  REM  IN WHAT YEAR AND WHAT MONTH?
2290 YR =  INT ((M - 1) / 12):MM = M - YR * 12
2300  REM  NEW INTEREST SINCE LAST PAYMENT
2310 MI = OLOAN * RYR
2320  REM  OUTSTANDING LOAN AFTER NEW PAYMENT
2330 OLOAN = OLOAN + MI - MPAY
2340  REM  TOTAL AMOUNT PAID
2350 TPAY = TPAY + MPAY
2360  REM  INFLATION ADJUSTED AMOUNT PAID
2370 APAY = APAY + MPAY * AV ^ YR
2380  REM  SALARY IMPACT
2390 IMPACT = IMPACT + MPAY / (SAL(0) * (1 + SAL) ^ YR)
2400  REM  LOAN PAID OUT?
2410  IF OLOAN < 0 THEN 2500
2420  IF EOY$ = "N" OR MM <  > 12 THEN  NEXT M: GOTO 2460
2430  PRINT "$"; INT (MPAY * 100) / 100;" YR "YR + 1" T $" INT (TPAY
   );
2440  PRINT " A $" INT (APAY)" I " INT (IMPACT * 100 / M)
2450  NEXT M
2460  PRINT "OVER FIFTY YEARS"
2470  REM
2480  REM  PRINT ON THE SCREEN
2490  REM
2500  PRINT "AFTER ";YR;" YRS ";MM;" M @ $";MPAY;" /MONTH"
2510  PRINT "TOTAL $"; INT (TPAY),"ADJUSTED $"; INT (APAY)
2520  PRINT "IMPACT FACTOR "; INT (IMPACT * 100 / M)
2530  NEXT MPAY
2540  NEXT SAL
2550  NEXT COLI
2560  NEXT RYR
2570  REM   DO IT AGAIN
2580  PRINT : PRINT "AGAIN Y/N ";: GOSUB 12000
2590  IF YN$ = "Y" THEN 1000
2600  STOP
9990  REM
9992  REM  GET A RANGE OF VALUES
9994  REM
```



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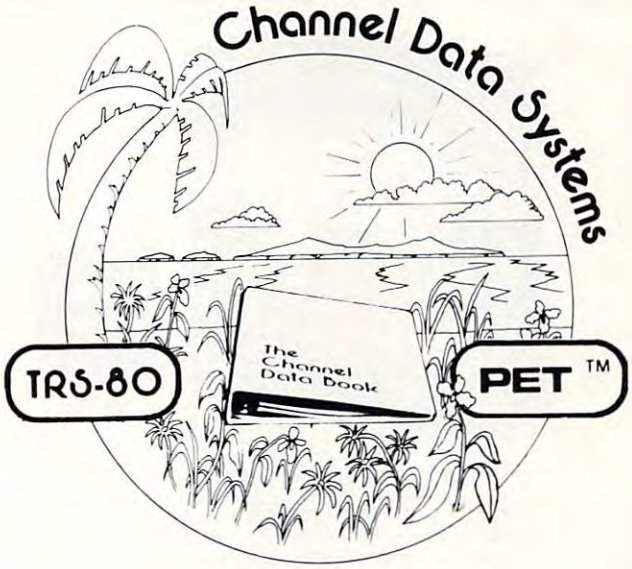
***** Call for info on communications for the VIC *****

```
10000  PRINT "LOW ";:DUMMY = DUMMY(1): GOSUB 11000:DUMMY(1) = DUMMY
10010  PRINT "HIGH ";:DUMMY = DUMMY(2): GOSUB 11000:DUMMY(2) = DUMMY

10020  IF DUMMY(2) < DUMMY(1) THEN  PRINT "INVALID": GOTO 10000
10030  REM   IF A RANGE THEN USE 5 STEPS
10040 DUMMY(3) = (DUMMY(2) - DUMMY(1)) / 5
10050  REM  WATCH FOR ZERO STEPS - NASTY THINGS
10060  IF DUMMY(3) = 0 THEN DUMMY(3) = 1
10070  PRINT : RETURN
10990  REM
10991  REM  GET A VALUE
10992  REM
11000  PRINT "PRESENT VALUE ";DUMMY: PRINT "NEW VALUE ";: GOSUB 1300
   0
11010  REM   RETAIN OLD VALUE?
11020  IF DUMMY$ = "" THEN DUMMY$ =  STR$ (DUMMY)
11030  REM  CHECK IF ZERO VALUE
11040 DUMMY =  VAL (DUMMY$): IF DUMMY > 0 THEN  RETURN
11050  IF DUMMY < 0 THEN  PRINT "INVALID": GOTO 11000
11060  PRINT "ZERO VALUE OKAY? Y/N ";: GOSUB 12000
11070  IF YN$ = "N" THEN  PRINT "CORRECT VALUE": GOTO 11000
11080  RETURN
11990  REM
11991  REM  GET A YES OR NO ANSWER
11992  REM
11993  REM   NULL RETURNS ARE ILLEGAL
12000  GOSUB 13000: IF DUMMY$ = "" THEN 12040
12010  REM  FIRST CHARACTER ONLY OF INTEREST
12020 YN$ =  LEFT$ (DUMMY$,1)
12030  IF YN$ = "Y" OR YN$ = "N" THEN  RETURN
12040  PRINT "ANSWER YES OR NO ";: GOTO 12000
12990  REM
12991  REM  GET AN INPUT LINE
12992  REM
13000 DUMMY$ = ""
13010  GET A$
13020  REM  IS IT A BACKSPACE? THEN DELETE WHOLE LINE
13030  IF A$ =  CHR$ (8) THEN  PRINT "**DELETED**": GOTO 13000
13040  PRINT A$;: IF A$ =  CHR$ (13) THEN  RETURN
13050 DUMMY$ = DUMMY$ + A$: GOTO 13010

]
```



OMNIFILE CBM or TRS-80 $30

Omnifile is a versatile, in-memory database program with sorting, formatting, and computational features. Records can be entered, edited, and processed with a single letter command. **Omnifile** applications include inventory records, mailing lists, sales journals and collection lists. Records can be stored on the Commodre floppy disks or on the tape cassette. **Omnifile** uses approximately 6k of RAM memory. Up to 500 records can be contained in memory in a 32k CBM at any time. Multiple files are easily accessed from disk or tape. Items can be sorted, moved, inserted and reformatted. Calculations can be made and totals can be printed. The **Omnifile** package includes the program with sample data, listing and manual, and will operate on the large keyboard Commodore PET or CBM computers with at least 16k memory. Also available on diskette for $36. An abbreviated version, **Data Logger,** requiring only 1k of RAM is available on cassette for $15.

GENERAL LEDGER/PERSONAL LEDGER CBM or TRS-80 $30

General Ledger is a complete double entry bookkeeping system with provisions for budgeting and keeping records of income, deductible and non-deductible expenses, assets and liabilities. Simple interactive features allow entering transactions, adding or editing accounts, and printing of a detailed income statement and balance sheets. Data can be stored on the Commodore floppy disks or cassette. **General Ledger** occupies about 6.2k of RAM memory, allowing approximately 200 accounts on a 16k machine. Transaction files can be accessed by our **Omnifile** database program for complete analysis, sorting by date, account number, etc. The **General Ledger** program will operate on the new Commodore PET or CBM microcomputer systems and comes with sample data, listing, and manual. Also available on diskette for $36. An abbreviated version allowing about 35 accounts on a 1.0 or 2.0 BASIC 8k PET is available on cassette for $20.

EXPLORE CBM $15

Inspired by the computerized fantasy simulation "Adventure," **Explore** is a conversational program which operates on the Commodore PET with only 8k bytes of memory. **Explore** contains four adventures in which you operate a computerized tank, hunt treasure in a magic cave, explore the mall in Washington D.C., and survive in a haunted castle. **Explore** package includes introduction, five data files, and complete manual. Available from Channel Data Systems on cassette for $15. Indication of old or new ROMs is requested.

CHANNEL DATA BOOK for PET CBM $20

A complete hardware and software reference service listing descriptions for over 1400 software programs and over 200 peripheral devices for PET. Also includes an information sources section, and addresses for Commodore Dealers in the USA and Canada, Commodore Vendors, and PET user groups. Designed to organize documentation, newsletters, listings, and other user selected information in an attractive 3-ring binder.

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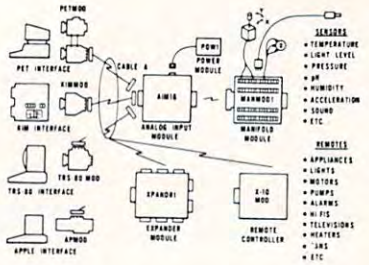
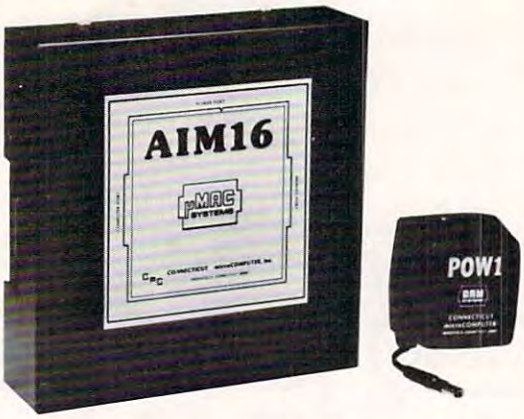
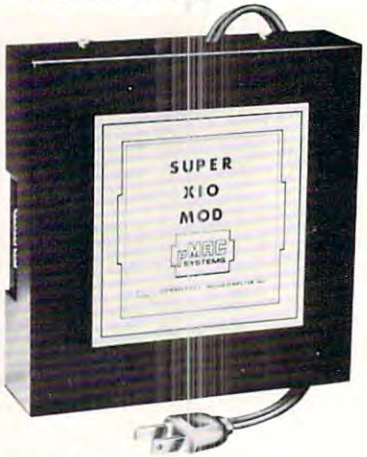
Microcomputer Measurement And Control For PET,APPLE,KIM and AIM65







The world we live in is full of variables we want to measure. These include weight, temperature, pressure, humidity, speed and fluid level. These variables are continuous and their values may be represented by a voltage. This voltage is the analog of the physical variable. A device which converts a physical, mechanical or chemical quantity to a voltage is called a sensor.

Computers do not understand voltages: They understand bits. Bits are digital signals. A device which converts voltages to bits is an analog-to-digital converter. Our AIM 16 (Analog Input Module) is a 16 input analog-to-digital converter.

The goal of Connecticut microComputer in designing the uMAC SYSTEMS is to produce easy to use, low cost data acquisition and control modules for small computers. These acquisition and control modules will include digital input sensing (e.g. switches), analog input sensing (e.g. temperature, humidity), digital output control (e.g. lamps, motors, alarms), and analog output control (e.g. X-Y plotters, or oscilloscopes).

Connectors

The AIM 16 requires connections to its input port (analog inputs) and its output port (computer interface). The ICON (Input CONnector) is a 20 pin, solder eyelet, edge connector for connecting inputs to each of the AIM16's 16 channels. The OCON (Output CONnector) is a 20 pin, solder eyelet edge connector for connecting the computer's input and output ports to the AIM16.

The MANMOD1 (MANifold MODule) replaces the ICON. It has screw terminals and barrier strips for all 16 inputs for connecting pots, joysticks, voltage sources, etc.

CABLE A24 (24 inch interconnect cable) has an interface connector on one end and an OCON equivalent on the other. This cable provides connections between the uMACSYSTEMS computer interfaces and the AIM 16 or XPANDR1 and between the XPANDR1 and up to eight AIM 16s.

Analog Input Module .

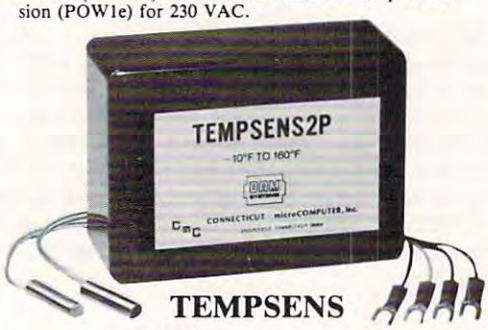
The AIM 16 is a 16 channel analog to digital converter designed to work with most microcomputers. The AIM 16 is connected to the host computer through the computer's 8 bit input port and 8 bit output port, or through one of the uMAC SYSTEMS special interfaces.

The input voltage range is 0 to 5.12 volts. The input voltage is converted to a count between 0 and 255 (00 and FF hex). Resolution is 20 millivolts per count. Accuracy is 0.5% ± 1 bit. Conversion time is less than 100 microseconds per channel. All 16 channels can be scanned in less than 1.5 milliseconds.

Power requirements are 12 volts DC at 60 ma.

POW1

The POW1 is the power module for the AIM16. One POW1 supplies enough power for one AIM16, one MANMOD1, sixteen sensors, one XPANDR1 and one computer interface. The POW1 comes in an American version (POW1a) for 110 VAC and in a European version (POW1e) for 230 VAC.



TEMPSENS

This module provides two temperature probes for use by the AIM16. This module should be used with the MANMOD1 for ease of hookup. The MANMOD1 will support up to 16 probes (eight TEMPSENS modules). Resolution for each probe is 1°F.

Remote Controller- Clock and Calendar

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   8 inputs - TTL levels or switch closures.
   Can be used as a trigger for a stored sequence.
   8 outputs - TTL levels
   Power supply included 110VAC only.

XPANDR1

The XPANDR1 allows up to eight Input/Output modules to be connected to a computer at one time. The XPANDR1 is connected to the computer in place of the AIM16 or X10 MOD. Up to eight AIM16s or seven Aim 16s and one X10 MOD are then connected to each of the eight ports provided using a CABLE A24 for each module.

For your convenience the AIM16 and the X10 MOD come as part of a number of sets. The minimum configuration for a usable system is the AIM16 Starter Set 1 which includes one AIM16, one POW1, one ICON and one OCON. The AIM16 Starter Set 2 includes a MANMOD1 in place of the ICON. The minimum configuration for a usable system is the X10 MOD Starter Set which includes one X10 MOD, one ICON and one OCON. These sets require that you have a hardware knowledge of your computer and of computer interfacing.

For simple plug compatible systems we also offer computer interfaces and sets for many computers.

AIM16 ..... 179.00
SUPER X10 MOD (110 VAC only) 249.00
POW1a (POWer module-110 VAC) 14.95
POW1e (POWer module-230 VAC) 24.95
ICON (Input CONnector) 9.95
OCON (Output CONnector) 9.95
MANMOD1 (MANifold MODule) 59.95
CABLE A24 (24 inch interconnect cable) 19.95
XPANDR1 (allows up to 8 Input or Output modules to be connected to a computer at one time) 59.95
TEMPSENS2P1 (two temperature probes, -10°F to 160°F) 69.95
LIGHTSENS1P1 (light level probe) 89.95

The following sets include one AIM16, one POW1, one OCON and one ICON.
AIM16 Starter Set 1a (110 VAC) 189.00
AIM16 Starter Set 1e (230 VAC) 199.00

All prices and specifications subject to change without notice. Our 30-day money back guarantee applies.

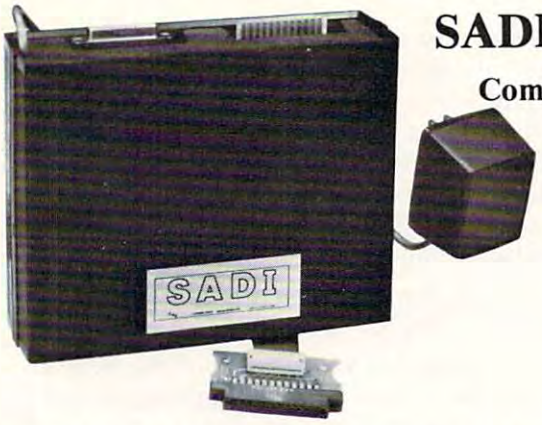
The following sets include one AIM16, one POW1, one OCON and one MANMOD1.
AIM16 Starter Set 2a (110 VAC) 239.00
AIM16 Starter Set 2e (230 VAC) 249.00

The following modules plug into their respective computers and, when used with a CABLE A24, eliminate the need for custom wiring of the computer interface.
PETMOD (Commodore PET) 49.95
KIMMOD (KIM,SYM) 39.95
APMOD (APPLE II) 59.95
TRS-80 MOD (Radio Shack TRS-80) 59.95
AIM65 MOD (AIM 65) 39.95

The following sets include one AIM16, one POW1, one MANMOD1, one CABLE A24 and one computer interface module
PETSET1a (Commodore PET - 110 VAC) 295.00
PETSET1e (Commodore PET - 230 VAC) 305.00
KIMSET1a (KIM,SYM,AIM65 - 110 VAC) 285.00
KIMSET1e (KIM,SYM,AIM65 - 230 VAC) 295.00
APSET1a(APPLE II - 110 VAC) 295.00
APSET1e(APPLE II - 230 VAC) 305.00
TRS-80 SET1a (Radio Shack TRS-80 - 110 VAC) 295.00
TRS-80 SET1e(Radio Shack TRS-80 - 230 VAC) 305.00
AIM65 SET1a(AIM65-110 VAC) 285.00
AIM65 SET1e(AIM65-230 VAC) 295.00

The following sets include one X10 MOD, one CABLE A24, one ICON and one computer interface module.
PETSET2(Commodore PET) 295.00
KIMSET2(KIM,SYM) 285.00
APSET2(APPLE II) 295.00
TRS-80 SET2 (Radio Shack TRS-80) 295.00
AIM65 SET2 (AIM65) 285.00
SUPER X10 MOD/XPANDR1 SET2 (if you already have a PET) 295.00

Printer And Communication Interfaces For The CBM/PET



SADI For Serial Two-way Communication, Parallel Printers, and Serial Printers

SADI - The microprocessor based serial and parallel interface for the Commodore PET. SADI allows you to connect your PET to parallel and serial printers, CRT's, modems, acoustic couplers, hard copy terminals and other computers. The serial and parallel ports are independent allowing the PET to communicate with both peripheral devices simultaneously or one at a time. In addition, the RS-232 device can communicate with the parallel device.

Special Features for the PET interface include:
- Conversion to true ASCII both in and out
- Cursor controls and function characters specially printed
- Selectable reversal of upper and lower case
- Addressable - works with other devices

Special Features for the serial interface include:
- Baud rate selectable from 75 to 9600
- Half or full duplex
- 32 character buffer
- X-ON, X-OFF automatically sent
- Selectable carriage return delay

Special Features for the parallel interface include:
- Data strobe - either polarity
- Device ready - either polarity
- Centronics compatible

Complete with power supply, PET IEEE cable, RS-232 connector, parallel port connector and case. Assembled and tested.
- SADIa (110VAC) $295
- SADIe (230VAC) $325

ADA1600 ● For Parallel NEC and Centronics Standard Printers

The ADA1600 is a low cost easy to use interface for the Commodore Computers. It allows the PET and CBM computers to use standard Centronics type printers (including the NEC 5530) for improved quality printing. The ADA1600 has a two foot cable which plugs into the PET IEEE port. Another IEEE card edge connector is provided for connecting disks and other peripherals to the PET. The ADA1600 is addressable and does not tie up the bus. The address is switch selectable. A four foot cable with a standard 36 pin Centronics connector is provided. A switch selects upper/lower case, upper/lower case reversed (needed for some Commodore machines) and upper case only for clearer program listings. Works with WORDPRO, BASIC and other software. No special programming is required. The case measures 3 1/2 x 5 3/4 inches. Comes complete, assembled and tested, with case and cables. Power is obtained from the printer or an external power supply may be used. Retail price for the ADA1600 is $129.

ADA1450 ● Serial Printer Adapters

The ADA1450 is a low cost, easy to use serial interface for the Commodore Computers. It allows the PET and CBM computers to use standard serial printers for improved quality printing. The ADA1450 has a two foot cable which plugs into the PET IEEE port. Another IEEE card edge connector is provided for connecting disks and other peripherals to the PET. The ADA1450 is addressable and does not tie up the bus. The address is switch selectable. A six foot RS-232 cable is provided with a DB25 connector. Pin 3 is data out. Pins 5,6 and 8 act as ready lines to the printer. Pins 4 and 20 act as ready lines from the printer. These lines can be switched for non-standard printers. Baud rate is selectable to 9600 baud. A switch selects upper/lower case, upper/lower case reversed (needed for some Commodore machines) and upper case only for clearer program listings. Works with WORDPRO, BASIC and other software. No special programming is required. The case measures 3 1/2 x 5 3/4 inches. Comes complete, assembled and tested, with case, cables, power supply and software on cassette for graphing functions, formatting data etc. The ADA1450 has a female DB25 connector at the end of the RS-232 cable for most standard printers. The ADA1450N has a male DB25 at the end of the RS-232 cable for the DIABLO serial printers. Retail price for the ADA1450 or 1450N is $139.

ADA730 Parallel ● For the Centronics 730 and 737 Printers

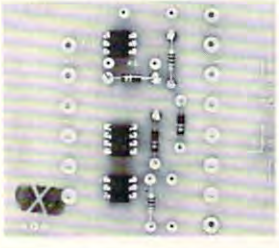
The ADA730 is a low cost easy to use interface for the Commodore Computers. It allows the PET and CBM computers to use Centronics type 730 and 737 printers. The ADA730 has a two foot cable which plugs into the PET IEEE port. Another IEEE card edge connector is provided for connecting disks and other peripherals to the PET. The ADA730 is addressable and does not tie up the bus. The address is switch selectable. A cable with a 36 pin card edge connector is provided. A switch selects upper/lower coase, upper/lower case reversed (needed for some Commodore machines) and upper case only for clearer program listings. Works with WORDPRO, BASIC and other software. No special programming is required. The case measures 3 1/2 x 5 3/4 inches. Comes complete, assembled and tested, with case and cables. Power is obtained from the printer or an external power supply may be used. Retail price for the ADA is $149.

Word Processor Program ●

PET Word Processor. On tape - $39.50, On disk - 49.50

For 8K Pets 29.50
For 16K and 32K Pets 39.50

Compose and print letters, flyers, ads, manuscripts, etc. Uses disk or tape. 30 page manual included.



ADA400 RS-232 To Current Loop Adapter

RS-232 to current loop adapter (ADA 400). $29.50
Two circuits - 1 each direction. Run an RS-232 device off a computer's teletype port or vice versa. Optoisolated.

ADA4005 - Solder Pads 24.50
ADA400B - Barrier Strips with screw terminals 29.50

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Home Heating And Cooling Audit

David E. Pitts
Houston, TX

Have you, like thousands of Americans, added insulation, storm windows, a setback thermostat, and caulking to improve the energy efficiency of your home? Other than the 15% energy credit you could claim on your taxes starting in 1979, it is difficult to know what savings one is achieving with these substantial investments of time and money. A colder than normal winter will cause increased fuel usage for heating which may or may not overshadow the energy savings by insulating. On the other hand, last winter (1979-80) was so mild in most parts of the United States that it brought significant fuel savings for most homeowners whether they insulated or not. However, energy costs have increased so much in some areas and for some fuels that these consumers may not have achieved a monetary savings.

The cost for heating or cooling a house is due to three things:

1) outside temperature
2) thermostat setting
3) insulation (including air infiltration)

Only the last two are under the homeowner's control. The most cost-effective action a homeowner can take is to raise the thermostat in the summer and lower the thermostat in winter. The next most effective is to increase the insulation. Having done this, the fuel use will still be driven by the outside temperature. In order to compare the severity and predict fuel use, meteorologists have developed two concepts:

1) Heating degree day
2) Cooling degree day

Heating degree day is an estimate of the heating necessary in the winter and cooling degree day is an estimate of the cooling necessary in the summer.

... energy fuel savings as well as economic savings can be calculated ...

Both are calculated from the maximum and minimum temperatures and summed each day to accumulate monthly and yearly totals. Heating degree days accumulate on days with an average temperature cooler than 65° F, and cooling degree days accumulate on days with an average temperature warmer than 65° F. These data are recorded for several hundred stations in the United States and are available in a publication "Local Climatological Data" from the U.S. Dept. of Commerce,

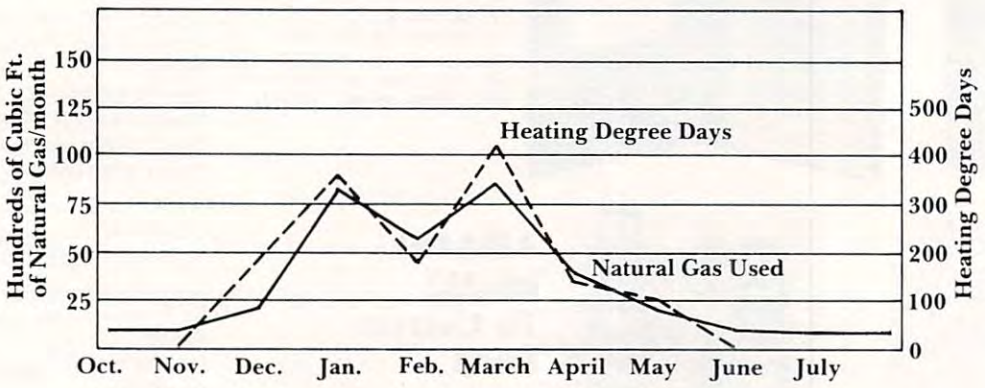
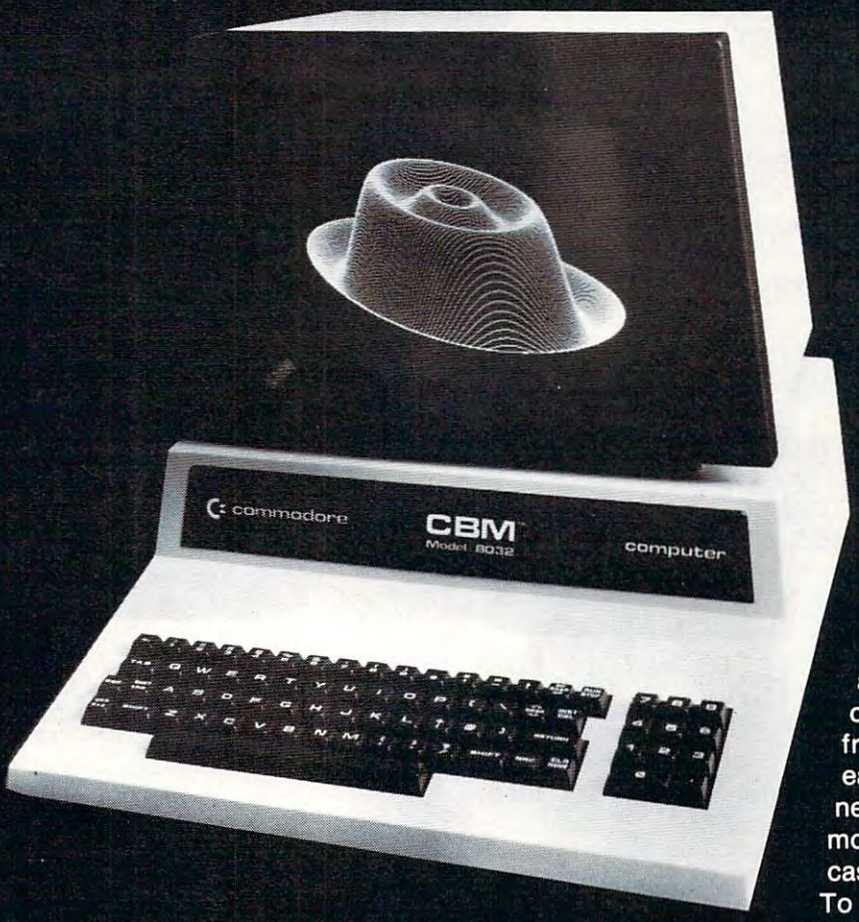


Figure 1. Heating Degree Days by Month for 1979-80 in Houston, TX and Natural Gas Used in the Author's Residence.

80 COLUMN GRAPHICS



The Integrated Visible Memory for the PET has now been redesigned for the new 12" screen 80 column and forthcoming 40 column PET computers from Commodore. Like earlier MTU units, the new K-1008-43 package mounts inside the PET case for total protection. To make the power and flexibility of the 320 by 200 bit mapped pixel graphics display easily accessible, we have designed the Keyword Graphic Program. This adds 45 graphics commands to Commodore BASIC. If you have been waiting for easy to use, high resolution graphics for your PET, isn't it time you called MTU?

The image on the screen was created by the program below.

```
 10 VISMEM: CLEAR
 20 P=160: Q=100
 30 XP=144: XR=1.5*3.1415927
 40 YP=56: YR=1: ZP=64
 50 XF=XR/XP: YF=YP/YR: ZF=XR/ZP
 60 FOR ZI=-Q TO Q-1
 70 IF ZI<-ZP OR ZI>ZP GOTO 150
 80 ZT=ZI*XP/ZP: ZZ=ZI
 90 XL=INT(.5+SQR(XP*XP-ZT*ZT))
100 FOR XI=-XL TO XL
110 XT=SQR(XI*XI+ZT*ZT)*XF: XX=XI
120 YY=(SIN(XT)+.4*SIN(3*XT))*YF
130 GOSUB 170
140 NEXT XI
150 NEXT ZI
160 STOP
170 X1=XX+ZZ+P
180 Y1=YY-ZZ+Q
190 GMODE 1: MOVE X1,Y1: WRPIX
200 IF Y1=0 GOTO 220
210 GMODE 2: LINE X1,Y1-1,X1,0
220 RETURN
```

K-1008-43M Manual only $10 (credited toward purchase)
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Write or call today for our full line catalog describing all MTU 6502 products, including our high speed 8" Floppy Disk Controller for up to 4 megabytes of PET storage.

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NOW 80 COLUMN PETS CAN HAVE MTU HIGH RESOLUTION GRAPHICS

```
RUN
              YEAR BY YEAR HEATING CONSERVATION AUDIT


--------------------------------------------------------------------------------
STATE (DON'T ABBREVIATE)? TEXAS

THE WINTER OF 1973-74 IS CALLED 74, CHOICES ARE 74 TO 80

STARTING YEAR? 78
LAST YEAR? 80

CHOICES OF INPUT ARE BY YEAR OR MONTH

BY YEAR (Y OR N)? Y

UNITS OF FUEL CAN BE ANYTHING: GALLONS, KWH, CUFT, 100CUFT
ALL FUEL ENTRIES MUST BE THE SAME UNITS
--------------------------------------------------------------------------------

YEAR=  78
FUEL USE FOR OCT 1 TO MAY 1? 650
COST(DOLLARS)? 205.05
--------------------------------------------------------------------------------
YEAR=  79
FUEL USE FOR OCT 1 TO MAY 1? 526
COST(DOLLARS)? 182.70
--------------------------------------------------------------------------------
YEAR=  80
FUEL USE FOR OCT 1 TO MAY 1? 318
COST(DOLLARS)? 120.60
--------------------------------------------------------------------------------
FUEL USE FOR JULY? 10
                STATE      CITY
            1   TEXAS      BROWNSVILLE
            2   TEXAS      AMARILLO
            3   TEXAS      FORT WORTH
            4   TEXAS      HOUSTON
CHOOSE # OF CITY? 4

--------------------------------------------------------------------------------
CHOSEN CITY= HOUSTON                        RATE(1ST YEAR)=          .31

     YEAR         RATE      FUEL SAVINGS      SAVINGS(DOLLARS)
      79          .34           15.88           5.51
      80          .37           178.1           67.54

--------------------------------------------------------------------------------
                     (+ = SAVINGS)(- = LOSS)
            1   TEXAS      BROWNSVILLE
            2   TEXAS      AMARILLO
            3   TEXAS      FORT WORTH
            4   TEXAS      HOUSTON
CHOOSE # OF CITY?

OK
```

National Climatic Center, Federal Building, Asheville, NC 28801. The concepts of the Cooling and Heating degree days have shown excellent correlation with fuel use in the author's residence (see figure 1 and 2) both in heating and air conditioning, on a month by month basis and an even higher correlation for an entire season. This correlation prompted the author to develop a BASIC program

The programs can evaluate efficiency from the year 1974, through and including 1980.

for calculating an energy usage rate in one year and predicting energy usage in the following years based on degree days. Using this technique, energy fuel savings as well as economic savings can be calculated even though the weather, energy cost, and energy efficiency of the home are changing month by month and year by year.

Two programs were written for the OSI-4PMF in "plain Jane" BASIC so as to be easily converted to other machines. Each program requires less than 8K and can be shortened considerably by selectively eliminating data statements to restrict the geographical coverage. Each program requires the homeowner to have records of fuel use and cost for two years or more. The programs can evaluate efficiency from the years 1974, through and including 1980. Any type of fuel can be utilized, just remember that the units you input will be the units calculated for the fuel savings. Likewise the rate is given as cost/fuel units, and so is dependent upon the units you input. Changing fuels or changing residences invalidates the technique. The heating season is from October 1 to May 1 and the cooling season is from April 1 to November 1 and are made extra long in order to accomodate the wide range of climates in the United States. Because many fuels are used for other purposes such as hot water heating, home lighting, etc., the off season minimum usage is used to remove these factors from the seasonal weather effects. Thus the heating program requests the July fuel use and the cooling program requests the January fuel use. Should a user live between the cities, listed runs for all cities in that region will allow interpolation. The following are some key variables:

ST$ = state
CT$ = city
H(1,I) = degree days for 1974 for city I
x = fuel use/degree days for base year
H = predicted fuel use minus actual fuel used
RATE(k) = cost/fuel unit
F(k) = fuel unit
D(k) = cost
k = year
MI = fuel use in minimum month

The precision of this technique is good, but may predict small savings or loss in years when no energy conservation practices were in effect. This uncertainty is due to the variance between day and night temperatures which is not always well represented by the mean temperature for the day.

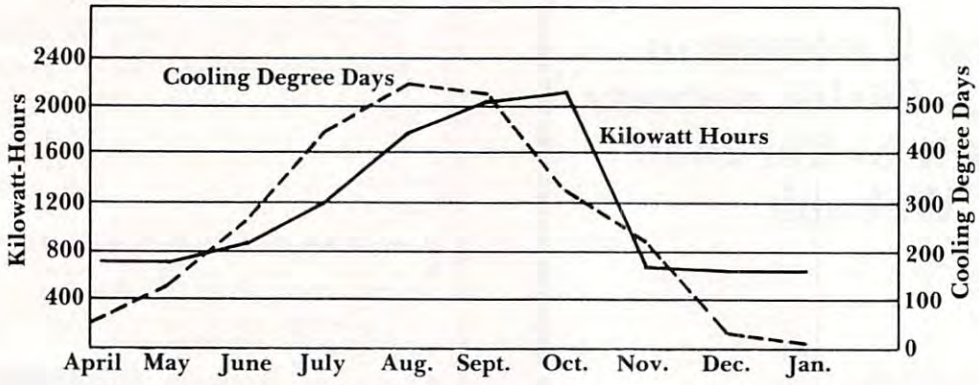

Figure 2. Cooling Degree Days by Month for 1979 in Houston, TX and Kilowatt Hours used in the Author's Residence

```
RUN
            YEAR BY YEAR COOLING CONSERVATION AUDIT

-------------------------------------------------------------
STATE (DON'T ABBREVIATE)? TEXAS

THE SUMMER OF 1974 IS CALLED 74, CHOICES ARE 74 TO 80

STARTING YEAR? 78
LAST YEAR? 80

CHOICES OF INPUT ARE BY YEAR OR MONTH

BY YEAR (Y OR N)? Y

UNITS OF FUEL CAN BE ANYTHING: GALLONS, KWH, CUFT, 100CUFT
ALL FUEL ENTRIES MUST BE THE SAME UNITS
-------------------------------------------------------------

YEAR=  78
FUEL USE FOR APR 1 TO NOV 1? 10422
COST(DOLLARS)? 374.28
-------------------------------------------------------------
YEAR=  79
FUEL USE FOR APR 1 TO NOV 1? 9483
COST(DOLLARS)? 402.56
-------------------------------------------------------------
YEAR=  80
FUEL USE FOR APR 1 TO NOV 1? 10204
COST(DOLLARS)? 528.08
-------------------------------------------------------------
FUEL USE FOR JANUARY? 679
              STATE      CITY
          1   TEXAS      BROWNSVILLE
          2   TEXAS      AMARILLO
          3   TEXAS      FORT WORTH
          4   TEXAS      HOUSTON
CHOOSE # OF CITY? 4

-------------------------------------------------------------
CHOSEN CITY= HOUSTON                    RATE(1ST YEAR)=      .03

     YEAR        RATE      FUEL SAVINGS      SAVINGS(DOLLARS)
      79         .04           367.35            15.59
      80         .05           734.26            37.99

-------------------------------------------------------------
                    (+ = SAVINGS)(- = LOSS)
          1   TEXAS      BROWNSVILLE
          2   TEXAS      AMARILLO
          3   TEXAS      FORT WORTH
          4   TEXAS      HOUSTON
CHOOSE # OF CITY?

OK
```

```
1 REM COOLING FUEL AUDIT
2 REM BY DAVID PITTS, 16011 STONEHAVEN DR. HOUSTON, TX 77059
10 REM
11 REM PROGRAM REQUIRES COOLING FUEL USE (ANNUAL OR BY MONTH)
12 REM COOLING MONTHS ARE APRIL 1 TO NOV 1, 2 YRS OR MORE REQUIRED
13 REM OUTPUT IS FUEL SAVINGS, AND $ SAVINGS
15 REM **********************************************
17 DEFFNTRC(E)=INT(E*100)/100
20 PRINTTAB(12);"YEAR BY YEAR COOLING CONSERVATION AUDIT":PRINT:PRINT
22 GOSUB500:INPUT"STATE (DON'T ABBREVIATE)";B$
23 FORI=1TO7:READM$(I):NEXT:PRINT
25 PRINT"THE SUMMER OF 1974 IS CALLED 74, CHOICES ARE 74 TO 80"
27 PRINT:INPUT"STARTING YEAR";YS:INPUT"LAST YEAR";YE:PRINT
30 L=YE-YS+1:PRINT"CHOICES OF INPUT ARE BY YEAR OR MONTH":PRINT
40 INPUT"BY YEAR (Y OR N)";A$:IFASC(A$)<>89THEN100
41 PRINT:PRINT"UNITS OF FUEL CAN BE ANYTHING: GALLONS, KWH, CUFT, 100CUFT"
43 PRINT"ALL FUEL ENTRIES MUST BE THE SAME UNITS":GOSUB500:PRINT
47 FORI=1TOL:PRINT"YEAR= ";INT(YS+I-1)
48 PRINT"FUEL USE FOR APR 1 TO NOV 1";:INPUTF(I):INPUT"COST(DOLLARS)";D(I)
90 GOSUB500:NEXT:GOTO200
100 FORI=1TOL:GOSUB500:PRINT"YEAR = ";INT(YS+I-1):FORJ=1TO7
105 PRINT"FUEL USE FOR ";M$(J);:INPUTF:PRINT"COST FOR ";M$(J);:INPUTD
110 F(I)=F(I)+F:D(I)=D(I)+D:NEXT:NEXT
200 INPUT"FUEL USE FOR JANUARY";MI:I=1
220 READST$,CT$(I),H(1,I),H(2,I),H(3,I),H(4,I),H(5,I),H(6,I),H(7,I)
230 IFLEFT$(ST$,7)=LEFT$(B$,7)THENI=I+1
240 IFST$="END"THEN250
245 GOTO220
250 J=I-1:LL=YS-74+1:PRINTTAB(15);"STATE";TAB(25);"CITY"
255 FORI=1TOJ
260 PRINTTAB(10);I;TAB(15);B$;TAB(25);CT$(I):NEXT
270 INPUT"CHOOSE # OF CITY";I:PRINT:GOSUB500
280 X=(F(1)-7*MI)/H(LL,I):RATE(1)=D(1)/F(1):H=FNTRC(RATE(1))
282 PRINT"CHOSEN CITY= ";CT$(I);TAB(37);"RATE(1ST YEAR)=";TAB(58);H
285 PRINT:PRINTTAB(5);"YEAR";
290 PRINTTAB(16);"RATE";TAB(25);"FUEL SAVINGS";TAB(42);"SAVINGS(DOLLARS)"
295 FORK=2TOL
300 H=H(LL+K-1,I)*X+7*MI-F(K):RATE(K)=D(K)/F(K):C=H*RATE(K)
312 H=FNTRC(H):RATE(K)=FNTRC(RATE(K)):C=FNTRC(C)
320 PRINTTAB(5);INT(YS+K-1);TAB(15);RATE(K);TAB(28);H;TAB(42);C
340 NEXT:PRINT:GOSUB500:PRINTTAB(20);"(+ = SAVINGS)(- = LOSS)":GOTO255
500 PRINT"----------------------------------------------------------------------":RETURN
1999 DATAAPRIL,MAY,JUNE,JULY,AUGUST,SEPTEMBER,OCTOBER
2000 DATATEXAS,BROWNSVILLE,3871,3857,3327,4023,4188,3689,3756
2010 DATATEXAS,AMARILLO,1396,1235,1013,1700,1556,1168,1666
2020 DATATEXAS,FORT WORTH,2578,2609,2251,3017,2965,2509,3142
2030 DATATEXAS,HOUSTON,2821,2656,2225,2751,2866,2577,3127
2032 DATAALABAMA,BIRMINGHAM,1640,1858,1427,2272,1975,1719,2177
2034 DATAALABAMA,MOBILE,2548,2732,2405,2846,2884,2442,2680
2036 DATAALABAMA,MONTGOMERY,1941,2349,1730,2630,2388,2033,2375
2038 DATAARIZONA,FLAGSTAFF,232,88,98,191,152,85,334
2040 DATAARIZONA,PHOENIX,4285,3785,3965,4521,4343,4186,3872
2042 DATAARIZONA,TUCSON,2788,2592,2760,3099,3184,3052,2844
2044 DATAARKANSAS,LITTLEROCK,1787,1941,1602,2266,2358,1926,2486
2046 DATACALIFORNIA,LOSANGELES,627,505,864,602,827,845,494
2048 DATACALIFORNIA,SANFRANCISCO,127,80,192,88,144,182,102
2050 DATACOLORADO,DENVER,715,554,667,799,748,661,950
2052 DATACONNECTICUTT,HARTFORD,764,870,819,905,657,811,787
2054 DATADELAWARE,WILMINGTON,1109,1101,1003,1120,1016,990,1333
2056 DATAFLORIDA,JACKSONVILLE,2460,2784,2179,2717,2559,2483,2647
```

```
2058 DATAFLORIDA,MIAMI,4657,4570,4014,4202,4183,4218,3486
2060 DATAFLORIDA,TALLAHASSEE,2472,2604,2292,2498,2480,2198,2458
2062 DATAGEORGIA,ATLANTA,1506,1600,1254,1735,1773,1762,2370
2064 DATAGEORGIA,SAVANNAH,2289,2574,1954,2643,2570,2390,2501
2066 DATAIDAHO,BOISE,851,789,535,822,597,752,511
2068 DATAIDAHO,POCATELLO,460,440,372,519,369,479,225
2070 DATAILLINOIS,CHICAGO,770,1124,906,1218,982,812,929
2072 DATAILLINOIS,SPRINGFIELD,984,1200,1021,1369,1253,1201,1452
2074 DATAINDIANA,EVANSVILLE,1229,1500,1112,1779,1550,1238,1672
2076 DATAINDIANA,FORTWAYNE,727,833,664,1032,898,677,844
2078 DATAINDIANA,INDIANAPOLIS,850,1046,770,1363,1300,882,1142
2080 DATAIOWA,DESMOINES,974,1237,1050,1342,1226,984,1262
2082 DATAIOWA,SIOUXCITY,980,1013,969,862,928,865,1071
2084 DATAKANSAS,TOPEKA,1173,1474,1294,1563,1434,1275,1810
2086 DATAKANSAS,WICHITA,1466,1512,1417,1841,2047,1663,2286
2088 DATAKENTUCKY,LOUISVILLE,1055,1506,1130,1717,1539,1236,1676
2090 DATALOUSIANA,BATONROUGE,2641,2618,2248,2772,2781,2379,2670
2092 DATALOUSIANA,NEWORLEANS,2655,2637,2390,2962,3059,2895,3030
2094 DATAMAINE,CARIBOU,116,271,231,223,264,290,211
2096 DATAMAINE,PORTLAND,296,351,308,308,336,316,468
2098 DATAMARYLAND,BALTIMORE,1038,1245,1149,1474,1274,1137,I407
2100 DATAMASSACHUSETTS,BOSTON,646,862,895,897,668,789,894
2102 DATAMICHIGAN,DETROIT,620,731,706,873,760,522,672
2104 DATAMICHIGAN,GRANDRAPIDS,400,619,638,714,588,614,667
2106 DATAMICHIGAN,SAULTST.MARIE,126,243,167,86,125,145,96
2108 DATAMINNESOTA,DULUTH,149,229,271,122,224,169,241
2110 DATAMINNESOTA,INT.FALLS,259,328,281,187,219,131,327
2112 DATAMINNESOTA,MINNEAPOLIS,619,850,950,691,811,651,776
2114 DATAMISSISSIPPI,JACKSON,2036,2300,1943,2535,2421,1947,2578
2116 DATAMISSOURI,KANSASCITY,1159,1534,1296,1403,1535,1174,1721
2118 DATAMISSOURI,ST.LOUIS,1175,1431,1229,1667,1519,1578,1907
2120 DATAMISSOURI,SPRINGFIELD,1095,1349,1085,1692,1565,1122,1850
2122 DATAMONTANA,BILLINGS,572,478,547,545,429,716,670
2124 DATAMONTANA,GREATFALLS,473,315,389,293,332,396,302
2126 DATAMONTANA,MISSOULA,303,258,158,295,185,390,125
2128 DATANEBRASKA,LINCOLN,1128,1282,1178,1250,1175,1098,1552
2130 DATANEBRASKA,OMAHA,1021,1389,1249,1364,1321,1124,1374
2132 DATANEVADA,LASVEGAS,3403,2973,2809,3332,3300,3387,3035
2134 DATANEVADA,RENO,258,348,236,500,340,404,400
2136 DATANEW HAMPSHIRE,CONCORD,302,553,419,488,521,519,450
2138 DATANEW JERSEY,TRENTON,977,1070,1053,1163,976,936,1288
2140 DATANEW MEXICO,ALBUQUERQUE,1353,1100,1141,1335,1398,1508,1519
2142 DATANEW MEXICO,ROSWELL,1655,1437,1786,2428,1991,1684,2061
2144 DATANEW YORK,ALBANY,386,597,476,574,456,636,561
2146 DATANEW YORK,NEWYORK,1017,953,1158,1097,919,1049,1276
2148 DATANEW YORK,SYRACUSE,405,555,357,520,623,595,687
2150 DATANORTH CAROLINA,ASHEVILLE,731,795,545,1007,973,792,1166
2152 DATANORTH CAROLINA,RALEIGH,1325,1452,1459,1701,1671,1275,1742
2154 DATANORTH CAROLINA,WILMNGTN,1978,2373,1936,2310,2097,1966,2230
2156 DATANORTH DAKOTA,FARGO,444,553,766,487,604,504,580
2158 DATANORTH DAKOTA,WILLISTON,440,376,507,410,421,415,600
2160 DATAOHIO,COLUMBUS,836,1147,608,1073,968,808,1008
2162 DATAOHIO,TOLEDO,608,692,599,784,741,602,740
2164 DATAOKLAHOMA,OKLACITY,1651,1615,1702,2163,2418,1805,2479
2166 DATAOREGON,BURNS,406,347,227,451,277,367,106
2168 DATAOREGON,PORTLAND,409,342,216,375,343,462,270
2170 DATAPENNSYLVANIA,HARRISBURG,1163,1026,901,1053,1015,828,1183
2172 DATAPENNSYLVANIA,PITTSBURG,657,721,358,623,836,620,876
2174 DATAPENNSYLVANIA,PHILADELPHIA,1165,1243,1211,1237,1247,1097,1410
2176 DATARHODE ISLAND,PROVIDENCE,666,694,631,821,610,640,789
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2178 DATASOUTH CAROLINA,CHARLESTON,2044,2408,1885,2584,2319,2204,2258
2180 DATASOUTH CAROLINA,GREENVILLE,1435,1547,1135,1958,1559,1296,1710
2182 DATASOUTH DAKOTA,RAPIDCITY,697,583,676,574,669,550,665
2184 DATASOUTH DAKOTA,SIOUXFALLS,751,910,1040,854,743,724,793
2186 DATATENNESSEE,CHATTANOOGA,1058,1365,1165,2095,1847,1432,1778
2188 DATATENNESSEE,KNOXVILLE,1340,1530,1133,1811,1612,1355,1814
2190 DATATENNESSEE,MEMPHIS,1840,2184,1800,2681,2357,2088,2683
2192 DATAUTAH,SALTLAKECITY,1191,900,943,1108,1018,1274,990
2194 DATAVERMONT,BURLINGTON,442,699,483,507,489,531,503
2196 DATAVIRGINIA,NORFOLK,1531,1744,1558,1930,1535,1433,1788
2198 DATAVIRGINIA,RICHMOND,1259,1433,1385,1814,1573,1375,1681
2200 DATAWASHINGTON,SEATTLE,196,197,129,232,210,171,57
2202 DATAWASHINGTON,SPOKANE,405,340,293,472,326,496,228
2204 DATAWEST VIRGINIA,CHRLSTON,910,1074,801,1227,1114,894,1123
2206 DATAWISCONSIN,GREENBAY,323,514,520,534,440,380,451
2208 DATAWISCONSIN,MADISON,457,742,627,622,589,450,630
2210 DATAWYOMING,CHEYENNE,349,193,217,252,297,352,415
2990 DATAWYOMING,LANDER,467,333,394,410,408,436,423
2995 DATAEND,END,0,0,0,0,0,0,0
3000 END
```

```
1 REM HEATING FUEL AUDIT
2 REM BY DAVID PITTS, 16011 STONEHAVEN DR. HOUSTON, TX 77059
10 REM
11 REM PROGRAM REQUIRES HEATING FUEL USE(ANNUAL OR BY MONTH)
12 REM HEATING MONTHS ARE OCT 1 TO MAY 1, 2 YRS OR MORE REQUIRED
13 REM OUTPUT IS FUEL SAVINGS, AND $ SAVINGS
15 REM **************************************************
17 DEFFNTRC(E)=INT(E*100)/100
20 PRINTTAB(12);"YEAR BY YEAR HEATING CONSERVATION AUDIT":PRINT:PRINT
22 GOSUB500:INPUT"STATE (DON'T ABBREVIATE)";B$
23 FORI=1TO7:READM$(I):NEXT:PRINT
25 PRINT"THE WINTER OF 1973-74 IS CALLED 74, CHOICES ARE 74 TO 80"
27 PRINT:INPUT"STARTING YEAR";YS:INPUT"LAST YEAR";YE:PRINT
30 L=YE-YS+1:PRINT"CHOICES OF INPUT ARE BY YEAR OR MONTH":PRINT
40 INPUT"BY YEAR (Y OR N)";A$:IFASC(A$)<>89THEN100
41 PRINT:PRINT"UNITS OF FUEL CAN BE ANYTHING: GALLONS, KWH, CUFT, 100CUFT"
43 PRINT"ALL FUEL ENTRIES MUST BE THE SAME UNITS":GOSUB500:PRINT
47 FORI=1TOL:PRINT"YEAR= ";INT(YS+I-1)
48 PRINT"FUEL USE FOR OCT 1 TO MAY 1";:INPUTF(I):INPUT"COST(DOLLARS)";D(I)
90 GOSUB500:NEXT:GOTO200
100 FORI=1TOL:GOSUB500:PRINT"YEAR = ";INT(YS+I-1):FORJ=1TO7
105 PRINT"FUEL USE FOR ";M$(J);:INPUTF:PRINT"COST FOR ";M$(J);:INPUTD
110 F(I)=F(I)+F:D(I)=D(I)+D:NEXT:NEXT
200 INPUT"FUEL USE FOR JULY";MI:I=1
220 READST$,CT$(I),H(1,I),H(2,I),H(3,I),H(4,I),H(5,I),H(6,I),H(7,I)
230 IFLEFT$(ST$,7)=LEFT$(B$,7)THENI=I+1
240 IFST$="END"THEN250
245 GOTO220
250 J=I-1:LL=YS-74+1:PRINTTAB(15);"STATE";TAB(25);"CITY"
255 FORI=1TOJ
260 PRINTTAB(10);I;TAB(15);B$;TAB(25);CT$(I):NEXT
270 INPUT"CHOOSE # OF CITY";I:PRINT:GOSUB500
280 X=(F(1)-7*MI)/H(LL,I):RATE(1)=D(1)/F(1):H=FNTRC(RATE(1))
282 PRINT"CHOSEN CITY= ";CT$(I);TAB(37);"RATE(1ST YEAR)=";TAB(58);H
285 PRINT:PRINTTAB(5);"YEAR";
290 PRINTTAB(16);"RATE";TAB(25);"FUEL SAVINGS";TAB(42);"SAVINGS(DOLLARS)"
295 FORK=2TOL
300 H=H(LL+K-1,I)*X+7*MI-F(K):RATE(K)=D(K)/F(K):C=H*RATE(K)
```

```
312 H=FNTRC(H):RATE(K)=FNTRC(RATE(K)):C=FNTRC(C)
320 PRINTTAB(5);INT(YS+K-1);TAB(15);RATE(K);TAB(28);H;TAB(42);C
340 NEXT:PRINT:GOSUB500:PRINTTAB(20);"(+ = SAVINGS)(- = LOSS)":GOTO255
500 PRINT"-----------------------------------------------------------------":RETURN
1999 DATAOCTOBER,NOVEMBER,DECEMBER,JANUARY,FEBRUARY,MARCH,APRIL
2000 DATATEXAS,BROWNSVILLE,418,520,518,974,800,728,640
2010 DATATEXAS,AMARILLO,3389,4163,3484,4515,4084,4540,4219
2020 DATATEXAS,FORT WORTH,1854,2281,1841,2967,2941,2730,2375
2030 DATATEXAS,HOUSTON,1157,1190,1309,2276,2103,1711,1545
2032 DATAALABAMA,BIRMINGHAM,2138,2570,2527,3488,3295,2777,2766
2034 DATAALABAMA,MOBILE,1037,1365,1393,2400,2206,1617,1608
2036 DATAALABAMA,MONTGOMERY,1643,1967,2119,3038,2403,1987,2028
2038 DATAARIZONA,FLAGSTAFF,6080,6740,6158,6032,4882,6813,6100
2040 DATAARIZONA,PHOENIX,1093,1558,1089,1071,692,1428,1022
2042 DATAARIZONA,TUCSON,1652,2183,1453,1644,1194,1840,1349
2044 DATAARKANSAS,LITTLEROCK,2645,3059,2763,3590,3723,3528,3142
2046 DATACALIFORNIA,LOSANGELES,1232,1305,1160,969,705,1452,808
2048 DATACALIFORNIA,SANFRANCISCO,2752,2918,2929,2594,1972,2774,2116
2050 DATACOLORADO,DENVER,5569,5826,5117,5258,4882,5937,5333
2052 DATACONNECTICUTT,HARTFORD,5540,5890,5349,6164,5711,6286,5569
2054 DATADELAWARE,WILMINGTON,3910,4676,4177,5206,4980,4883,4364
2056 DATAFLORIDA,JACKSONVILLE,933,1168,1390,2061,1791,1525,1406
2058 DATAFLORIDA,MIAMI,131,59,202,311,331,185,204
2060 DATAFLORIDA,TALLAHASSEE,1106,1547,1594,2199,2166,1746,1692
2062 DATAGEORGIA,ATLANTA,2305,2873,2697,3834,3298,2757,2737
2064 DATAGEORGIA,SAVANNAH,1274,1537,1735,2527,2253,1751,1881
2066 DATAIDAHO,BOISE,4977,5318,5376,5715,4287,5984,4792
2068 DATAIDAHO,POCATELLO,6387,6713,6252,6474,5103,7190,5839
2070 DATAILLINOIS,CHICAGO,5634,6039,5135,6613,6322,6686,5537
2072 DATAILLINOIS,SPRINGFIELD,4998,5433,4693,6157,6057,6075,5308
2074 DATAINDIANA,EVANSVILLE,3873,4424,3960,5236,5113,4979,4676
2076 DATAINDIANA,FORTWAYNE,5660,6093,5198,6723,6472,6271,6046
2078 DATAINDIANA,INDIANAPOLIS,4698,5477,4762,6260,5698,5748,5484
2080 DATAIOWA,DESMOINES,5908,6468,5268,6418,6606,7041,5827
2082 DATAIOWA,SIOUXCITY,6120,6924,5946,6961,7020,7912,6263
2084 DATAKANSAS,TOPEKA,4873,5225,4408,5455,5556,6023,5045
2086 DATAKANSAS,WICHITA,4540,4820,4035,4702,4855,5310,4620
2088 DATAKENTUCKY,LOUISVILLE,3697,4289,3694,5016,4896,4583,4392
2090 DATALOUSIANA,BATONROUGE,1050,1458,1548,2133,1996,1744,1762
2092 DATALOUSIANA,NEWORLEANS,931,1295,1430,2057,1860,1453,1447
2094 DATAMAINE,CARIBOU,8980,9024,8947,9140,8152,8638,7860
2096 DATAMAINE,PORTLAND,6472,6747,6709,7462,6600,7040,6427
2098 DATAMARYLAND,BALTIMORE,4241,4264,3857,4940,4542,4508,4271
2100 DATAMASSACHUSETTS,BOSTON,4998,5230,4620,5492,4963,5425,5017
2102 DATAMICHIGAN,DETROIT,5923,6375,5583,6754,6408,6538,6088
2104 DATAMICHIGAN,GRANDRAPIDS,6338,6987,5933,7167,6605,6944,5898
2106 DATAMICHIGAN,SAULTST.MARIE,8576,8602,8079,9047,8245,8848,8021
2108 DATAMINNESOTA,DULUTH,9292,9435,8662,9310,8657,9577,8351
2110 DATAMINNESOTA,INT.FALLS,9844,9755,9435,10044,9858,10745,9442
2112 DATAMINNESOTA,MINNEAPOLIS,7560,7969,6785,7800,7789,8132,7140
2114 DATAMISSISSIPPI,JACKSON,1746,2066,2058,2961,2881,2451,2568
2116 DATAMISSOURI,KANSASCITY,4775,5407,4401,5550,5671,5811,5106
2118 DATAMISSOURI,ST.LOUIS,4507,5001,4173,5466,5410,5368,4574
2120 DATAMISSOURI,SPRINGFIELD,3982,4659,3837,5033,4973,5116,4140
2122 DATAMONTANA,BILLINGS,6294,7106,6118,6076,7068,7878,5814
2124 DATAMONTANA,GREATFALLS,6810,7482,6503,6006,7606,8138,6164
2126 DATAMONTANA,MISSOULA,6797,7104,6668,6896,6423,8068,6439
2128 DATANEBRASKA,LINCOLN,6067,6504,5302,6131,6484,6881,5562
2130 DATANEBRASKA,OMAHA,6069,6316,5037,6045,6140,6391,5954
2132 DATANEVADA,LASVEGAS,2418,2610,2298,2150,1664,2517,2147
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2134 DATANEVADA,RENO,5184,5820,5548,5196,4228,5679,4625
2136 DATANEW HAMPSHIRE,CONCORD,6924,7304,7194,7732,7094,7229,6479
2138 DATANEW JERSEY,TRENTON,4373,4763,4172,5355,5056,4818,4595
2140 DATANEW MEXICO,ALBUQUERQUE,4206,4707,4328,4761,3543,4020,3735
2142 DATANEW MEXICO,ROSWELL,3015,3660,2771,3469,2712,3585,3297
2144 DATANEW YORK,ALBANY,6539,6835,5999,6989,6315,6806,6023
2146 DATANEW YORK,NEWYORK,4333,4643,4131,5195,4804,4950,4434
2148 DATANEW YORK,SYRACUSE,6241,6439,5917,6806,6234,6573,5895
2150 DATANORTH CAROLINA,ASHEVILLE,3375,3947,3843,4755,4281,3882,3793
2152 DATANORTH CAROLINA,RALEIGH,2758,3550,2895,4258,3801,3286,3464
2154 DATANORTH CAROLINA,WILMNGTN,1683,2249,1908,2847,2658,2256,2464
2156 DATANORTH DAKOTA,FARGO,9171,8502,7937,8893,9012,9915,8402
2158 DATANORTH DAKOTA,WILLISTON,8714,8616,8081,8192,8867,9784,7787
2160 DATAOHIO,COLUMBUS,4701,5314,4860,6494,5860,5653,5253
2162 DATAOHIO,TOLEDO,5996,6243,5674,7093,6673,6520,5992
2164 DATAOKLAHOMA,OKLACITY,3278,3762,2950,3835,3977,4142,3543
2166 DATAOREGON,BURNS,6395,6587,6880,6102,5711,7093,5830
2168 DATAOREGON,PORTLAND,4070,3993,3992,4057,3715,4577,3690
2170 DATAPENNSYLVANIA,HARRISBURG,4509,5199,4498,5437,5059,4915,4422
2172 DATAPENNSYLVANIA,PITTSBURG,5005,5516,5105,6822,5636,5964,5536
2174 DATAPENNSYLVANIA,SCRANTON,5950,5691,5251,6642,5963,6348,5417
2176 DATARHODE ISLAND,PROVIDENCE,5184,5531,5172,6035,5497,5867,5029
2178 DATASOUTH CAROLINA,CHARLESTON,1393,1941,1837,2702,2340,1972,2195
2180 DATASOUTH CAROLINA,GREENVILLE,2730,3199,2920,3851,3392,3122,3166
2182 DATASOUTH DAKOTA,RAPIDCITY,6477,7045,6111,6622,6923,7626,6050
2184 DATASOUTH DAKOTA,SIOUXFALLS,7088,7598,6685,7484,7822,8393,6799
2186 DATATENNESSEE,CHATTANOOGA,2898,3694,3313,4113,3729,3349,3483
2188 DATATENNESSEE,KNOXVILLE,2833,3418,3340,4148,3822,3520,3467
2190 DATATENNESSEE,MEMPHIS,2500,2878,2526,3442,3355,3205,3013
2192 DATAUTAH,SALTLAKECITY,5402,5495,5392,5370,3982,5526,4722
2194 DATAVERMONT,BURLINGTON,7276,7306,6945,7726,7257,7623,6615
2196 DATAVIRGINIA,NORFOLK,2674,3210,2827,3817,3478,3432,3358
2198 DATAVIRGINIA,RICHMOND,3265,3944,3232,4389,4033,3861,3532
2200 DATAWASHINGTON,SEATTLE,4369,4537,4200,3699,3650,4414,3995
2202 DATAWASHINGTON,SPOKANE,6171,6613,6104,5978,5826,7368,5650
2204 DATAWEST VIRGINIA,CHRLSTON,3807,4813,3832,5487,4896,4534,4526
2206 DATAWISCONSIN,GREENBAY,7324,7794,7079,8319,7616,8227,7040
2208 DATAWISCONSIN,MADISON,6934,7161,6270,7837,7413,7827,6922
2210 DATAWYOMING,CHEYENNE,6561,7106,6274,6540,6100,6851,6179
2990 DATAWYOMING,LANDER,7122,7482,7058,6961,6445,8528,6891
2995 DATAEND,END,0,0,0,0,0,0,0
3000 END
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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.

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.

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.

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 itself. Either the human or the computer can double or generate dice rolls. Board positions can be created or saved for replay (North Star and CP/M). BACKGAMMON 2.0 is played in accordance with the official rules of backgammon and is sure to provide many fascinating sessions of backgammon play.

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.

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.

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.

CHOMP-OTHELLO (Atari only) — **Price: $11.95 Cassette/$15.95 Diskette**
CHOMP-OTHELLO? It's really two challenging games in one. CHOMP is similar in concept to NIM; you must bite off part of a cookie, but avoid taking the poisoned portion. OTHELLO is the popular board game set to fully utilize the Atari's graphics capability. It is also very hard to beat! This package will run on a 16K system.

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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 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 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!

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.

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 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.

ADVENTURE

CRANSTON MANOR ADVENTURE (North Star and CP/M only) — **Price: $21.95 Diskette**
At last! A comprehensive Adventure game for North Star. CRANSTON MANOR ADVENTURE takes you into mysterious CRANSTON MANOR where you attempt to gather fabulous treasures. Lurking in the manor are wild animals and robots who will not give up the treasures without a fight. The number of rooms is greater and the associated descriptions are much more elaborate than the current popular series of Adventure programs, making this game the top in its class. Play can be stopped at any time and the status stored on diskette.

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.

**ATARI, PET, TRS-80, NORTHSTAR, CP/M and IBM are registered tradenames and/or trademarks.* ***TRS-80 diskettes are not supplied with DOS or BASIC.*

BUSINESS and UTILITIES

SPELLGUARD™ (CP/M only) — **Price: $269.95 Disk**

SPELLGUARD is a revolutionary new product which increases the value of your current word processing system (WORDSTAR, MAGIC WAND, ELECTRIC PENCIL, TEXTED EDITOR II and others). Written entirely in assembly language, SPELLGUARD™ rapidly assists the user in eliminating spelling and typographical errors by comparing each word of the text against a dictionary (expandable) of over 20,000 of the most common English words. Words appearing in the text but not found in the dictionary are "flagged" for easy identification and correction. Most administrative staff familiar with word processing equipment will be able to use SPELLGUARD™ in only a few minutes.

MAIL LIST 2.2 (Apple, Atari and North Star diskette only) — **Price: $34.95**

This program is unmatched in its ability to store a maximum number of addresses on one diskette (minimum of 1100 per diskette, more than 2200 for "double density" systems!). Its many features include alphabetic and zip code sorting, label printing, merging of files and a unique keyword seeking routine which retrieves entries by a virtually limitless selection of user defined codes. Mail List 2.2 will even find and delete duplicate entries. A very valuable program!

FORM LETTER SYSTEM (FLS) (Apple and North Star diskette only) — **Price: $21.95**

Use FLS to create and edit form letters and address lists. Form letters are produced by automatically inserting each address into a predetermined portion of your letter. FLS is completely compatible with MAIL LIST 2.2, which may be used to manage your address files.

FLS and MAIL LIST 2.2 are available as a combined package for $49.95.

SORTIT (North Star only) — **Price: $29.95 Diskette**

SORTIT is a general purpose sort program written in 8080 assembly language. This program will sort sequential data files generated by NORTH STAR BASIC. Primary and optional secondary keys may be numeric or one to nine character strings. SORTIT is easily used with files generated by DYNACOMP's MAIL LIST program and is very versatile in its capabilities for all other BASIC data file sorting.

PERSONAL FINANCE SYSTEM (Atari and North Star only) — **Price: $34.95 Diskette**

PFS is a single disk menu oriented system composed of 10 programs designed to organize and simplify your personal finances. Features include a 300 transaction capacity; fast access; 26 optional user codes; data retrieval by month, code or payee; optional printing of reports; checkbook balancing; bar graph plotting and more. Also provided on the Atari diskette is ATARI DOS 2.

THE COMMUNICATOR (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.

DYNACOMP also supplies THE COMMUNICATOR with an Atari 830 modem for a combined price of $219.95. The modem is available separately for $189.95.

TEXT EDITOR II (CP/M) — **Price: $29.95 Diskette/$33.45 Disk**

This is the second release version of DYNACOMP's popular TEXT EDITOR I and contains many new features. With TEXT EDITOR II you may build text files in chunks and assemble them for later display. Blocks of text may be appended, inserted or deleted. Files may be saved on disk/diskette in right justified/centered format to be later printed by either TEXT EDITOR II or the CP/M ED facility. Futher, ASCII CP/M files (including BASIC and assembly language programs) may be read by the editor and processed. In fact, text files can be built using ED and later formatted using TEXT EDITOR II. All in all, TEXT EDITOR II is an inexpensive, easy to use, but very flexible editing system.

COMPRESS (North Star only) — **Price: $12.95**

COMPRESS is a single-disk utility program which removes all unnecessary spaces and (optionally) REMark statements from North Star BASIC programs. The source file is processed one line at a time, thus permitting very large programs to be compressed using only a small amount of computer memory. File compressions of 20-50% are commonly achieved.

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

This handy program allows North Star 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.

GRAFIX (TRS-80 only) — **Price: $14.95 Cassette/$18.95 Diskette**

This unique program allows you to easily create graphics directly from the keyboard. You "draw" your figure using the program's extensive cursor controls. Once the figure is made, it is automatically appended to your BASIC program as a string variable. Draw a "happy face", call it H$ and then print it from your program using PRINT H$! This is a very easy way to create and save graphics.

EDUCATION

HODGE PODGE (Apple only, 48K Applesoft or Integer BASIC) — **Price: $19.95 Cassette/$23.95 Diskette**

Let HODGE PODGE be your child's baby sitter. Pressing any key on your Apple will result in a different and intriguing "happening" related to the letter or number of the chosen key. The program's graphics, color and sound are a delight for children from ages 1 1/2 to 9. HODGE PODGE is a non-intimidating teaching device which brings a new dimension to the use of computers in education.

TEACHER'S PET I (Available for all computers) — **Price: $11.95 Cassette/$15.95 Diskette**

This is the first of DYNACOMP's educational packages. Primarily intended for pre-school to grade 3, TEACHER'S PET provides the young student with counting practice, letter-word recognition and three levels of math skill exercises.

MORSE CODE TRAINER (TRS-80 only) — **Price: $12.95 Cassette/$16.95 Diskette**

MORSE CODE TRAINER is designed to develop and improve your speed and accuracy in deciphering Morse Code. As such, MCT is an ideal software package for FCC test practice. The code sound is obtained through the earphone jack of any standard cassette recorder. You may choose the pitch of the tones as well as the word rate. Also, various modes of operation are available including number, punctuation and alphabet tests, as well as the keying of your own message. A very effective way to learn code!

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 effort 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

DYNACOMP now distributes the 23 volume NSSE library. These diskettes each contain many programs and offer an outstanding value for the purchase rice. They should be part of every North Star user's collection. Call or write DYNACOMP for details regarding the contents of the NSSE collection.

Price: $9.95 each/$7.95 each (4 or more)
The complete collection may be purchased for $149.95

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.

STATISTICS and ENGINEERING

DIGITAL FILTER (Available for all computers) — **Price: $29.95 Cassette/$33.95 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: $14.95 Cassette/$18.95 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: $16.95 Cassette/$20.95 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.

TFA (Transfer Function Analyzer) — **Price: $19.95 Cassette/$23.95 Diskette**

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.

HARMONIC ANALYZER (Available for all computers) — **Price: $24.95 Cassette/$28.95 Diskette**

HARMONIC ANALYZER was designed for the spectrum analysis of repetitive waveforms. Features include data file generation, editing and storage/retrieval as well as data and spectrum plotting. One particularly unique facility is that the input data need not be equally spaced or in order. The original data is sorted and a cubic spline interpolation is used to create the data file required by the FFT algorithm.

FOURIER ANALYZER, TFA and HARMONIC ANALYZER may be purchased together for a combined price of $49.95 (three cassettes) and $59.95 (three diskettes).

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

REGRESSION I is a unique and exceptionally versatile one-dimensional least squares "polynomial" curve fitting program. Features include very high accuracy; an automatic degree determination option; an extensive internal library of fitting functions; data editing; automatic data and curve plotting; a statistical analysis (eg: standard deviation, correlation coefficient, etc.) and much more. In addition, new fits may be tried without reentering the data. REGRESSION I is certainly the cornerstone program in any data analysis software library.

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.

REGRESSION I, II and MULTILINEAR REGRESSION may be purchased together for $51.95 (three cassettes) or $63.95 (three diskettes).

ANOVA (Available for all computers) — **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, Volume I (Not available for Atari)

DYNACOMP is the exclusive distributor for the software keyed to the popular text *BASIC Scientific Subroutines, Volume I* by F. Ruckdeschel (see the BYTE/McGraw-Hill advertisement in BYTE magazine, January 1981). These subroutines have been assembled according to chapter. Included with each collection is a menu program which selects and demonstrates each subroutine.

Collection #1: Chapters 2 and 3: Data and function plotting, complex variables
Collection #2: Chapter 4: Matrix and vector operations
Collection #3: Chapters 5 and 6: Random number generators, series approximations

Price per collection: $14.95 Cassette/$18.95 Diskette
All three collections are available for $39.95 (three cassettes) and $49.95 (three diskettes).

Because the text is a vital part of the documentation, *BASIC Scientific Subroutines, Volume I* is available from DYNACOMP for $19.95 plus 75¢ postage and handling.

ROOTS (Available for all computers) — **Price $10.95 Cassette/$14.95 Diskette**

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.

LOGIC SIMULATOR (Apple only; 48K RAM) — **Price: $24.95 Cassette/$28.95 Diskette**

With LOGIC SIMULATOR you may easily test your complicated digital logic design with respect to given set of inputs to determine how well the circuit will operate. The elements which may be simulated include multiple input AND, OR, NOR, EXOR, EXNOR and NAND gates, as well as inverters, J-K and D flip-flops, and one-shots. The response of the system is available every clock cycle. Inputs may be clocked in with varying clock cycle lengths/displacements and delays may be introduced to probe for glitches and race conditions. At the user's option, a timing diagram for any given set of nodes may be plotted using HIRES graphics. Save your breadboarding until the circuit is checked by LOGIC SIMULATOR.

LOGIC DESIGNER (North Star and CP/M only) — **Price: $34.95 Diskette**

LOGIC DESIGNER is an exceptional Computer Aided Design (CAD) program. With it you may convert a large and complicated digitial truth table (the functional specification) into an optimized Boolean logic equation. This equation may then be *easily* converted into a circuit design using either NAND or AND/OR gates. Operationally, LOGIC DESIGNER is composed of a BASIC program which calls in a machine language routine to reduce execution time. Example: For a 7 variable by 127 line table, the processing time is only two minutes. LOGIC DESIGNER is clearly a fast and powerful tool for building digital circuitry.

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Estimating Gas Mileage With An Empty Tank

J. L. Christensen
El Cajon, CA

In days gone by, the estimation of gas mileage was routinely performed by many drivers to check the health of their favorite conveyance. Gasoline was cheap and the procedure was straightforward. One simply filled the gas tank, drove a couple hundred miles, then refilled the tank. The mileage driven divided by the gallons to refill the tank was the gas mileage.

Today, with the cost of gasoline competing with the cost of a nuclear power plant, not all of us can afford to fill the tank so casually. In fact, for long periods we may find ourselves driving consistently off the bottom half of the tank. This practice results in poor mileage estimates since we no longer have a solid benchmark (a full tank) against which to measure fuel consumption.

The BASIC program presented on the following pages helps to restore gas mileage accuracy while allowing us to drive off the botton of the tank. Fuel consumption is estimated from the gas gauge instead of the 'full tank' method. As everyone knows, automobile fuel gauges are notoriously non-linear, so this program is designed to calibrate the gauge by fitting a cubic equation to data supplied by the driver. The program estimates gas mileage over any selected mileage interval which allows the program operator to discriminate between city driving and the mileage obtained on a trip.

How To Take Data

To use the program, the driver must keep a log in the following format:

Miles	Gallons	Start Gauge	End Gauge

Figure 1. The Gasoline Log

Each time the driver visits his friendly service station, he should enter the miles from the odometer and the gallons of gas added to the tank. He must also enter the gas gauge readings before (Start Gauge) and after (End Gauge) adding the gas. For a bit more generality you may want to add other columns for the date, liters (in case you can't buy gallons) and price.

Now fuel gauges are normally provided with a scale of several divisions. The bottom line is marked with an 'E' while the top of the scale is marked with an 'F'. Automotive gas gauges are rarely provided with numeric annotation. However, the driver may supply the necessary quantitative meter scale by assigning an integer value to each division beginning with 0 at the 'E' position. Thus the gas gauge will appear as shown below:

Figure 2. The Gas Gauge Scale

When recording the fuel gauge reading, the driver is expected to interpolate between divisions. This is normally possible to within about ± 10% of the interdivision scale. The fuel gauge reading in the above figure is estimated to be 1.4.

Be sure to read the gauge when the car is resting on level ground. Also some gauges have a very sluggish response so the driver may have to wait a minute or so after restarting the car to get an accurate reading.

If the fuel consumption during a trip is of interest, the driver should enter the odometer reading at the start of the trip, the fuel added, if any, and the gauge readings. If no fuel has been added, enter 0 in the Gallons column and the same fuel gauge reading in both the Start and End Gauge columns. At the conclusion of the trip, again enter the odometer reading, 0 gallons and the same gauge reading in both the Start and End Gauge columns.

Following data assimilation, the program asks the operator for the minimum mileage interval over which the fuel consumption will be computed. Proper account will be taken of the gas remaining in the tank at the start and end of each interval. If the input mileage interval corresponds to that of a trip, the gas consumption on the trip will be computed as well as the consumption over other similar intervals.

Program Operation

The flowchart in Figure 3 will be of assistance in identifying major functions and operations of the program.

The mileage and gas gauge data for the program is provided in a DATA statement beginning at line 201. During program development, DATA statements are preferred over INPUT

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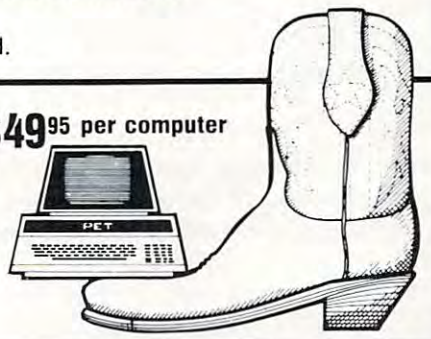

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```
 MILES          GAL        ST. GAUGE         END GAUGE
 57146.        8.78            .4               2.8
 57272.        4.3             .3               1.9
 57311.        4.39            .2               1.9
 57349.        1.66            .1                .6
 57364.        4.35            0                1.7
 57394.        8.7             0                2.3
 57473.        4.3             0                1.75
 57506.        4.17            .1               1.8
 57550.        4.16            -.1              1.5

  TANK EQUATION:
  GL = A3*(GA)^3 + A2*(GA)^2 + A1*(GA) + A0
  A3=.609321        A2=-1.73937        A1=3.88762
  ----------------------------------
 GAUGE           GAL
 0               0
 .2              .712824
 .4              1.31574
 .6              1.83801
 .8              2.30887
 1               2.75757
 1.2             3.21335
 1.4             3.70547
 1.6             4.26317
 1.8             4.9157
 2               5.69231
 2.2             6.62224
 2.4             7.73474
 2.6             9.05906
 2.8             10.6244
 3.              12.4601
 3.2             14.5954
 3.4             17.0595
 3.6             19.8816
 3.8             23.091
 4.              26.717

ST MI:57146.      END MI:57311.      GAL:13.6829      MI/GAL:12.0588
ST MI:57272.      END MI:57473.      GAL:24.4262      MI/GAL:8.22887
ST MI:57311.      END MI:57473.      GAL:19.8128      MI/GAL:8.17652
ST MI:57349.      END MI:57506.      GAL:19.01        MI/GAL:8.25881
ST MI:57364.      END MI:57550.      GAL:21.9268      MI/GAL:8.48278
ST MI:57394.      END MI:57550.      GAL:17.5768      MI/GAL:8.87535

 TOTAL GAL:42.3725        TOTAL MILES:404
AVE MILES/GAL:9.01353
OVER AN AVERAGE INTERVAL OF:171.167      MILES
```

statements since the data is not lost if (when) the program bombs. In either case, the value of M1 at line 153 must be set equal to the number of lines of data.

Following data input, the program asks for the "MINIMUM MILEAGE INTERVAL" over which the fuel consumption estimate is to be computed. This value is called U1 in subsequent calculations. At line 310, the program commences at the first mileage entry and searches through following entries until it finds the next entry and searches through following entries until it finds the next entry that equals or exceeds the first entry by U1. The gas consumption is computed over this interval and the program then returns to the second entry and performs the same task. If you would like the mileage between each visit to the pump, enter 0 for the minimum mileage interval.

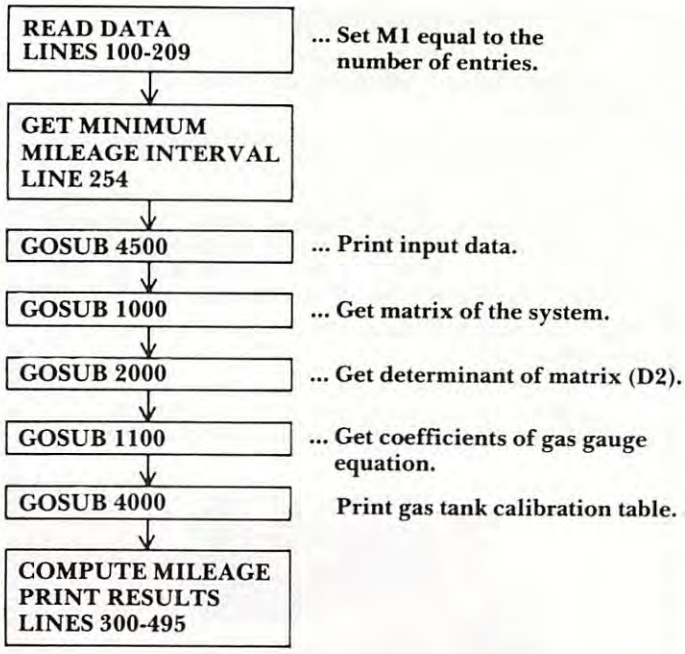

Figure 3. Program Flowchart

The fuel consumption, G1, between two mileage entries, M1 and M2, is computed at line 342. It is the total gallons added between M1 and M2 (including the fuel at M1 but excluding the fuel at M2) plus the fuel in the tank at M1 minus the fuel in the tank at M2. The fuel in the tank at the time of the mileage readings is computed from the gas gauge equations at lines 316 and 340. The program prints intermediate results at line 343 and final results are printed following the end of the primary FOR-NEXT loop at line 450. If the operator has entered a minimum interval which exceeds the available data entries, the program will print "INSUF. DATA OR INTERVAL TOO LONG" and recycle to get a lower value for the minimum interval. The total gas consumed over the entire data set, G4, and the total mileage interval of the data set, Z4, is computed at lines 396 and 397 respectively.

Insofar as practical there has been a deliberate effort to modularize the program through the use of subroutines. Each clearly definable function has been prepared as a subroutine. This technique makes program preparation logical and also simplifies later program modifications. For instance, after the tank is calibrated, the requirement to take End Gauge readings is unnecessary. You may therefore delete the call to these subroutines and insert the gauge coefficients by means of algebraic equivalents.

As illustrated in the flow diagram, the subroutine at 4500 reprints the gas data log. The gauge calibration is performed by subroutines 1000, 2000 and 1100. Subroutine 4000 prints the coefficients of the gas gauge equation with the exception of a constant, A0. The gas tank calibration table is also printed with the assumption that A0 is zero. This assumption may or may not be valid, depending on the characteristics of tank and gas gauge.

An important feature of this program is the method used to calibrate the gas gauge. The gauge is assumed to vary in accordance with the following cubic expression:

$$GL = A3 * (GA)^3 + A2 * (GA)^2 + A1 * (GA) + A0$$

where GL is gallons and GA is the gauge reading.

The program does a least squares curve fit to the data by finding coefficients of the cubic equation which best satisfy the data. The gallons added to the gas tank is assumed to be the difference between the values of the above cubic equation solved at the End Gauge reading and the Start Gauge reading. That is:

$$\blacktriangle GAL = A3 * (GA^3_e - GA^3_s) + A2 * (GA^2_e - GA^2_s) + A1 * (GA_e - GA_s)$$

where ▲GAL is the gallons of gas added to the tank at each data point. GA_s is the Start Gauge reading and GA_e is the End Gauge reading at the same data point. The value of A0 is not computed, nor is it needed since the program uses only the incremental change in gallons and does not need the absolute number of gallons in the tank as a function of the gauge reading. The method of least squares curve fitting will not be described here, but it is available in standard texts such as ref 1. Essentially this technique finds coefficients of the equation such as to minimize the difference between the gallons recorded in the data table and the gallons obtained by means of the above equation and the gauge readings. Since three coefficients must be found, at least three data points will be required. Naturally more data points will result in a better fit. Please note that the equation will be best in those areas where the most data has been taken. The equation should not be trusted in regions of the gas gauge where no data has been provided. If all the data has been taken on the low end of the gauge, the equation is likely to be inaccurate at the upper end of the gauge.

The subroutine at 1000 sets up the elements of a 3 by 3 matrix containing various summations of the data set of gauge readings. This matrix is referred to as the 'matrix of the system' or simply the system matrix. The subroutine at 2000 finds the determinant, D, of a 3 by 3 matrix. The subroutine at 1100 saves the determinant of the system matrix in D2 and sequentially exchanges each column of the system matrix for summations of the gallons data, B(K1). The determinant of the resulting matrix is then computed at line 1155 and the corresponding coefficient, A(J1) is then determined by dividing by D2. Note that before each column exchange is made, the original system matrix is restored at line 1141.

Results

The results of program operation are shown in the example below. The program first reprints the

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input data in a form similar to the gasoline log. Next the tank equation and values of the first three coefficients of the equation are printed. If you would like the value of the final coefficient, A0, simply fill the tank to capacity and note the position of the gauge reading. Substitute the full tank gauge reading into the equation and, from your automobile owner manual, set GL equal to the capacity of the gas tank, The value of A0 is then determined to make the equation balance.

Following the gas tank equation, the program prints a table relating the gauge reading to the gallons of gas. Note that this table is useful in obtaining the gallons of gas added to the tank from the differences in gauge readings. It will not provide the absolute gallons in the tank as a function of gauge reading since it is offset by the value of A0. If desired, you may modify the table to include this value by adding A0 to the equation at line 4015.

The program now prints a table of intermediate results consisting of the consumption between successive mileage entries whose difference is not less than the specified MINIMUM MILEAGE INTERVAL. In this example the minimum allowed interval was 150 miles. You will note that the data set contained entries which resulted in an average interval of 171.167 miles.

Finally the program prints the total gallons and the total mileage of the data set followed by the average miles/gallon obtained over the average mileage interval.

Reference

1.) McCracken, D. D. and Dorn, W. S. "Numerical Methods and Fortran Programming", John Wiley and Sons, New York, 1964.

```
100   REM:  PROGRAM   $GASS
150   DIM G[50,3],M[50],C[3,3],B[3],F[3],A[3],D[3]
153   LET M1=9
160     FOR I=1 TO M1
162     READ M[I],G[I,1],G[I,2],G[I,3]
170     NEXT I
199   REM MILES, GALLONS, ST GAUGE, END GAUGE
201   DATA 57146.,8.78,.4,2.8
202   DATA 57272.,4.3,.3,1.9
203   DATA 57311.,4.39,.2,1.9
204   DATA 57349.,1.66,.1,.6
205   DATA 57364.,4.35,0,1.7
206   DATA 57394.,8.7,0,2.3
207   DATA 57473.,4.3,0,1.75
208   DATA 57506.,4.17,.1,1.8
209   DATA 57550.,4.16,-.1,1.5
250   REM*****START PROGRAM*********
254   PRINT "MINIMUM MILEAGE INTERVAL";
255   INPUT U1
257   GOSUB 4500
258   GOSUB 1000
260   GOSUB 2000
261   GOSUB 1100
262   GOSUB 4000
300   LET Z3=0
307   LET N1=0
308   LET Z2=0
309   LET G4=-G[M1,1]
310     FOR I=1 TO M1
312     LET T4=G[I,2]
314     LET S1=M[I]
315     LET G1=0
316     LET G2=A[3]*T4*T4*T4+A[2]*T4*T4+A[1]*T4
317     LET G4=G4+G[I,1]
320       FOR J=(I+1) TO M1
324       LET G1=G1+G[(J-1),1]
330       LET D5=M[J]-M[I]
332       IF (D5 <= U1) THEN 380
336       LET T5=G[(J),2]
```

WARNING!

We have all heard that nothing you can type in from the keyboard can hurt the computer. Not completely true.

There is a particular POKE which, on some CBM computers, risks burning the screen phosphor or blowing out a weak component on one of the computer's boards. To be on the safe side, never POKE 59458,62. This poke appears as line 130 of a program, "Epidemic," on page 46 of the May 1981, **COMPUTE!**. The intended effect — speeding up the output to the screen — might cause problems with some computers.

COMPUTE! mentions this danger on page 91 of the January/February 1980, issue. Unfortunately the early issues of **COMPUTE!** are now out of print.

You cannot, with absolute accuracy, comfort beginners with the assurance, "Go ahead. Nothing you type in could hurt the computer." This POKE can result in a shrinking of the size of the display on the CRT and a consequent intensification of the phosphor fluoresce. Such intensity can burn the screen. Associated with this is the possibility that components inside the computer might be damaged as well. Sometimes a faster PRINT to the screen is desirable, but this can be, for some machines, a damaging way to achieve it.

```
340       LET G3=A[3]*T5*T5*T5+A[2]*T5*T5+A[1]*T5
342       LET G1=G1+G2-G3
343       PRINT " ST MI:";M[I];"END MI:";M[J];" GAL:";G1;" MI/GAL:";D5/G1
346       LET Z2=Z2+D5
347       LET N1=N1+1
348       LET Z3=Z3+D5/G1
350       GOTO 390
380       NEXT J
390     NEXT I
395   LET T1=G[1,2]
396   LET G4=G4+A[3]*T1*T1*T1+A[2]*T1*T1+A[1]*T1-G2
397   LET Z4=M[M1]-M[1]
410   IF (N1#0) GOTO 440
420   PRINT " INSUF. DATA OR INTERVAL TOO LONG"
430   GOTO 254
440   PRINT
450   PRINT "  TOTAL GAL:";G4;"  TOTAL MILES:";Z4
480   PRINT " AVE MILES/GAL:";(Z3/N1)
490   PRINT " OVER AN AVERAGE INTERVAL OF:";(Z2/N1);"MILES"
495   STOP
500   REM*******************************
1000   REM: SUBROUTINE "MATRIX "
1002   REM: THIS SUBROUTINE SETS UP THE ELEMENTS
1003   REM: OF THE GAS TANK MATRIX.
1004   REM
1010     FOR J=1 TO 3
1015     LET B[J]=0
1020       FOR K=1 TO 3
1025       LET C[J,K]=0
1027       NEXT K
1030     NEXT J
1035     FOR I=1 TO M1
1037       FOR J=1 TO 3
1040       LET D[J]=G[I,3]^J-G[I,2]^J
1045       LET B[J]=B[J]+D[J]*G[I,1]
1050       NEXT J
1060       FOR K=1 TO 3
1065         FOR L=1 TO 3
1068         LET C[K,L]=C[K,L]+D[K]*D[L]
1070         NEXT L
1075       NEXT K
1080     NEXT I
1090   RETURN
1100   REM....SUBROUTINE " COEFFICIENTS"
1101   REM.......THIS SUB GETS THE COEFFICIENTS OF THE EQ.
1102   LET D2=D
1140     FOR J1=1 TO 3
1141     GOSUB 1000
1145       FOR K1=1 TO 3
1146       LET C[K1,J1]=B[K1]
1150       NEXT K1
1155     GOSUB 2000
1160     LET A[J1]=D/D2
1162     NEXT J1
1170   RETURN
1190   REM ..............................
2000   REM: SUBROUTINE "DETERMINANT"
2002   REM      THIS SUBROUTINE FINDS THE DETERMINANT OF THE
2003   REM      MATRIX.
```

```
2005  LET F[1]=C[2,2]*C[3,1]-C[2,1]*C[3,2]
2006  LET F[2]=-C[1,2]*C[3,1]+C[1,1]*C[3,2]
2007  LET F[3]=C[1,2]*C[2,1]-C[2,2]*C[1,1]
2008  LET D=0
2009    FOR W=1 TO 3
2010    LET D=D+F[W]*C[W,3]
2011    NEXT W
2015  RETURN
2016  REM.............................
4000  REM
4001  REM:  SUBROUTINE "PRINT TANK CALIBRATION"
4002  PRINT "    TANK EQUATION:"
4003  PRINT "    GL = A3*(GA)^3 + A2*(GA)^2 + A1*(GA) + A0     "
4004  PRINT "    A3=";A[3];"  A2=";A[2];"  A1=";A[1]
4005  PRINT "    ----------------------------------"
4010  PRINT "  GAUGE            GAL"
4011  LET R1=0
4012  LET R2=.2
4013  LET R3=4
4015  LET G=A[3]*R1^3+A[2]*R1^2+A[1]*R1
4016  PRINT TAB(2);R1,G
4017  LET R1=R1+R2
4020  IF (R1>R3) THEN 4050
4030  GOTO 4015
4050  PRINT
4051  RETURN
4052  REM.............................
4500  REM
4501  REM SUBROUTINE "INPUT DATA"
4502  REM .....THIS PRINTS THE INPUT DATA
4503  PRINT "  MILES          GAL        ST. GAUGE          END GAUGE"
4504    FOR I=1 TO M1
4505    PRINT TAB(2);M[I],G[I,1],G[I,2],G[I,3]
4506    NEXT I
4507  PRINT
4510  RETURN
4511  REM.............................
5000  END
```

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Intermediate BASIC Tutorial:

How To Make Conversation With Your Computer

John Victor
Greenwich, CT

Computer programs that appear to have conversations with humans have fascinated computerists and non-computerists alike. Most of these programs focus on key words to determine the computer's reply.

For example, there is a popular computer program that simulates a psychiatrist. When the "patient" types in an answer to a question such as "what is the matter with you?", the program analyzes the typed answer for words such as father, mother, sex, etc. If key words are found, the program then produces a canned response such as "tell me more about your mother," or "does talking about sex bother you?"

Simple conversational programs can be written using the string manipulation features of Atari, Apple, PET or OSI BASIC. The techniques allow you to look at any string of characters for certain words that may be present in the string.

First, let's look at some of the fundamentals of string logic. We can write a BASIC statement to compare two strings of characters:

```
IF A$="YES" THEN GOTO 100
```

The computer will look at the string stored as A$ and, if it matches "YES" it will go to line 100. However, if there is any variation at all, the computer will consider the two strings as not matching. For example, if A$ contains "YES I DO," or even "YES " or " YES" (note the extra space) the computer will consider this as not matching "YES".

Programmers often ask program users to type in YES or NO responses, but they do not really care if the program user can spell. The only thing that concerns them is the first letter, the Y or the N, that indicates the user's intent. In Microsoft BASIC the programmer can get around the problem of the user's input by using the MID$ function.

```
INPUT A$
IF MID$(A$,1,1)="Y" THEN GOTO 100
```

The first number indicates what character the computer is going to start with. Here the computer is to start with the first character. The second number indicates how many characters over the computer is going to look at. Here the computer is to look at just one character. In the above statement, no matter what the user types in, if the first character is a Y, the program will go to line 100.

Atari BASIC works a little differently. MID$ is not used. Instead, the same operation is done like this:

```
INPUT A$
IF A$(1,1)="Y" THEN GOTO 100
```

The first number here represents the first character to be looked at, but the second number does not indicate the number of characters. Instead, it is the position of the last character to be looked at. Since the first and the last character are both 1, the computer will only look at one character.

... some of the fundamentals of string logic.

The MID$ function can be used to find strings inside a larger string. For example, we can store a list of three-letter words in a string variable (rather than using DATA statements):

```
A$="DOG CAT RAT SAT GET KIN FIN SUN RUN"
```

MID$(A$,9,3) will give us the three-letter word starting with the 9th character, which is the word RAT. (Spaces count as characters).

We can now set up a FOR-NEXT loop that will print all of the three-letter words in the string:

```
10  DIM A$(40)
20 A$ = "DOG CAT RAT SAT GET KIN
     FUN SUN RUN"
30  FOR W = 1 TO 33 STEP 4
40  PRINT  MID$ (A$,W,3)
41  REM                ATARI VERSION
     -- 40 PRINT A$(W,W+2)
50  NEXT W
```

When the loop starts, W equals one and the equivalent of MID$(A$,1,3) is printed. Next, W is made equal to five and the equivalent of MID$(A$,5,3), the word CAT, is printed.

We can change the above program to work for any length string stored in A$ by using the LEN function. LEN(A$) gives us the number of characters in A$. The following will count to the end of A$, no matter what its length:

```
30 FOR W = 1 TO LEN(A$)-2 STEP 2
```

The minus 2 allows for the last two letters in the three-letter word.

In the following example, we will take the process one step further. We will ask the program

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user to type in a string of words, and we will look for one word from that string.

```
10  DIM A$(40)
20  PRINT : PRINT "TYPE IN A SENT
    ENCE."
25  PRINT : PRINT
26  INPUT A$
27  PRINT
30  FOR W = 1 TO  LEN (A$) - 2
40  IF  MID$ (A$,W,3) = "THE" THEN
     PRINT "YOU USED THE WORD 'T
    HE'": END
41  REM          ATARI VERSION US
    ES A$(W,W+2)="THE"
50  NEXT W
60  PRINT "YOU DID NOT USE THE WO
    RD 'THE'."
```

In the above program, the computer looks at every three-letter group starting with the first character, and moving over 1 on each count of W. If THE is found, the program will print the appropriate message and stop the program. If not, the loop continues. Now for our final example. The next two programs illustrate a conversational technique whereby the computer user is asked a question, and the computer analyzes the answer for certain key words.

```
1  REM  APPLE VERSION
2  DIM A$(40)
5  DATA  BAD,LOUSY,AWFUL,TERRIBLE
    ,NOT GOOD,NOT TOO GOOD,NOT V
    ERY GOOD,NOT WELL
20  TEXT : HOME : REM  CLEAR SCRE
    EN
25  PRINT : PRINT : PRINT
26  PRINT "HOW ARE YOU TODAY?"
27  INPUT A$
30  FOR V = 1 TO 8
40  READ B$
50  FOR C = 1 TO  LEN (A$) -  LEN
    (B$) + 1
60  IF B$ =  MID$ (A$,C, LEN (B$)
    ) THEN 100
70  NEXT C
80  NEXT V
90  PRINT : PRINT "I'M GLAD.": END
100  PRINT : PRINT "THAT'S TOO BA
    D...": END
```

```
1 REM ATARI VERSION
2 DIM A$(40),B$(20)
5 DATA BAD,LOUSY,AWFUL,TERRIBLE,NOT TOO
GOOD,NOT GOOD,NOT VERY GOOD,NOT WELL
20 GRAPHICS 0
25 PRINT :PRINT :PRINT
26 PRINT "HOW ARE YOU TODAY?"
27 INPUT A$
30 FOR V=1 TO 8
40 READ B$
50 FOR C=1 TO LEN(A$)-LEN(B$)+1
55 IF LEN(A$)-LEN(B$)<0 THEN 80
60 IF B$=A$(C,C+LEN(B$)-1) THEN 100
70 NEXT C
80 NEXT V
90 PRINT :PRINT "I'M GLAD.":END
100 PRINT :PRINT "THAT'S TOO BAD...":EN
D
```

Lines 30 to 80 establish a nested loop. On each turn of the outer loop, a key word or phrase is read into B$ from a DATA line. The inner loop then tries to find the key word in the string typed into A$ by the program user.

Line 50 sets the number of turns of the inner loop equal to the length of the string typed in by the user, minus the length of the key word. This will allow the computer to try every group of letters in the string that could possibly match the key word.

There are certain problems inherent in these types of programs.

In line 60 LEN(B$) replaces a constant in the MID$ statement because different key words of different lengths are going to be stored in B$. If the key word is found in A$, line 60 sends the program to line 100. If not, the next key word is read into B$ from DATA and the outer loop turns one more time. If no key words are found, the program ends in line 90.

There are certain problems inherent in this type of program. The first is that all possible key words must be accounted for or the program messages will not be appropriate. In our example, if the program user typed in I FEEL BLAH, the program would not recognize BLAH as a key word. Another possibility is that the program might misinterpret another word as a key word. For example, I FEEL AWFULLY GOOD is interpreted in the negative since the word AWFUL is imbedded in the string. However, even with its limitations, this sort of programming is both interesting to write and fun to use. ©

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A complete disk system includes the PEDISK II Controller, Disk Operating System software, connecting cable, and an external disk drive set. Simply plug in the controller board, and your disk system is ready to run.

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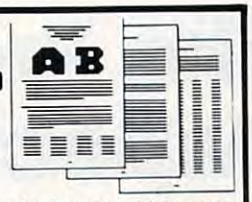

Paper-Mate is a full-featured word processor for $29.00 by Michael Riley. Paper-Mate incorporates 60 commands to give you full screen editing with graphics for all 16k or 32K PETs, all printers, and disk or tape drives. It also includes most features of the CBM WordPro III, plus many additional features.

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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, PET graphics as well as text can be used. Paper-Mate can send any ASC11 code over any secondary address to any printer.

Paper-Mate works on 16K or 32K PETs with any ROM, cassette or disk, and CBM or non-CBM printers. An 8K version is in the planning.

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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.

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For CBM/PET Computers

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Flex File is a set of flexible, friendly programs to allow you to set up and maintain a data base as well as 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.

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MAILING LABELS

When record size is 127 characters (typical for mailing list), each disk can handle over 1000 records (about 2800 with the 8050 drive). Labels can be printed any number of labels across, and in any column position. Any number of fields can be printed on a label in any order, and two or three fields can be joined together on one line (like first name, last name, and title). A "type of customer" field allows selective printing.

REPORT WRITER

The contents of any field can be placed in any column. Numerics can be decimal point justified and rounded to any accuracy. Any column can be defined as a series of mathematical functions performed on other columns. These functions may include +, −, x, /, %, and various log and trig functions. Results of operations such as running total may be passed from row to row. At the end of the report a total and/or average can be calculated 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 was developed by Michael Riley.
Flex File System $60

Specify machine size (32K recommended) and ROM type for both disk and computer.

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The Practical Aspects Of Assembly Language Programming

Bruce D. Carbrey
Raleigh, NC

Part I: Using Flags

It starts with a vague sense of dissatisfaction with the limitations of BASIC. Then you feel a twinge of jealousy towards that mysterious cult of software Gurus who seem to use black magic to exhort their machines to run devilishly fast and speak in strange tongues to devices like PIAs and UARTS. Before you know it you're TAKING THE PLUNGE (**COMPUTE!**, March, 1981), and after struggling down a river of addressing modes and across a sea of opcodes, you know you've passed the initiation rites and can call yourself an Assembly Language Programmer. But perhaps you still feel like something of a novice programmer when it comes to assembly language. If you know assembly language, but don't feel confident that your machine language routines are the best that they can be, this series of articles may help. Even if you are an "expert" assembly language programmer, you may find a useful technique or two presented. Or, you may know of better techniques, in which case I encourage you to write them up and send them in to **COMPUTE!**, so we can all benefit.

I'm going to cover a number of loosely-related topics in detail, putting emphasis on program efficiency. After all, it is almost axiomatic that if you are programming in assembly language at all, you are doing it either to improve execution speed or to reduce program size, or both. The rest of this article assumes that you have a basic working knowledge of 6502 assembly language. The first installment discusses the deceptively simple topic of flags.

Representing Flags

Flags are familiar to any experienced programmer. A flag is a variable which can have only two possible states: TRUE or FALSE. It can be represented by a single bit in memory, but for ease of manipulation by a program, a whole byte is usually used.

Since flags are so simple in concept, you may be surprised to know that many programmers use flags quite inefficiently. To demonstrate what I mean, first consider the example program in Listing 1. This subroutine, usually called a keyboard driver, reads one character from an ASCII-encoded keyboard. The keyboard is assumed to be connected to a parallel I/O port such as is found in a 6820, 6522, 6530, 6532, or similar device. The seven data lines from the keyboard are tied to bits 0 through 6, and a negative-going strobe is connected to bit 7 of the port. When bit 7 of the port becomes zero, the ASCII code for the key which is depressed can be read on the remaining 7 bits. Notice that the strobe is connected to bit 7 because bit 7 is always zero in the ASCII code anyway, and because we can test it easily using BMI or BPL instructions, since bit 7 is the sign bit in a word.

Now suppose that you discover that your Monitor program will accept only uppercase alphabetic letters for commands, but your keyboard only delivers lower case letters unless you hold down SHIFT. What can you do about this nuisance if you don't have an ALPHA LOCK key? You

Properly used, flags can greatly simplify and improve your programming.

could go to the parts box and build a circuit to modify your keyboard, or you can take the software approach and simply add some code to your driver to "fold" all lower-case alphabetic characters ($61 through $7A in the ASCII table) to their uppercase equivalents, as shown below:

```
FOLD    CMP   #$7B    ;LOWER CASE "Z" + 1
        BCS   FOLD1   ;BRANCH IF NOT LOWER CASE ALPHA
        CMP   #$61    ;LOWER CASE A
        BCC   FOLD1   ;BRANCH IF NOT LOWER CASE ALPHA
        SBC   #$20    ;ELSE FOLD LOWER TO UPPER CASE
                      ALPHA
FOLD1   ...
```

This code can simply be inserted at the end of the keyboard driver, just before the RTS. The trouble is, your driver will now *always* return upper case alphabetic characters. This may be desirable for entering commands to the Monitor, but when you're in the Editor you may want to be able to input lower case. The solution? You need an "Alpha-Lock Enable" flag to tell the driver whether to allow lower case or not. You can start by allocating space for your flag:

```
ALFALK  .BYTE  0  ;ALPHA LOCK FLAG FOR
                  KEYBOARD DRIVER
```

Now how do you use it? The natural choice is to set

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- Copy files on disk (DOS)
- Reset disk system (DOS)
- Initialize 2000 series drives (DOS)
- Check error channel (DOS)
- New a disk (DOS)
- Validate a disk (DOS)
- Scroll down
- System cold start
- One key command to load a program (DOS)
- Send program listing to printer (with* or without* form feed at end)
- Send screen contents to printer (normal mode* or squeezed*)
- Send screen contents to disk file by any name*
- Disk program append*
- Repeat key function*
- Kill to turn off repeat*
- Escape to turn off ROM*
- Convert hex to decimal or
- Convert decimal to hex (with error detection)
- Fast jump to monitor
- Fast shift to upper or lower case
- Fast jump to cold start
- One key command to save a program
- Beep (programmable)*

**Asterisk indicates routines which can be called in basic as subroutines for increased computer power.*

Warning! Extensive testing has proven that even casual users of **UtiliRom** become hooked on its efficiency and speed. Serious programmers and custom software designers appreciate the fact that routines are included for fast disk I/O — up to 3 times faster than the system routines. In addition. **UtiliRom** can help protect software designs from theft.

UtiliRom firmware is available for any socket on any Commodore system (including the Address 9000). When used with **Chipmate** firmware (below), you can use UtiliRom in the same socket simultaneously with one other 2K ROM such as Toolkit™.

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Order **Chipmate firmware with UtiliRom** for same socket simultaneous use with most other 2K ROMs. **Chipmate with UtiliRom** is only $61.90. **Chipmate alone** is $14.95.

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the flag to 1 if it's true and 0 if it's false. The complete driver routine using this method is shown in Listing 2.

This routine is satisfactory (because it works!), but it can be substantially improved. Notice that you had to temporarily save the returned character on the stack while you tested the Alpha-lock flag.

Next time I'll show a substantial improvement and more ways to improve efficiency.

LISTING 1: SIMPLE KEYBOARD DRIVER ROUTINE

```
                        ;
                        ;       SUBROUTINE INCH: KEYBOARD DRIVER FOR ASCII-ENCODED
                        ;       KEYBOARD WITH PARALLEL INTERFACE.
                        ;
                        ;       ADDRESSES SHOWN ARE FOR 6530 ON KIM-1 COMPUTER.
                        ;       KEYBOARD DATA LINES TO PORT A BITS 0 TO 6,
                        ;       NEGATIVE GOING STROBE TO BIT 7.
                        ;
                        ;       ON ENTRY: NO ARGUMENTS.
                        ;       ON RETURN: REGISTER A = ASCII CODE FOR KEY PRESSED;
                        ;       X AND Y PRESERVED.
                        ;
1700            PAD     =       $1700   ;KIM PORT A DATA REGISTER ON 6530
1701            PADD    =       $1701   ;KIM PORT A DATA DIRECTION REGISTER
                        ;
0000                    *=      $1780   ;**PROGRAM ORIGIN**
                        ;
1780 A900       INCH    LDA     #$00
1782 8D0117             STA     PADD    ;SET PORT DIRECTION = INPUTS
1785 AD0017     INCH1   LDA     PAD     ;TEST PORT
1788 30FB               BMI     INCH1   ;WAIT FOR STROBE PULSE
178A 2C0017     INCH2   BIT     PAD
178D 10FB               BPL     INCH2   ;WAIT FOR END-OF-STROBE
178F 60                 RTS
                        ;
0000                    .END
NO ERROR LINES
```

LISTING 2: KEYBOARD DRIVER WITH ALPHA LOCK FLAG
USING 0 = FLASE AND NON-0 = TRUE

```
                ;
                ;       SUBROUTINE INCH: KEYBOARD DRIVER FOR ASCII-ENCODED
                ;       KEYBOARD WITH PARALLEL INTERFACE.
                ;
                ;       ADDRESSES SHOWN ARE FOR 6530 ON KIM-1 COMPUTER.
                ;       KEYBOARD DATA LINES TO PORT A BITS 0 TO 6,
                ;       NEGATIVE-GOING STROBE TO BIT 7.
                ;
                ;       ON ENTRY: IF ALFALK IS NON-0, THEN ALL LOWERCASE LETTERS WILL
                ;       BE RETURNED AS THE EQUIVALENT UPPERCASE ALPHA.
                ;       ON RETURN: REGISTER A = ASCII CODE FOR KEY PRESSED;
                ;       X AND Y PRESERVED.
                ;
1700            PAD     =       $1700   ;KIM PORT A DATA REGISTER ON 6530
1701            PADD    =       $1701   ;KIM PORT A DATA DIRECTION REGISTER
                ;
0000                    *=      $1780   ;PROGRAM ORIGIN
                ;
1780 A900       INCH    LDA     #$00
1782 8D0117             STA     PADD    ;SET PORT DIRECTION = INPUTS
1785 AD0017     INCH1   LDA     PAD     ;TEST PORT
1788 30FB               BMI     INCH1   ;WAIT FOR STROBE PULSE
178A 2C0017     INCH2   BIT     PAD
178D 10FB               BPL     INCH2   ;WAIT FOR END OF STROBE
```

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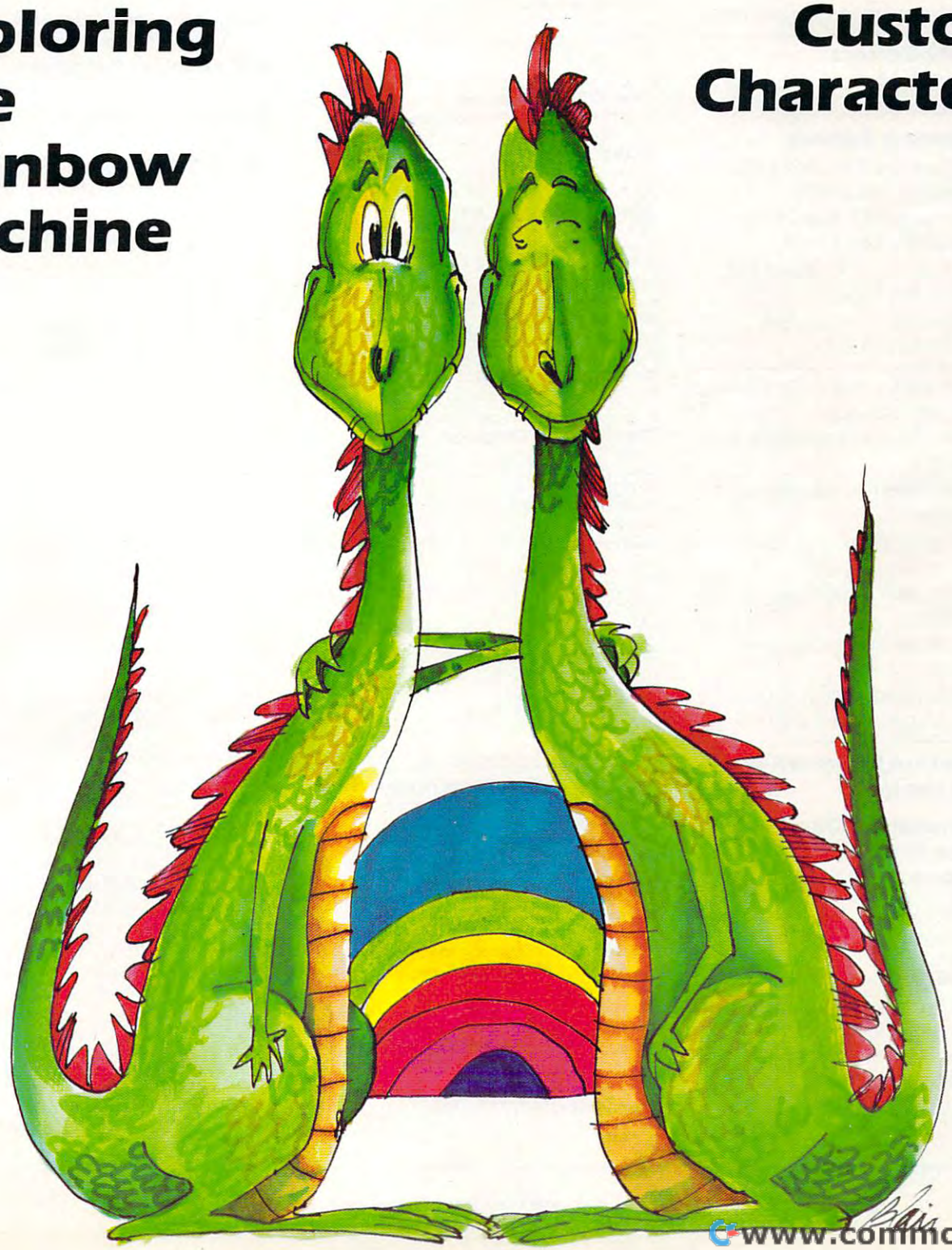

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Table of Contents

The Editor's Notes

Robert Lock

Welcome to the introductory issue of **Home and Educational Computing!** In these pages you'll find a hint of what's to come in the months ahead. Our concept of a magazine is quite simple: we should be a source of useful, reliable information to users at all levels, from absolute beginner to most advanced. In each issue you'll find information valuable in learning to apply your computer in an ever greater variety of ways.

You're important to this magazine as a reader and contributor. We welcome your comments, suggestions, programs and articles. And please let us know what you think of the magazine.

On With The Notes

If you're already a VIC-20 owner, you may be experiencing some color problems. The units shipped, at least in the US, have experienced some variable amount of RF interference. Two things to try:

1. Reorient your VIC or modulator (as you would a portable TV antenna) to see if relative position improves your color.
2. Inside your VIC is a blue, variable resistor. This can be adjusted to vary color intensity. We strongly discourage this method for the novice, and recommend you ask your dealer for advice on "fine tuning" your color.

Our rumor mill says these problems will be corrected in the version of VIC that's fully FCC approved. These units, scheduled to begin shipment in late July or August, have an improved video circuit and better shielding. A modulator (for connection to your TV) will no longer be standard equipment. It will now cost you an extra $29.95. And that's the state of the color question at the moment. If your "Rainbow" machine isn't making rainbows, we suggest a heart to heart chat with your dealer. In our opinion Commodore should provide those of you with an "early model color problem" with a *cheerful* upgrade.

Where's Our Software?

Although Commodore has been expressing proper concern for getting support to all of you outside software vendors, our feedback from the field has been quite the reverse. Several of the established software houses have vented displeasure with the lack of support and information available from VIC headquarters. We'd like to hear from more software vendors, and to also hear from Commodore on plans to truly initiate some support.

New Products And Reviews

Next issue, we'll start our **New Products** section, bringing you timely information on the latest developments in the world of the VIC-20. You'll also enjoy our **Reviews** section; careful and fair analysis of new products, with the goal of helping you make informed buying decisions.

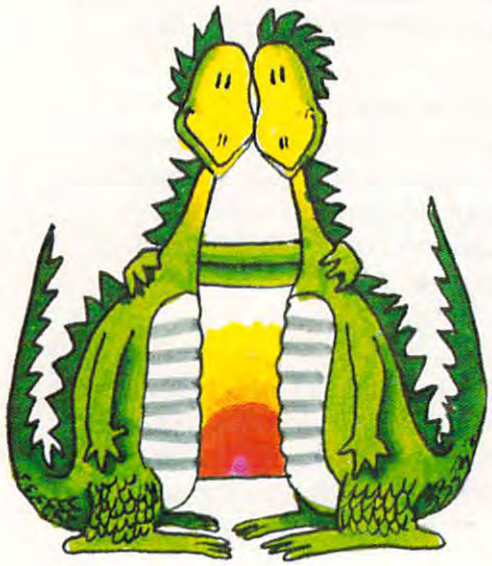
Exploring The Rainbow Machine
A Beginner's Guide ... To The VIC (Part I)

Ramon Zamora and George Firedrake
Palo Alto, CA

PreRamble

Let's begin with dragons. George and Ramon are two of the many Dragons of Menlo Park. They are friends of Bob Albrecht, known throughout the world, by both kids and adults, as *the* Dragon. (Many people believe that Bob is a real dragon, temporarily disguised as a human, so that we will listen to what he has to say about kids and learning.)

George Firedrake and Bob are old, old friends and claim to have adventured together several thousand years ago. George is often



overheard singing parts of an elaborate dragonsong about their escapades. Together, George and Bob have experienced a dream of an important task to be done. They are to find as many dragonfriends as possible and create dragonstories that help the people of the planet Earth, especially kids, acquire knowledge and mastery of the planet's new technologies.

Ramon appears to be a young dragon. Although he says he is only

a few hundred years old (a span of time that, to a dragon, is hardly any time at all), Ramon is a creator of dragonsongs and dragonstories that reach beyond his years. (Hmmm...perhaps he is older than he looks.)

Recently, Bob and Ramon have been busy establishing a new form of learning environment in the Menlo Park Public Library, called ComputerTown, USA!, and building various dragonlairs about the community.

What does all this dragon stuff have to do with a column about the new VIC computer? Well, dragons are not fond of divulging their larger plans; they like to let events unfold as they may. But, George has let it be known that he feels that the new VIC is an important tool for kids, parents, and teachers to start to use. He claims that the color, sound, and graphics features of the VIC make it, for now, an ideal instrument on which to develop innovative learning materials about how to use personal computers.

Whatever their reasons, the Dragons of Menlo Park are busy writing dragonsongs and dragonstories on the VIC. What you are about to read is part of one of their new adventurous explorations for beginners on the computer they have renamed the *Rainbow Machine*.

— DragonNotes
(March 1981)

The Beginning VIC Display

WARNING!

These columns are written for beginners, and for newcomers to computing and the Commodore VIC personal computer. If you are a skilled computer user, reading this material may cause any one of a number of strange and unpredictable reactions.

WARNING!

What word would you say you use for something that is useful but fun? Why, FUNctional, of course! The new Commodore VIC is a FUNctional computer. The VIC's Color, Sound, and Graphics features are fun to use. The same features play a double role and help you create useful applications for your home, business, or classroom.

As beginners, you will explore the VIC's Color, Sound, and Graphics so that you teach yourself what the VIC can do. The material in these columns can be used by anyone wanting to learn about the VIC. (Anyone means both kids and adults.) You get to work at your own pace. If you like to explore the VIC s-l-o-w-l-y, then do so. If you discover that you already know some parts being discussed then skip ahead. *You* are in control.

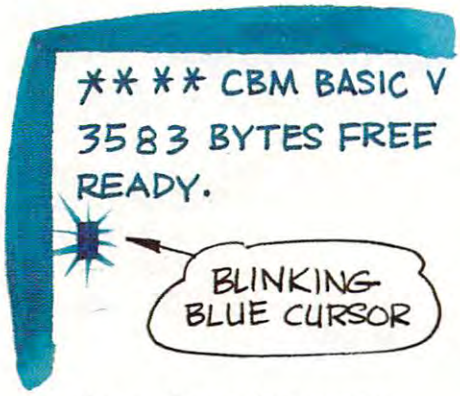
Get ready for your adventures with the VIC. If you wish, find a friend to work with you. Learning about a computer is often more enjoyable (and you sometimes learn more) when done with a friend.

If you have not already done so, unpack your VIC and, following the directions in the VIC user's manual, connect the VIC to your TV set. When the VIC is ready to go ...

TURN ON THE VIC

The VIC screen comes to life, in brilliant color. (If the color is not brilliant, perhaps your VIC is con-

nected to a black-and-white TV set.) Look closely at the screen for a few moments. Check to see that the display on your TV appears like this (we assume your VIC is connected to a color TV):



The messages that appear when you first turn on the VIC should show up as *blue* letters on a *white* screen. Around the Edge of the white central area is a colored border. The border color is *cyan*. Cyan is a lighter blue that has a greenish hue.

You can ignore the first two message lines. (Hmmm...did the VIC misspell *bites*? No, but more on *bytes* later.) The READY message is the VIC's way of saying to you that it is ready to do something. You will tell the VIC what to do by typing on the keyboard. In addition to the

Get ready for your adventures with the VIC.

READY message, the VIC also displays the blinking rectangle, called the *cursor*, to let you know that it is your turn to type. The position of the cursor on the screen indicates where what you type is likely to appear.

The Keys To The VIC

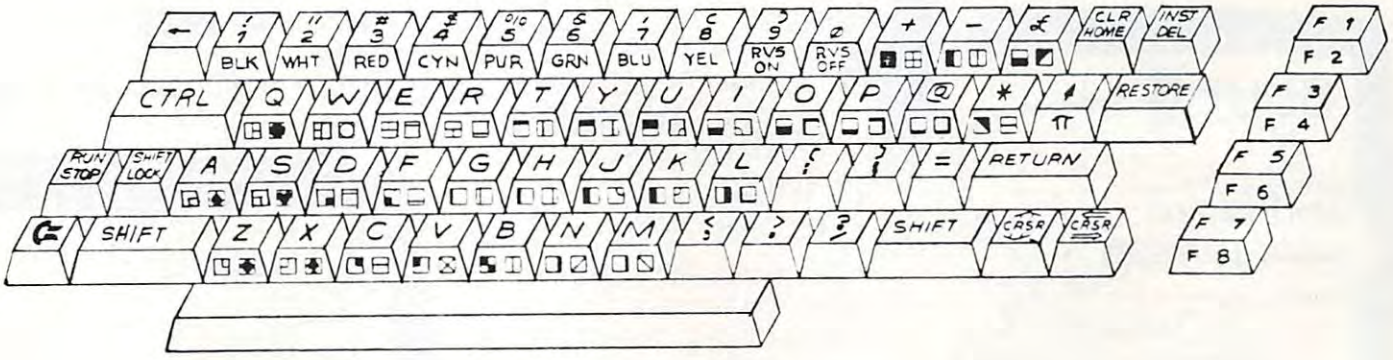
The keyboard is your control center for talking to the VIC. Whatever you type is sent to the VIC and, at the same time, placed on the TV screen so you can verify what you are entering. All the VIC's messages to you are also placed on the screen. Look at the keyboard for a few minutes. The number of keys, all the graphics symbols, and funny words like HOME, CTRL, and CRSR appear everywhere.

The VIC keyboard, however, is a lot like a typewriter in many ways. There are letter keys, number keys, shift keys, and a shift lock key. If you are not a typist, don't worry. Most of what you are going to enter, for a while, only requires a couple of fingers.

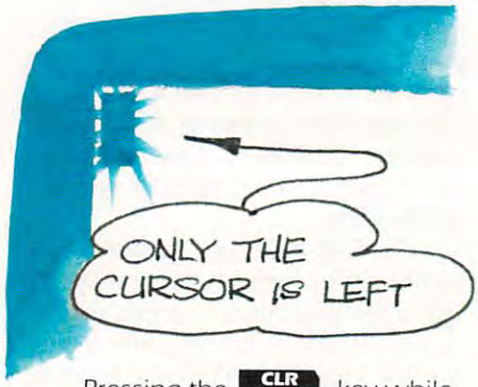
Time for your first experiment. Locate the **SHIFT** key on the left side of the keyboard. (Note: There are two **SHIFT** keys on the VIC, one on the left and one on the right, near the bottom corners. Also, there is a **SHIFT LOCK** key.) You want the **SHIFT** key on the left. When you locate that key, hold it down with a finger on your *left* hand. Now, locate this key:

CLR HOME

With the **SHIFT** key held down with your left hand, press the **CLR HOME** key. What happens? Do the messages on the TV disappear? What does the screen look like?



The VIC Keyboard



Pressing the CLR HOME key while holding down a SHIFT key CLeaRs the screen. Get it? The word CLR on the CLR HOME key comes from the word CLeaR. So to clear the screen:

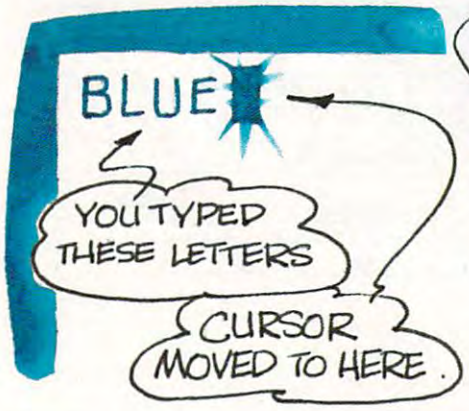
Hold down SHIFT and press CLR HOME

Congratulations! You completed your first communication with the VIC. By pressing the two keys, you told the VIC to do something, namely, clear the screen, and the VIC cheerfully responded. When the screen is clear, the VIC places the blinking cursor in the upper left corner of the display, telling you that it is again your turn to type something.

Type the following (press the keys shown below):

B L U E

Your screen should display:



How do you tell the VIC what colors to use?

Each letter you typed appeared on the screen. The cursor moved to the right one position each time you pressed a letter key and sits at the end of the word. (Right now, it doesn't matter what word you typed. So, if you accidentally spelled BLUE as BLEW or BLEU or BLIP, you didn't blow it.)

You now have the word BLUE (or some word) in the color blue on the screen. Press the large RETURN key and observe the TV display.

The message that the VIC sent to the screen can be interpreted as *I Don't Understand What You Typed.* Anytime you enter something that the VIC does not understand the SYNTAX ERROR message will appear.

Don't worry when you see this message. You have not done anything that will harm the VIC. (In fact, short of standing on your keyboard, you cannot type anything into the VIC that will cause serious problems.) The message appeared because the VIC can only understand certain words; it has a limited vocabulary. But, more on that issue later. Back to your explorations with the VIC keys.

The VIC Colors

Typing the word BLUE produced a SYNTAX ERROR. Typing the word for any other color (RED, GREEN, and so forth) would give the same result. How do you tell the VIC what colors to use? Try this experiment:

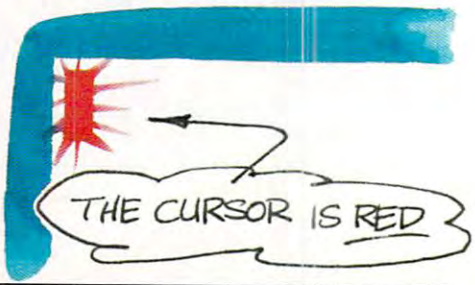
Hold down SHIFT and press CLR HOME

The screen clears and the cursor returns to the top left corner of the display area.

Now, locate the key labeled CTRL. Hold down the CTRL key and press the key with the number 3 on top.

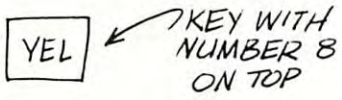
Hold down CTRL and press 3

Look closely at the screen. What color is the cursor?



The cursor is now *red*! Look again at the number 3 key; look at the face of the key. Do you see the letters RED on the front? Aha! All the number keys from 1 through 8 have color codes on their faces. Hold down the **CTRL** key and press another color key. Try this:

Hold down CTRL and press YEL



Is the cursor *yellow*? Your turn: change the cursor to all the colors indicated. (What happens when you press the **WHT** key? Does the cursor disappear?) Remember: you must hold the **CTRL** key down while you press the color keys.

Holding down the **CTRL** key and pressing these keys gives the following colors

BLK	WHT	RED	CYN
black	white	red	cyan
PUR	**GRN**	**BLU**	**YEL**
purple	green	blue	yellow

Try typing a few words in the various colors. Type RED in red; PURPLE in purple; CYAN in cyan. What about typing WHITE in white? The screen's *background* color is already white. If you attempt to type in white, nothing appears on the screen. Try it! Send some invisible messages.

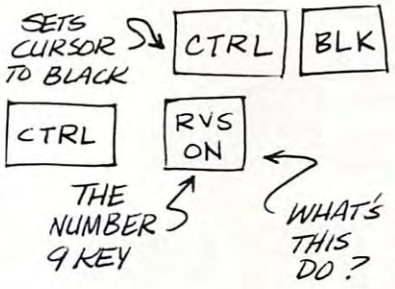
The Rainbow Machine

Time to explore why we call the VIC the Rainbow Machine. Clear the screen. (By now you are probably remembering how this part is done.)

Hold down SHIFT and press CLR HOME

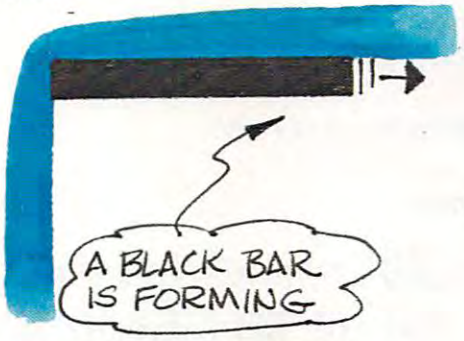
With the Screen clear, and the cursor back in the top corner, press the following keys:

Hold down CTRL and press BLK, then hold down CTRL and press RVS-ON

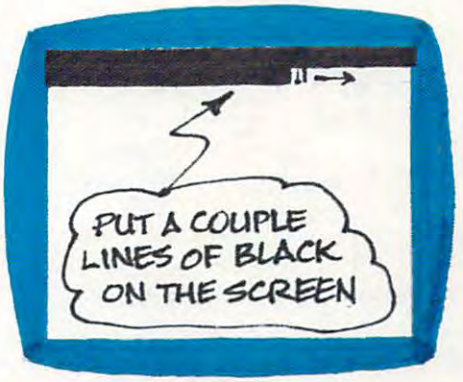


OK! Now, locate the SPACE bar. It is the large bar at the bottom of the keyboard. When pressed, it normally produces a space on the TV display, just like a typewriter produces a space on a piece of paper.

Press the SPACE bar and *hold it down*. What happens? Is the VIC drawing a black bar across the screen?



Continue holding the SPACE bar down until the bar reaches the right edge of the screen. What happens then? Why, the VIC keeps on drawing the black bar on the next line. Let the VIC draw until you get two full lines or so, on the screen, then release the SPACE bar.



Now, change to another color. For example, change RED.

Hold down CTRL and press RED

Press the SPACE bar once again. A *red* bar begins to appear. Keep drawing bars and changing colors until the screen is filled with the VIC Rainbow.

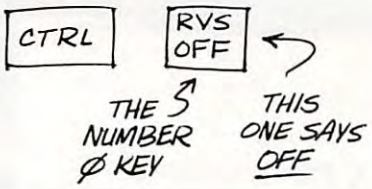
You can use the VIC Rainbow to adjust your TV's color settings. Tune

Send some invisible messages.

the TV to the colors that look best on your screen.

When you finish making rainbows, do this:

Hold down CTRL and press RVS-OFF



This action sets the VIC SPACE bar back to *normal*. Pressing the SPACE bar after you press the **RVS-OFF** key now puts a space on the screen. You will have other chances to experiment with RVS-ON and RVS-OFF as you progress through this material.

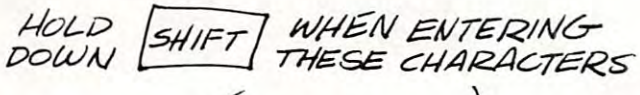
... you will find a mystery exercise that you type into the VIC.

VIC Mystery Experiment #1

Up to this point you have explored or experimented with these VIC features:

- ***The cursor**
- ***The SHIFT key**
- ***The RETURN key**
- ***Clearing the screen**
- ***RVS-ON**
- ***SYNTAX ERRORs**
- ***Typing words**
- ***Color keys**
- ***The SPACE bar**
- ***The CLR HOME key**
- ***RVS-OFF**
- ***Rainbow-Making**

At the end of each column in this series you will find a *mystery* exercise that you type into the VIC, and that leads into material in future columns. Here is Mystery Experiment #1. Clear the VIC's screen (by now, you know how this is done). Type the following into the VIC. If you make a typing mistake, press the **RETURN** key and retype the line. Experiment and see what you get!



			SHIFT	SHIFT			SHIFT	SHIFT	SHIFT	SHIFT			
You type:	1	0	?	"	SPACE	J	Q	K	"	;	RETURN		
The VIC shows:	1	0	?	"	(SPACE)	⁀	•	⁀	"	;			
You type:	2	0	G	O	T	O	1	0	RETURN				
The VIC shows:	2	0	G	O	T	O	1	0					
You type:	R	U	N	RETURN									
The VIC shows:	**This is the mystery part!**												
Hint #1:	**Bluebirds**												
Hint #2:	**Press RUN STOP to "stop" the migration.**												
Hint #3:	**Type R U N RETURN to re-start the migration.**												

Have fun with your VIC! See you next time.

VIC As Super Calculator

Jim Butterfield
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Everyone knows that you can load programs into the VIC and get some pretty clever things to happen. Don't forget that you can also do useful tasks with your VIC without any programs at all.

The technique is called Direct Statements. These are lines that you type without a number at the beginning. For example, if you type PRINT "HELLO" or just ? "HELLO" for short, VIC will obligingly print HELLO. Not too useful, but we're just warming up for the good stuff.

Quick arithmetic is easy to do. To add five and six, type PRINT 5+6. It works just as you expect it to.

VIC uses an * (asterisk) character to signify multiplication, and a / (slash) for division. So PRINT 2*3/4 gives you an answer of 1.5 as you would think. By the way, you'll quickly learn that VIC ignores spaces: PRINT 2 * 3 / 4 gives the same result, and you may feel that it's neater.

When you start mixing multiplication/division with addition and subtraction you'll need to get used to a quick VIC trick: it always performs the multiplication and division first. This means that PRINT 2*3+4*5 will produce 26 (six plus twenty), not 50 as you might think at first. If you really multiply by five you can always force VIC to see things your way by using brackets: PRINT (2*3+4)*5 makes it work. You can use multiple brackets if you wish: PRINT ((2+3)*4)+5 is quite acceptable, and PRINT (2+3)*(4+5) produces the expected answer of five times nine or 45. Remember that you must close the brackets as many times as you open them, or you may get the dreaded ?SYNTAX ERROR notice that tells you that you've done something dumb. If you'd rather be exact about brackets and call them parentheses, that's OK — just remember to use them correctly.

VIC has special functions similar to an advanced scientific calculator.

You'll quickly discover that you can raise a number to a power with the upward arrow: PRINT 2↑3 gives you two cubed, which is eight. Powers are always performed before multiplication, division, addition or subtraction — unless you use brackets. By the way, you'll discover that powers of a number have one very nice feature: the sign of a number is handled correctly in almost all cases. If you have a mathematical bent, you can probably guess what will happen if you raise a number to a fractional or negative power; if you don't, you might like to try it anyway and see what happens. One last thing about powers: they don't work out exactly in all cases: three raised to the fourth power might give you a value just a shade higher or lower than 81.

We've still only just begun. VIC has special functions similar to an advanced scientific calculator. For example, PRINT SQR(5) calculates and prints the square root of five. You have quite a few trigonometric functions: SIN, COS, TAN and the arctangent ATN if you need them, but be careful: they are worked from angles in radians. If you measure your angles in degrees, be sure to convert using a factor of pi/180: for example, the sin of 30 degrees is calculated with: PRINT SIN(30*π/180). For the math whiz, there are logarithms and exponentials using the LOG and EXP functions. If you use these, you'll need to know that they are natural logarithms. If you prefer to use unnatural logarithms (base 10), use a factor of LOG(10) to divide or multiply: the common log of two can be calculated with PRINT LOG(2)/LOG(10).

Memories

Calculators use memories: and VIC the super-calculator gives you lots of memory. You get to name your memory: type A=17 and the value of 17 stored into a memory location called A. Later, you can use this value in other calculations such as PRINT A+9. You can change the memory value at any time with a statement like A=14. You can add or subtract to it with unusual (at first) syntax such as A=A+4 or A=A-11. When you do this kind of thing, remember that the new value is set only after the calculation is complete. So if A equals 5, the expression A=A*3-A would calculate five times three minus five, and then set the result (ten) into memory location A.

You may name memory locations (called "variables" in the VIC) almost anything you like: for example, HENRY=7 will work. You'll be much better off to use a single letter (A, B, C, etc.) or a letter followed by a number (D9, M4, etc.) since VIC can get confused with certain combinations of letters. For example, TANK would get mixed up with the TAN function.

One last thing: memory can get wiped out very easily in the VIC. Certain commands like NEW and

CLR will do it; and typing in any line starting with a number will clear all the variables. Be careful.

Multiple Calculations

If you want to calculate several things, you can do it with a single PRINT command. Just put a semicolon (;) or a comma (,) between the espressions you want to calculate. For example: PRINT 3+5,3*5,3/5 calculates three values and prints them neatly on a single line. If you used the semicolon: PRINT 3+5;3*5;3/5 the values would be printed close together rather than in neat columns.

You can put several commands together on a single line, separated by a colon (:) character. To add a value of one to variable X, and then print X+4, you might code: X=X+1 : and then print X+4. The colon will separate the statements so that VIC will understand that they are to be performed separately.

Repeating Calculations

If you can ask VIC to do something once, you ask for the same calculation to be performed many times. All you need to do is put the job you want done between the two following statements: FOR J=1 TO ... : ... (your statement) ... : NEXT J.

Beginners like to see their name printed many times. They should code: FOR J=1 TO 100 : PRINT "JOE" :NEXT J to have the name JOE printed one hundred times. Since each name is printed on a separate line of the screen, there won't be room for all those JOEs. Try changing the PRINT statement by adding a little extra punctuation behind JOE — for example PRINT "JOE", with a comma, or PRINT "JOE"; with a semicolon. You have a lot of control over how things appear on the screen.

It doesn't seem to make much sense to print a fixed calculation such as the square root of ten over and over again. We have much more flexibility than that. As the central statement repeats, the value of the variable (J in the example above) will step through the values we have shown (1 to 100). You may use this variable as a memory value and calculate with it. To print a table of the square roots of numbers from ten to twenty, code: FOR J=10 TO 20 :PRINT J,SQR(J) :NEXT J and the job will be done.

Remember that everything between the FOR and NEXT statements will be repeated with the value of the variable (J in this case) stepping through its range. Don't forget that you can use any variable name you like: FOR M=3 TO 7 is perfectly good so long as you say NEXT M at the point that you want to go back and repeat.

Summary

Direct statements are a good way to learn some of the simple rules of Basic, and they are handy for quick calculations, too.

When you start writing BASIC programs, you'll find it handy to try some of the program lines as direct statements first, to make sure that they work properly. And if your program gives you trouble and stops, you'll find that statements from the program, entered in Direct mode, can give you a hint as to what's going on.

But no matter how advanced you get in your programming adventures, don't forget what a zippy little calculator you have at your fingertips.

Direct statements are a good way to learn ... ... simple rules of BASIC.

Custom Characters For The VIC

David Malmberg
Fremont, CA

One of the many innovations built into the new Commodore VIC is the ability to design our own special characters and have them available to BASIC programs. The possible uses are many. Now you can have different language fonts, such as Japanese, Chinese, or Arabic. You can display electronic schematic symbols. Or, you can write a program that transcribes stenographic characters into English. Greek alphabet characters are now available for tutorial math programs requiring special symbols. You can even design your very own space invader creatures.

This article explains how to make these custom characters. It also presents a utility program to make the job of designing these characters and incorporating them into your BASIC programs quite easy and straightforward. Finally, a sample program is given that demonstrates the custom character features of the VIC by displaying all of the special math symbols of the Greek alphabet.

VIC Character Sets

The character set to be used by the VIC is determined by the value in location 36869. (Note: all locations are given in decimal). This is similar to location 59468 in the PET or CBM machines. The various VIC character sets specified by POKEing this location are as follows:

POKE36869,240 gives upper case and graphics (when shifted)
POKE36869,242 gives lower case and upper case (when shifted)
POKE36869,255 cause the VIC to set aside the first 64 characters of the character set as user defined characters. These special characters will be determined by values in the 512 locations beginning at 7168.

... you can have different language fonts, such as Japanese ...

VIC Character Representation

To understand how to design your own VIC characters, you must first understand how the VIC represents its characters internally. Just how this is done was demonstrated by Jim Butterfield in his article in the April 1981 issue of **COMPUTE!** Jim pointed out that the two "normal" character sets can be located by using the following equation:

```
CHR(I) = 32768 + B + 8*I
  where B = 0 for the upper/
    graphics set
  and B = 2048 for lower/upper
    characters
  and I = the "screen POKE" value of
    the character
(e.g., @ is 0, A is 1, B is 2, etc.)
```

As an example, let's look at how the VIC stores an upper case "A." It has a "screen POKE" value of 1, so by using the above equation we see that it is stored in the eight consecutive bytes beginning at location 32776. If we were to PEEK these locations, we would find the following decimal values — which have the specific bit patterns which define the pixel (i.e., dot) pattern the VIC uses when its prints an "A."
The bit pattern corresponds to the binary representation of the decimal number found in the location. For example, location 32782 contains a decimal 66 which is 01000010 in binary — i.e., the pattern at the bottom of the VIC's representation of an "A".

BYTE LOCATION	DECIMAL VALUE	BIT PATTERN 7 6 5 4 3 2 1 0
32776	24	. . * * . . . .
32777	36	. . * . . * . .
32778	66	. * . . . . * .
32779	126	. * * * * * * .
32780	66	. * . . . . * .
32781	66	. * . . . . * .
32782	66	. * . . . . * .
32783	0	. . . .

Defining Your Own Characters

Let's see how you would go about designing and incorporating your own custom character into a BASIC program. For example, let's add the following vicious-looking creature to your version of Space Invaders or Dunjonquest.

	PIXEL PATTERN 7 6 5 4 3 2 1 0	BINARY	DECIMAL
ROW 0	* . . . . . . *	10000001	129
ROW 1	* . . * * . . *	10011001	153
ROW 2	. * * . . * * .	01100110	102
ROW 3	. . * * * * . .	00111100	60
ROW 4	* * * * * * * *	11111111	255
ROW 5	. . * * * * . .	00111100	60
ROW 6	. * . . . . * .	01000010	66
ROW 7	. * . . . . * .	01000010	66

The binary and decimal values corresponding to the creature's pixel pattern are also given. To get the VIC to use this pattern as one of its characters, let's enter and run the following short program:

```
100 X = PEEK(56)-2: POKE 52,X: POKE
  56,X: POKE51,PEEK(55): CLR
110 CS =256*PEEK(52) + PEEK(51)
120 FOR I = CS TO CS+511: POKEI,
  PEEK(I+32768-CS): NEXT
130 FOR I = 0 TO 7: READ J: POKE
  CS+I,J: NEXT
140 DATA 129,153,102,60,255,60,
  66,66
150 POKE 36869,255: PRINT"CLR"
160 FOR I = 1 TO 11: PRINT"@ "0:
NEXT
```

After running the program you should see a row of 11 of your creatures on the top line of the screen.

Let's review this program line-by-line to understand how to use these special characters in other programs. Line 100 PEEK's two pages lower (a page is 256 bytes). Line 100 also changes the pointer to the beginning of the strinng variables (locations 51 and 52) to point to the beginning of these two pages. The CLR resets the user RAM boundaries so that these two pages are protected from the rest of the BASIC program. Line 110 calculates the starting location for the table containing the new character set.

Line 120 transfers the first 65 characters of the standard upper case character set from ROM into the new character set table in the top two pages of user BASIC RAM. This is not strictly required, but it is good practice because it allows you to have access to "normal" characters as well as your specially designed charcters on the same screen.

Line 130 reads the data in line 140 that defines the pixel pattern for the creature and POKEs it into the table space used by the first character of the new character set, i.e., the table space used by the "@" sign in the normal upper case character set.

Line 150 tells the VIC to use the custom character set where the first 64 characters are user defined. Line 160 tries to print a row of @'s but ends up printing your creature because its pixel pattern is in the table where the @ would normally be located.

You could continue to add to this simple program to build a complex game that would use your creature whenever you PRINTed "@" or POKEd the screen with a zero (i.e., the @'s normal screen POKE value). To return to the normal character set, give the direct command: POKE 36869,240 which will cause all your creatures to be transformed back to @'s.

The program has two operation modes: ... review mode ... and ... editing and new-character definition ...

A Utility Program

Listing 1 is a short BASIC program for the VIC which helps with the design, testing, and coding of special characters by essentially automating the process described above. The program has two operation modes: (1) a review mode which allows you to see how the current character set looks — including your custom characters, and (2) an editing and new-character definition mode.

Review Mode

When you first run the program in listing 1 you will initially be in the review mode and the screen will look like this:

```
@ABCDEFG    OPTIONS
HIJKLMNO
PQRSTUVW    N EW CHAR
XYZ[£]      E EDIT CHAR
■!"#$%&'    Q QUIT
()*+,-./
01234567
89:;<=>?
```

The characters shown in the first eight rows and eight columns of the screen are the currently defined custom character set. Note that you start the program with the normal upper case characters. As you redefine the characters, the new characters will be displayed in their appropriate place in this character table. For example, if we had used the utility program to create the creature in the previous example it would be displayed in place of the @ sign whenever we were in the review mode.

The blank in the first column of the fifth row will be red and serve as a "fake" cursor. You will be able to use all normal cursor controls, including HOME and CLR to position this fake cursor on any of the characters displayed in the character set. This fake cursor will also have automatic repeat key and automatic wraparound features.

To define a new special character, move the fake cursor to the position of the character in the normal character set you wish to replace. A good idea is to replace characters that are seldom used, so that you still have access to the more popular characters, i.e. the letters and digits. Once the cursor is positioned, hit "N" on the keyboard to define a new character in place of the one the cursor is on. If you are just reviewing a character that you have previously created and decide it needs more work, then position the cursor on the character and hit "E". Either "E" or "N" will shift the program into the EDIT mode.

Edit Mode

As an example, let's assume that you wanted to add serifs to the character "K". After placing the red cursor over the K you would hit an "E" to enter the Edit mode, and the screen

would look like this:

```
■.*...*.      OPTIONS
..*..*..
..*.*...      + ADD DOT
..**....      – ERASE
..*.*...      = UPDATE
..*..*..      B BASIC
..*...*.      R REVIEW
.......       Q QUIT
```

The screen shows the pixel pattern for the character K in a large 8-by-8 format. The cursor is "homed," but may be repositioned using the cursor control keys to rest on any of the large pixels. Once the cursor is properly positioned, a pixel may be "turned-on" by hitting a "+" or "turned off" by hitting a "–" sign. After you are satisfied with your handiwork, hit an "=" sign to put that character into the character set table. Then if you wish to see the character in its normal size and format, hit an "R" to go back to the Review mode.

After the design of the special character is complete, you may hit a "B" to have the VIC print the BASIC code needed to add this character to other programs. For example, if we had used this utility program to design the creature used in the previous example, and we hit a "B", the VIC would display the following lines of BASIC code:

```
200 READ X: FOR I = X TO X+7: READ
    Y: POKE X,Y: NEXT
210 DATA 7168, 129, 153, 102, 60,
    66, 66
```

You will recognize that these lines of code are essentially equivalent to lines 130-140 in the previous example. IMPORTANT — these lines of code will only work if lines 100-120 in the previous example or their equivalent have already been executed. Listing 2 gives an example of how the BASIC code generated by this utility program might be used to incorporate a number of special characters (specifically the math symbols in the Greek alphabet) into a BASIC program.

A word of caution — hitting a "B" or an "R" will both generate displays based on what is actually in the character set data table. This may not correspond to the current large-sized pixel pattern. Always be sure this table is correct by updating it via the "=" command prior to using the "B" or "R" commands.

Hitting a "Q" while in either the Edit or Review modes will cause both the memory size and the character set to be reset to their normal states and the program to end.

A Few Suggestions

If you want to use a custom pattern that is larger than just one character, use the utility program to design the pieces of the overall pattern into contiguous characters, as shown in the Review mode display. For example, if you want a 3-across by 2-down pattern, you could use the utility program to design the various parts into the character positions normally occupied by @, A, B, and H, I, J. Then whenever you PRINTed these characters in your BASIC program (in the correct configuration — of course) you would get your desired large custom pattern.

If the reverse character flag is on (i.e., the character you are PRINTing has been preceded by a reversed "R") the VIC will use the standard character set and not the custom character set. You will find this useful when you have already redefined various characters, and you want to use those same original characters on the same screen. You can simply PRINT those characters in reverse. This "trick" is used in the Review mode of the utility program to assure that the options are always printed properly.

Programming Challenges

Here are two challenges to programmers who would like to show they have mastered the VIC's custom character features and who want to write very useful programs that can be used and enjoyed by the growing VIC community: (1) Write a program that will draw a straight line (or as close to one as possible) between any two pixels on the VIC's screen. (2) Write a generalized graph program that can graph equations (one or more simultaneously) in high resolution by defining special characters — on the fly — as the shape of the equations require them.

... two challenges to programmers ...

Table 1

```
100 POKE36879,27:PRINT"□ CHARACTER GENERATOR"
110 PRINT"■■  BY DAVID MALMBERG"
120 REM 43064 VIA MORAGA
130 REM FREMONT, CALIFORNIA
140 X=PEEK(56)-2:POKE52,X:POKE56,X:POKE51,PEEK(55):CLR
```

```
150 CS=256*PEEK(52)+PEEK(51)
160 FORI=CSTOCS+511:POKEI,PEEK(I+32768-CS):NEXT
170 S=7680:CL=22
180 CR=0:LN=200:P=12:BG=3:BR=1
190 POKE36879,BG*16+BR
200 DEFFNA(XX)=S+R*CL+C:REM SCREEN POKE LOCATION
210 DEFFNB(XX)=8*R+C:REM SCREEN POKE VALUE FOR CHARACTER
220 GOTO580
230 PRINT"□":GOSUB810
240 PRINT"■";:FORI=0TO7:PRINT".....":NEXT:F=0
250 PRINT"■":R=0:C=0
260 Z=FNA(0)
270 IFF=0THENPOKEZ,PEEK(Z)+128:GOTO310
280 IFZ=ZLTHEN300
290 POKEZL,IL:POKEZL+30720,BC:ZL=Z:IL=PEEK(ZL)
300 POKEZ,32:POKEZ+30720,2
310 GETA$:IFA$=""THEN310
320 IFF=0THENPOKEZ,PEEK(Z)-128
330 REM CURSOR CONTROL OPTIONS
340 IFA$="Q"THENPOKE56,PEEK(56)+2:POKE36869,240:PRINT"□":END
350 IFA$="■"ANDC=7THENC=0:GOTO260
360 IFA$="■"THENC=C+1:GOTO260
370 IFA$="■"ANDC=0THENC=7:GOTO260
380 IFA$="■"THENC=C-1:GOTO260
390 IFA$="■"ANDR=7THENR=0:GOTO260
400 IFA$="■"THENR=R+1:GOTO260
410 IFA$="□"ANDR=0THENR=7:GOTO260
420 IFA$="□"THENR=R-1:GOTO260
430 IFA$="■"THEN250
440 IFF=1THEN540
450 REM DEFINE NEW CHARACTER OPTIONS
460 IFA$="+"THENPOKEZ,81:GOTO260
470 IFA$="-"THENPOKEZ,46:GOTO260
480 IFA$="="THEN680
490 IFA$="□"THEN240
500 IFA$="R"THEN580
510 IFA$="B"THEN770
520 GOTO260
530 REM REVIEW CHARACTER SET OPTIONS
540 CR=FNB(0)
550 IFA$="N"THENPOKE36869,240:GOTO230
560 IFA$="E"THENPOKE36869,240:F=0:GOTO730
570 GOTO260
580 POKE36869,255:R=4:C=0:ZL=FNA(0):IL=32
590 PRINT"□@ABCDEFG":PRINT"HIJKLNMO":PRINT"PQRSTUVW":PRINT"XYZ[\]↑←":F=1
600 PRINT" !"+CHR$(34)+"#$%&'":PRINT"()*+,-./":PRINT"01234567":PRINT"89:;<=>?"
610 PRINT"■"SPC(12);"■OPTIONS■":PRINT
620 PRINTSPC(10);"■N NEW CHAR■"
630 PRINTSPC(10);"■E EDIT CHAR■"
640 PRINTSPC(10);"■Q QUIT■"
650 BC=PEEK(38400)
660 GOTO260
670 REM UPDATE CHARACTER DATA IN TABLE
680 PRINT"■";:X=CS+8*CR:FORR=0TO7:SM=0:FORC=0TO7:D=7-C
690 SM=SM-2↑D*(PEEK(FNA(0))=81):NEXTC
700 POKEX+R,SM:PRINTSPC(8);SM:NEXTR
710 R=0:C=0:GOTO260
720 REM EDIT CHARACTER FROM TABLE
730 X=CS+8*CR:PRINT"□":FORR=0TO7:Y=PEEK(X+R):FORC=0TO7:Z=FNA(0)
740 Q=46:Y=Y*2:IFY>255THENQ=81:Y=Y-256
750 POKEZ,Q:NEXTC,R:R=0:C=0:GOSUB810:GOTO260
760 REM BASIC STATEMENTS TO DEFINE CHARACTER
770 X=CS+8*CR:PRINT"■■■■■■■■■■"
780 PRINTLN;"READ X: FOR I=X TO X+7: READ Y: POKE X,Y: NEXT":LN=LN+10
790 PRINTLN;"DATA";X;:FORI=XTOX+7:PRINT"■■,";PEEK(I);:NEXTI:PRINT
```

```
 800 GOTO260
 810 PRINT"■";SPC(13)"■OPTIONS■":PRINT
 820 PRINTSPC(P);"■+■ ADD DOT"
 830 PRINTSPC(P);"■-■ ERASE"
 840 PRINTSPC(P);"■=■ UPDATE"
 850 PRINTSPC(P);"■B■ BASIC"
 860 PRINTSPC(P);"■R■ REVIEW"
 870 PRINTSPC(P);"■Q■ QUIT"
 880 RETURN
READY.
```

Table 2

```
 100 POKE36879,27:PRINT"□ VIC CHARACTER DEMO"
 110 PRINT"■■  BY DAVID MALMBERG"
 120 REM 43064 VIA MORAGA
 130 REM FREMONT, CALIFORNIA
 140 X=PEEK(56)-2:POKE52,X:POKE56,X:POKE51,PEEK(55):CLR
 150 CS=256*PEEK(52)+PEEK(51)
 160 FORI=CSTOCS+511:POKEI,PEEK(I+32768-CS):NEXT
 170 READ X:IFX<0THEN200
 180 FORI=X TO X+7:READJ:POKEI,J:NEXT
 190 GOTO170
 200 PRINT"□■ABCDEFG":PRINT"HIJKLNMO":PRINT"PQRSTUVW":PRINT"XYZ[\]↑←"
 210 PRINT" !"+CHR$(34)+"#$%&'":PRINT"()*+,-./":PRINT"01234567":PRINT"89:;<=>?"
 220 PRINT"■"SPC(11);"■OPTIONS■":PRINT
 230 PRINTSPC(11);"■N NORMAL■"
 240 PRINTSPC(11);"■L LOWER■"
 250 PRINTSPC(11);"■G GREEK■"
 260 PRINTSPC(11);"■Q QUIT■"
 270 PRINT:PRINT:PRINT
 280 GETA$:IFA$=""THEN280
 290 IFA$="N"THENPOKE36869,240
 300 IFA$="L"THENPOKE36869,242
 310 IFA$="G"THENPOKE36869,255
 320 IFA$="Q"THENPOKE36869,240:POKE56,PEEK(56)+2:END
 330 GOTO280
 340 DATA7168,24,24,36,60,102,66,66,0
 350 DATA7176,124,34,34,60,34,34,124,0
 360 DATA7184,126,34,34,32,32,32,112,0
 370 DATA7192,24,24,36,36,102,66,126,0
 380 DATA7200,126,34,32,56,32,34,126,0
 390 DATA7208,126,70,12,24,48,98,126,0
 400 DATA7216,102,36,36,60,36,36,102,0
 410 DATA7224,24,36,66,126,66,36,24,0
 420 DATA7232,28,8,8,8,8,8,28,0
 430 DATA7240,102,36,40,48,40,36,102,0
 440 DATA7248,24,24,60,36,36,102,102,0
 450 DATA7256,66,102,90,66,66,66,66,0
 460 DATA7264,66,98,82,74,70,66,60,0
 470 DATA7272,126,0,36,60,36,0,126,0
 480 DATA7280,24,36,66,66,66,36,24,0
 490 DATA7288,126,36,36,36,36,36,36,0
 500 DATA7296,124,34,34,60,32,32,112,0
 510 DATA7304,126,98,48,24,48,98,126,0
 520 DATA7312,62,42,8,8,8,8,28,0
 530 DATA7320,20,42,8,8,8,8,28,0
 540 DATA7328,8,28,42,42,28,8,8,0
 550 DATA7336,102,66,36,24,36,66,102,0
 560 DATA7344,42,42,42,28,8,8,28,0
 570 DATA7352,0,24,36,66,66,36,102,0
 580 DATA7360,0,0,0,0,0,0,0,0
 590 DATA7368,0,0,0,0,0,0,0,0
 600 DATA7376,0,0,0,0,0,0,0,0
 610 DATA-1
READY.
```

The Confusing Quote

Charles Brannon

As you type in a program, you will eventually come to a place where information is in quotes. This tells the computer to "take this exactly as shown," instead of interpreting it. For example, the instruction PRINT "PRINT" causes the word PRINT to be displayed on the screen. The PRINT in quotes is entirely different from the command PRINT. What, however, do you do when you're typing in a line like:

```
10 INPUT "WHAT IS YOUR NAME";N$
```

and you make a mistake at the beginning of the line? You just cursor-left to the error, and correct it. Right? Nope. What you get are a bunch of reverse-field vertical lines. These are *control characters*, but that explanation doesn't help you retype that error.

When you typed that first quote you entered the twilight zone of *quote mode*, which is both one of the most frustrating and most useful features of the VIC. The trick is that cursor keys are not only for use in screen editing, but can also be programmed. When the VIC comes to one of those reverse-field vertical lines, it will attempt to actually move the cursor left one space. This can be used to produce animation. When a character is printed on the screen, the cursor moves to the right one space, just like on a typewriter. If, however, you move it back with a programmed cursor-left, you can replace the old character with a new one. Try this line:

```
10 FOR I=1 TO 20:PRINT" ●‖";
:NEXT I
```

Other cursor controls can be programmed as well. The most commonly-used one is the clear-screen character. This is at the start of most programs, and it appears as a reverse-field heart. Actually, all control characters on the VIC are in reverse-field. Cursor-down (Q) can be used to skip down to any line quickly, without a having to print a blank line. Hence the line:

```
10 PRINT:PRINT:PRINT:PRINT
```

can be replaced by

```
10 PRINT "QQQQ";
```

Used in conjunction with the HOME character, cursor down can act like a "vertical TAB statement." At the start of your program, define CD$ (or any string, really) to be equal to HOME and 21 cursor-downs. Now can place the cursor on any line with PRINT LEFT$ (CD$,L); where L is the screen line, from zero to 22. Reverse field on and off are also easy to use; just insert the appropriate characters before and after the text you want highlighted. The color control keys are used similarly, except that while reverse-field is cancelled by a carriage-return, the color command remains in effect until changed. Has your display ever disappeared?

The trick is that cursor keys are not only for use in screen editing, but can also be programmed.

Don't despair, you probably changed the text color to white (CONTROL2), and if the background was white, everything would disappear. Just type CTRL some other color to regain it, or reset with STOP/RESTORE.

Okay, now you're using control characters to do amazing things, but you may be experiencing another problem — you can't make the VIC print them. The problem here is that you are not in quote mode. Here is exactly how quote mode works:

1. If you type an odd number of quotes, you are in *quote-mode* — all cursor controls (except DELete) will show up for better or worse.
2. An even number of quotes, two or four, or none at all, lets you be in the *edit mode*, where you can move the cursor anywhere and type.
3. A special way to get into quote mode is by the INST key. When you insert a gap in text, you are temporarily in quote mode. If you type any control key, it will be printed. This is useful for placing cursor controls inside an already-typed line.

Finally, if you are going crazy trying to figure out what those quotes are doing to your line, just type SHIFTED RETURN to escape to the next line. SHIFTED RETURN does not act like an ENTER key. It just moves to the next line, and cancels reverse field and quote mode. You can then cursor up to the mangled line and fix it.

Remember, one of the VIC's strengths is its ability to manipulate the cursor, colors, and even select upper/lower or uppercase/graphics. Don't neglect this feature. And you can quote me on that.

THE apple® GAZETTE

Animating Integer BASIC Low-Resolution Graphics

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Animated low-resolution graphics can add a lot of pizazz to your Basic program. It takes longer to design the program, and requires the knowledge of a few peeks and pokes, but is not really too difficult to learn, and the results make the effort extremely worthwhile.

There are two basic techniques involved. The first is the design of the animated figures. This is similar to what is done in designing cartoon figures. The second technique involves "flipping pages" on the computer while successively drawing each section of your animated figure to create the illusion of movement. Each technique will be explained here, with a short Integer Basic program using the technique as an example.

Designing The Figure

Before you take pencil and paper in hand it is a good idea to spend some time observing or visualizing the object you wish to animate in the various phases of its motion. For the program example here, the figure to be animated was a girl, who was to be shown walking from left to right across the screen. Observation of people walking was followed by paper and pencil sketches of the various stages of the walking motion, as shown in fig. 1. In this example, the illusion of walking can be created with a succssion of four pictures, A, B, C, and D, as shown.

Once you have a sketch of your figure, you'll need some graph paper. Quadrille-ruled paper is fine, but the special Apple graphics paper available in some computer outlets is more accurate, because the "squares" on the screen are really rectangles, which can throw off the proportions of your finished figure.

Each phase of the movement of the figure should be drawn on its own rectangular section of the graph paper. Each rectangular section should be the same size, and the figure should be centered in exactly the same position in each rectangle. (See fig. 2). In the case of the girl, the rectangle had to be wide enough to accomodate the figure, whether the leg was projected forwards or backward. An extra space was also allowed on either side of the girl, but this is not essential. Each rectangle should be numbered as shown in Fig. 2, with the upper left-hand corner counted as 0,0 (just as the upper left corner of the graphics screen is 0,0).

Now you are ready to develop the subroutines that will draw the figure. You will need one subroutine for each phase of the movement, as a minimum. These subroutines should be assigned

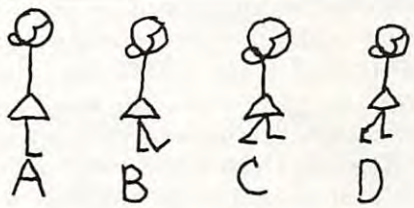

Figure 1

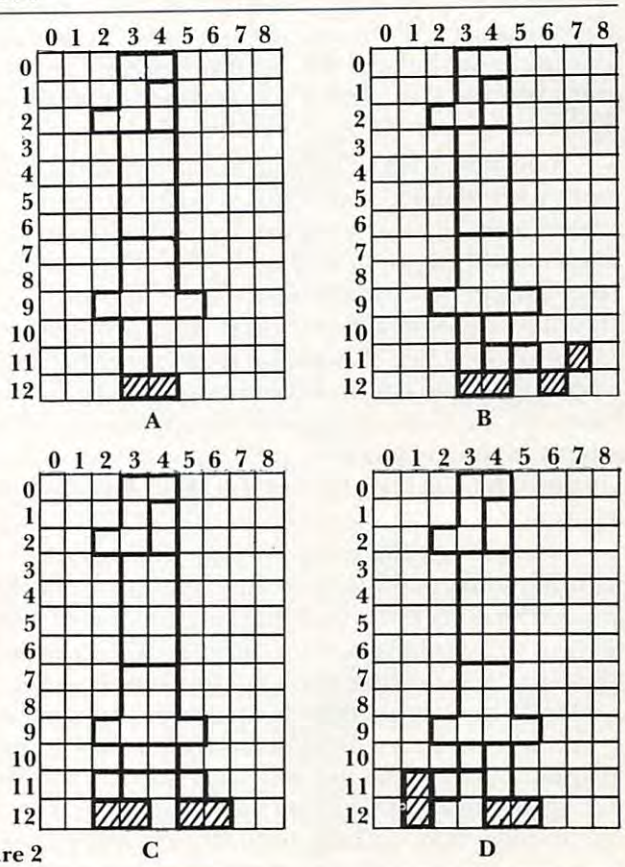

Figure 2

low line numbers, and as many commands as possible should be crammed into each line in order to speed up the drawing time. (The larger your picture is, the more critical this aspect becomes.) Use HLIN and VLIN commands wherever possible.

Since your figure is going to be moving on the screen, your subroutines should not plot specific points (such as PLOT 12,21), but should be written instead in general terms. To do this call the 0,0 square of each rectangle X,Y. Then write your commands in terms of X and Y. For example, the girl's face is drawn with a short vertical line at column 4 in the picture. The *specific* command to draw the face would be VLIN 1,2 at 4. The *general* command is VLIN Y+1,Y+2 at X+4. If X and Y are set to zero before the subroutine is called, the face will be drawn from Y=1 to Y=2 at X=4. It can be moved one space to the right by adding one to X before calling the subroutine.

The subroutines that draw the girl in this program are located from 100 to 200. Subroutine 100 draws the upper half of the girl, which is the same in each picture. Subroutine 120 draws the lower half in the standing position (A). 130 draws the lower half with one foot stepping forward (B), 140 is mid-stride (C), and 150 finishes the sequence (D). To make the girl "walk," the main program calls 100 (top half) followed by the appropriate bottom half, going from A to D over and over. The value for X is incremented by one before each successive step is drawn, so that the girl moves across the screen one square at a time. To prevent leaving a trail behind the figure, you also need an erase routine (160 in this program) to remove each figure before the next one is drawn.

You may wish to stop at this point and experiment with making your figure move across the screen without taking advantage of the page-flipping technique described below. This will give you a chance to add additional drawings or to eliminate drawings not needed. The problem you will observe is that it is distracting to see the figure blinking on and off as it is erased and redrawn in front of you. For a very small figure this could be tolerated, but as pictures get larger or more complicated the blinking causes the animation to lose its appeal.

The remainder of this article describes a technique for making your figure move smoothly across the screen without blinking on and off. One section will explain how to "flip pages" to prevent blinking. Another section explains how to reset LOMEM in your Integer Basic program in order to free the memory needed for the second page of graphics. A third section will describe the subroutine that is used to transfer the contents of page one to page two, and the final section will tell you how the main program works.

Flipping Pages

The Apple has two blocks of memory that can be used for low-resolution graphics. They are referred to as pages. Page one is the one you normally use when you enter the command GR. This page is also used for your text statements. Gaining access to page two requires a bit of trickery. One of the tricks is to prevent this page from being used to store the variables in your Integer program. This is performed by putting the statement LOMEM: 3072 as the first line of the program. Unfortunately, you can't just type that in. (Try it and see for yourself!) But there is a way to do it, which is explained below. The second trick is to put a picture on page two. But alas! there is no command to draw or print text on page two. It can be done, however, by making the drawing on page one, in the usual way, and calling a special subroutine in the Apple Monitor to make a copy of page one on page two. This is also explained below.

Setting LOMEM:

There is more than one way to accomplish this task, but the method described here results in the simplest program. It requires doing some things in the Apple Monitor, but each step will be carefully explained, so you should have no trouble. You may want to save the program you have typed so far (if any) before you begin. If you haven't started a program yet, this will be your first line.

Enter the following as the first line of your Integer program: 0 PRINT 3072. Now type CALL-151 to get into the Monitor. (Fig. 3 shows what you will see as we go along.) You should see the * prompt. The first task is to locate the machine language version of the Basic program line 0 which you just typed in. This is done by looking at the numbers stored in two special memory locations in the Monitor – memory locations 00CA and 00CB (or CA and CB for short.) These locations are called pointers, and contain numbers representing the address of the beginning of your program. (Note: The letters A, B, C, D, E, and F are numbers (10 through 15) in machine language. The 0's in machine language are all zeros, so when you see "0" in this part of the article, type a zero on your computer, not a letter 0.)

Type CB (return). You will see 00CB- ##. The actual number represented here by ## will depend on the size of your program and the amount of memory in your computer. In Fig. 3 the number is 90. Now type CA (return). You will see 00CA– ## (## = C3 in fig. 3). The two-digit numbers you just found are the two halves of the four digit address of line zero of your Basic program. The first half of the four digit number is the one you found at CB, and the second half is the one you found at CA. In the example in fig. 3, the whole four digit number is 90C3. By typing this number (using the actual numbers you found on