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October, 1981
Issue 17
Vol. 3, No. 10
63379

The Journal For Progressive Computing™

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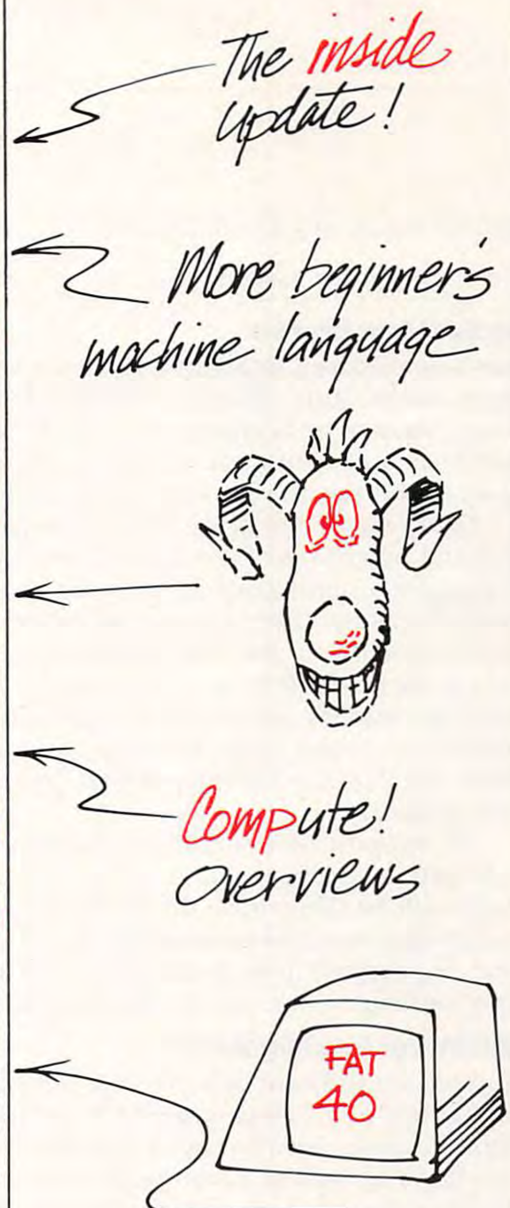

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The Editor's notes...

Robert Lock, Editor/Publisher

The Next Few Months

Atari's aggressive pricing moves, in the wake of Commodore's announcement of the VIC-20 last spring, seem to be bringing rewards. We hear that *monthly* sales now approach last year's *annual* sales figures. And the numbers are still growing.

IBM's initial entry into the personal computer market is impressive. We watched several fully configured units at work recently at the Midwest Computer Show. The reactions of viewers were as significant as the units. One gentleman, after observing the machine briefly, remarked, "Well they finally got into the market, huh — I'll buy one." And that's just one of the beauties of name recognition. We'll have a full overview of these new IBM systems soon.

We expect to see Apple, Inc. moving quickly to defend their place in the market. The IBM entries will hit their niche the hardest in terms of pricing, features and positioning. We might expect some re-positioning on Apple's part, with one new entry making a push into the $1,000 system area.

Atari Moves Into Minnesota

Our contacts indicate that the state of Minnesota school computer contract, held for the past three years by Apple, Inc., has been awarded to Atari. In their move to capture a significant piece of the educational market, Atari offered quantity prices of $579 for the following package:

> Atari 400, BASIC cartridge, 810 disk drive, joystick, and 13" black and white TV.

A competitive package, to say the least! Several thousand systems to start with, our sources say, and similar arrangements are being set up around the country. One of the dealer-level beefs we heard when Apple, Inc. was moving directly into the high volume sales markets was that dealers were being left out.

Atari, to their lasting benefit we're sure, will be selling through individual dealers in each town. The dealers will then carry through providing service, ongoing support and additional software, and peripherals as required on a local basis. We applaud this significant support of the dealer network.

10,000,000 Personal Computers By The End of '86?

A conservative estimate if you believe some marketing plans. The systems selling for less than $400.00 may hit that point even sooner. We expect 1982 alone to see delivery of well over 1,000,000 core units: Atari 400's, VIC-20's, and Radio Shack Color Computers.

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When you sell a manuscript to **COMPUTE!**, or one of our other publications, we purchase all rights to your manuscript, including accompanying software. The software rights are non-exclusive however, in that we freely give permission on request to original authors, authorizing the sale or distribution of their software. It is understood that such sale or distribution is non-exclusive, and subject to agreement by the author. We also retain the right to sell and distribute the software on a non-exclusive basis, subject to royalty and contractual agreement by the author.

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strengthening their US marketing operations for some time now. We're hopeful that a recent personnel move will translate that theory into practice. Kit Spencer, the former marketing head for Commodore UK, has come over to head up US marketing operations. While in England, Kit built an organization which, at one point, held 70% of the market share. Should be interesting to see how he does here if the powers that still be let him have his go at it. You'll find a candid, exciting interview with Kit in our November issue.

The Single Board Computer Gazette — A Decision And Announcement

The December issue of **COMPUTE!** will be the last with an SBC Gazette. The gradual reorientation of **COMPUTE!**, and the changing needs of our readers, contributed to this decision. While the Gazette will go away, interest won't — we'll still have occasional and timely articles relevant to all readers. And we'll still have the continuing contributions of Marvin DeJong, Gene Zumchak's column *Nuts And Volts*, and more.

Creative Computing Acquires Computers And Programming Magazine

In the push for biggest, *Creative Computing* has made a dynamic move to leap past McGraw Hill's *BYTE* magazine as the largest circulation magazine in the industry. *Creative* bought *Computers and Programming* magazine (remember *Elementary Electronics* magazine? — that's it with a name change and an audience repositioning). *Creative*'s blending the C&P audience into their own subscriber base, ending up with a projected circulation in excess of *BYTE*'s 200,000 +.

It's an interesting marriage of reader populations and we're curious to see how it all sorts out.

Telecommunications And COMPUTE!

One of my pet frustrations has been the amount of editorial paper shuffling we end up doing around here. All of our typesetting is now done inhouse on Mergenthaler equipment. By early spring we expect to be set up editorially to serve as "store and forward" hosts to our columnists. They'll be able to call our machines (PET, Atari, Apple, etc.) and transmit columns to us directly. We'll be able to edit on-line, and then load editorial material directly into our typesetting unit, thereby saving millions of keystrokes, and two entire copy proofing steps.

It's nice to think we'll actually get to the point where we can save ourselves tremendous amounts of time using the technology we're all surrounded by!

Happy Birthday — COMPUTE! Grows On

With this issue our press run has increased to 40,000. Two years ago, we were in the midst of anxiously trying to gather our first 400 subscribers. Our first issue went out to fewer than 40 dealers, world-wide. Now, two years later, this issue goes to readers in more than 50 countries, and a dealer/newsstand network just short of a thousand.

Our growth has been marked by constant compounding due, in large part, to you, our readers. Our recently completed reader survey included a question designed to help us identify where we find you. Or, better stated, where you find us. While the answers showed us our advertising works, and our new subscribers from retail outlets are important, the second largest source of new subscribers was you — the existing readers. Well over 30% of our new subscribers find **COMPUTE!** via a friend's recommendation. Facing page 40, you'll find our direct mail cards. Give one to a friend and sign them up. Thanks.

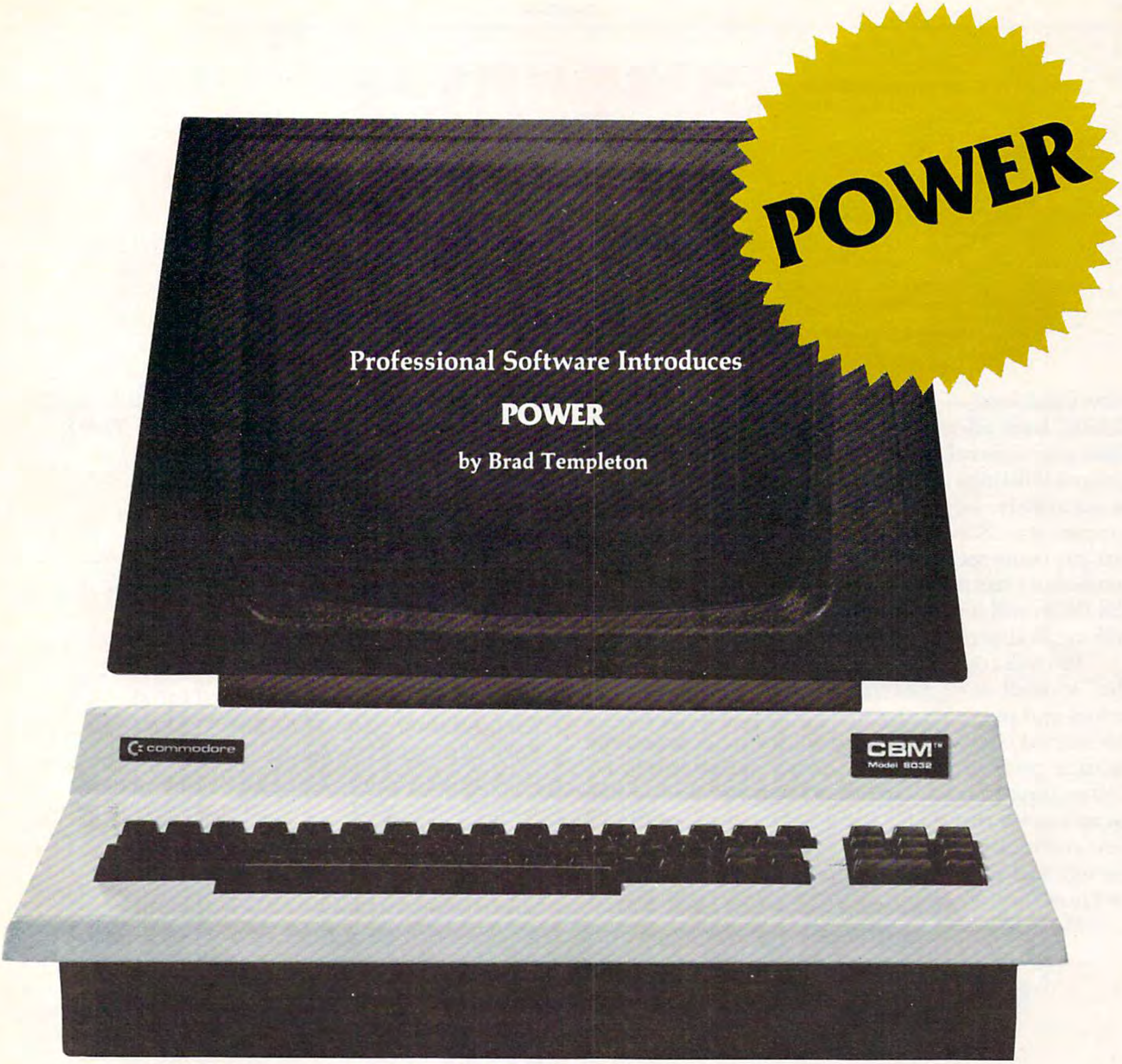
California Here We Come (And Michigan, New York, Boise...)

In our efforts to bring production and delivery to earlier dates, we're gradually making changes that should bring subscriber delivery to a par with store delivery. One big change we expect to implement by the December issue will involve all of you West Coast readers. Currently the mail is taking three weeks or more in some cases to get to you. As far as we can tell, there's absolutely nothing we can do with the US Postal Service to improve that delivery time. You're "Zone 8" from us, and that's that. Beginning with the December issue, we'll truck your magazines across country and mail them in California.

You should see substantially improved delivery time and be able to enjoy your **COMPUTE!** that much sooner.

COMPUTE! Books Update

Our first two books, the Atari and the PET/CBM book, were delayed during our production revamping. They are now scheduled for completion and shipping in October. Those of you who've ordered the book, and waited patiently (or not so patiently) should be assured your orders will be shipped first. In this case, we'll send them out first class mail. Sorry for the delay.
— RCL



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POWER's special keyboard 'instant action' features and additional commands make up for, and go beyond the limitations of CBM BASIC. The added features include auto line numbering, tracing, single stepping through programs, line renumbering, and definition of keys as BASIC keywords. POWER even includes new "stick-on" keycap labels. The cursor movement keys are enhanced by the addition of auto-repeat and text searching functions are added to help ease program modification. Cursor UP and cursor DOWN produce **previous** and next lines of source code. COMPLETE BASIC program listings in memory can be displayed on the screen and scrolled in either direction. POWER is a must for every serious CBM user.

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COMPUTE!'s New Listing Conventions For CBM

New machines — VIC and "FAT-40" — and 4.0 BASIC have added a host of new editing functions and color control codes. To make **COMPUTE!**'s program listings as easy as possible for you to type in accurately, we will list CBM programs in a new, simpler way. Starting in this issue, you will see that our previous method — reconstructed cursor symbols — has been replaced by bracketed words. [DOWN] will mean the cursor-down key. [3 LEFT] will mean three cursor-lefts, and so on.

We will continue to split program lines with the ˉ symbol. It signals that the line is continued below and prevents any spaces from being hidden. All shifted characters and graphics are represented by their underlined non-graphics equivalent. Line 110 in David Swaim's article, "High Resolution Bar Graphics for the PET," is a good example of the new conventions. We hope you will agree that this change will simplify your typing of programs. Let us know how you feel.

Here is a table of the new conventions:

Key To COMPUTE!'s CBM Listings

All Machines

Clear Screen	{CLEAR}
Home Cursor	{HOME}
Cursor Up	{UP}
Cursor Down	{DOWN}
Cursor Right	{RIGHT}
Cursor Left	{LEFT}
Insert Character	{INST}
Delete Character	{DEL}
Reverse field on	{RVS}
Reverse field off	{OFF}

CBM 8032/"FAT 40"

Set Window Top	{SET TOP}
Set Window Bottom	{SET BOT}
Scroll Up	{SCR UP}
Scroll Down	{SCR DOWN}
Insert Line	{INST LINE}
Delete Line	{DEL LINE}
Erase to Beginning	{ERASE BEG}
Erase to End	{ERASE END}
Toggle TAB	{TGL TAB}
TAB	{TAB}
ESCape key	{ESC}

VIC 20 Color Computer

Set color to Black	{BLK}
Set color to White	{WHT}
Set color to Red	{RED}
Set color to Cyan	{CYN}
Set color to Purple	{PUR}
Set color to Green	{GRN}
Set color to Blue	{BLU}
Set color to Yellow	{YEL}
Function One	{F1}
Function Two	{F2}
Function Three	{F3}
Function Four	{F4}
Function Five	{F5}
Function Six	{F6}
Function Seven	{F7}
Function Eight	{F8}
Any Non IMplemented Function	{NIM}

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Computers And Society

David D. Thornburg
Innovision
Los Altos, CA

Speculations On The Appropriateness Of Technology ...

Many years ago the Dick Tracy comic strip featured a character named Diet Smith who had invented a magnetic levitation process which allowed (among other things) interplanetary travel. His slogan was "The nation that controls magnetism controls the Universe."

The idea that new technologies can generate social change on a large scale is more common in science fiction than it is in reality. Today we seem less concerned with technology giving us control of the universe than with the question of whether certain technologies are appropriate for any use whatsoever. If we are to believe authors like Alvin Toffler and Frank Herbert, the personal computer is soon to become an indispensable part of our lives. According to these futurists, everyone will be using these marvelous machines soon.

And yet, if the personal computer is to play such an important role in our lives, it isn't at all clear just how this is going to happen. In fact, the personal computer world seems to be entering a period of some confusion at this time — a confusion born less of technology than of the question of just what the appropriate applications for this technology are.

Before 1979, most of the personal scale computer systems in the world were in the hands of hobbyists — people who eagerly became the explorers of this new field, mapping uncharted territory and reporting their findings to the more timid. These people knew exactly what they were doing, and they were in control of their computers from the first time they turned them on.

Next came people wanting to use these machines for business applications. For these people there was a large gap between the user's expectations and the limited tasks these machines appeared able to perform. The conversion of the personal computers into a useful tool didn't happen overnight. Software pioneers, working out of bedrooms, garages, and warehouse offices generated thousands of programs for these customers in the hope that the perfect application would be found. However well intentioned the effort, until recently, the personal computer simply wasn't an adequate tool. When used for inventory control, for example, the memory capacity of most micros is too small for all but the tiniest company; and most tiny companies who know enough to want to use a computer also know that they won't be tiny companies forever.

And so, after a period where many programmers appeared to be taking the role of Eddington's monkeys, thrashing at thousands of keyboards and hoping that one of them would produce a work of Shakespeare, two magnificently appropriate applications for business users were developed. These were the electronic spread sheet (of which VisiCalc is the most popular), and word processing. Each of these applications was new for the "data processing" environment normally associated with business computers — and each of them suited the size and capabilities of the personal computer very well. Each of these applications was new for the "data processing" environment normally associated with business computers — and each of them suited the size and capabilities of the personal computer very well.

Once these applications became accepted, two things happened to the industry. Business users started buying personal computers by the hundreds of thousands, and the traditional Fortune 500 computer companies made their decision to enter the fray. It took the hardware pioneers, Commodore, Apple, Tandy, Atari, and others, to qualify the market for the new entrants — notably Xerox and IBM. In the space of a year, the personal computer went from being an inappropriate tool to being an essential tool for many thousands of businesses.

And now we see several computer manufacturers making their plunge into the newest (and largest) marketing frontier of all — the mass consumer market. This is the most dangerous market of all to enter with a new technology, since many fine product concepts have lain like so many rusted Edsels on the path to the marketplace. And yet several brave manufacturers have declared their intentions to be successful in a market which has yet to define its principal application. If you doubt the seriousness of this effort, note that, last year, computers were generally sold only through computer and office product stores. This year, computers can be found in most large department stores and catalog showrooms — places from which they are being purchased in record numbers.

Even as these machines are being sold, one must ask if their purchasers realize that they too are pioneers — that the appropriate application for personal computers in the home is yet to be defined. To explore the appropriateness of the personal computer in the home, let's look at two factors: applications and ease of use.

If we examine the appliances which are already in homes today, we can separate them into roughly three categories — utilitarian, communication, and entertainment. Utilitarian appliances include clothes washers, stoves, refrigerators, and other appliances which are used to maintain and serve the utility needs of the household. The only pure communication device most people have in their homes is the telephone, although one could put CB radio in this category as well. The remaining appliances — television, radio, stereo system, *etc.*, fall under the entertainment category. These entertainment devices are overwhelmingly communications oriented. The vast majority of this equipment is designed to receive broadcast material, or to play pre-recorded material. It wasn't until the video game that a non-communications oriented entertainment appliance entered the arena.

And now we must ask where the personal computer fits into the home. Some people envision the home computer as the wonder device which serves many functions simultaneously — controlling the lawn sprinklers, receiving the latest news from the UPI wire, and challenging its owners to a fast game of Space Evaders. If this vision is correct, then the personal computer will become the home appliance which bridges the gaps between all the other appliances we know about.

However, as I talk with potential computer owners, I detect a great deal of confusion. Most of these people see the computer as the next home appliance, but are very unclear as to how this appliance will serve them. Many people seem to think that the major useful application for these machines is to serve as a high quality video game.

While there is an awareness of the educational value of having a computer around the house, there are not an overwhelming number of well designed educational programs on the market. Nonetheless, advertising which makes parents feel guilty for not getting a computer for their children has probably increased personal computer sales to families.

Communications is another legitimate application, but many potential users are not yet ready to use the computer as a replacement for the post office or the morning paper. And home financial management sounds like a great ideal until people realize the tremendous amount of labor associated with maintaining a data base.

Unless people can see some direct benefit from their purchase, they will either defer their purchase, or end up buying a computer which lies unused on the shelf. It may be hard for **COMPUTE!** readers to accept, but I will wager that there are a whole lot of computers sitting on closet floors, unused, because the purchaser didn't realize that this machine was not yet appropriate for the tasks he or she had in mind.

Even if the magic programs were found tomorrow, computers will not be sold by the millions unless people think they are easy to use. To a consumer who is used to pushing a button on a dishwasher, or to turning two dials on a television set, a full blown computer keyboard (with keys labeled CTRL and ESC) can be quite intimidating. Also, any computer which says READY when first turned on certainly isn't ready for the average user who is used to nothing more complex than a record changer.

To be useful in the true mass market, the computer must display a list of meaningful options when it is first turned on. The user must be given as much guidance as possible. Fortunately, most of the personal computers on the market today are capable of being programmed so that a user-friendly interface program is loaded automatically when the system is powered up.

The situation is far from hopeless. Even with all its defects, the personal computer *is* being purchased by consumers who want to be on the leading edge of this technology. Those of us who understand these machines need to listen to these new pioneers when they tell us what they want. We need to be responsive to the suggestions of all users, regardless of their level of technical sophistication. Most of all we need to experiment with a wide variety of software covering a wide spectrum of applications until the truly appropriate "home" application is discovered.

Only then can we rightly call this the age of the personal computer, and only then can we say that this technology can be appropriate for all users. The personal computer promises to give each of us control of our informational universe — and when that day arrives, we will have achieved real power!

Next Time ...

We will explore User-Friendly languages — why BASIC may not be basic any more. ©

Reader's Feedback

"With reference to "The World Computer," poor Mr. DeJong. He is not the first and certainly not the last person to have trouble loading a program. His real problem, however, is not software, but his perception of the entire microcomputer industry. The implication that this industry has moved out of its infancy and is maturing, or worse, has matured, is not supported by real world conditions. For example, I sold my first APPLE computer in the fall of 1976, a mere 5 years ago, a time when people didn't know APPLES from oranges (pardon the pun). BASIC was the only language, software was virtually non-existent, peripherals were few and far between, and computer literacy was a term that hadn't been coined yet. Since then great strides have been made in the field of languages, software, hardware and education, but, in spite of this progress, the industry is only approaching its infancy. Second generation computers like the ATARI, the VIC-20, the APPLE III and others from such giants as IBM and XEROX are proof of this. All of these units have expanded on the foundations laid by APPLE, Radio Shack, and others.

The driving force behind this creative work is not universality, but diversity. The opportunity to come up with a better idea, the ability to design and market a more powerful machine or program or peripheral supplies the incentive to change. The prospects of a "world computer" as described by Mr. DeJong are horrifying! First is the problem of design, with so many hands in the pie it would either end up an electronic eunuch or have so many bells, gongs and whistles that it would be frightfully expensive or be a nightmare to operate (or both).

How about an operating language? Do you use BASIC, COBOL, CP/M, SMALL TALK, FORTRAN, FORTH, or should they all be dumped in favor of a totally new language? If the latter, what happens to all the existing software? What happens to the "world computer" if the design is improved? Should any such changes be 100% compatible with older units, thus draining innovations of their potential? Lastly, why even have an APPLE, ATARI, COMMODORE, TRS-80, or any such multitude of manufacturers if, for all intents and purposes, all the machines are cast in the same mold? We could have one large, inefficient firm cranking out "generic" computers, complete with label-less white boxes. The possibility is simply too monstrous to consider seriously!" Vern L. Mastel

---

"Concerning Mr. Thornburg's "rebuttal" to my article, it was never my intention to sell "drill" type programs to anyone. The whole point of the article was to allow the teacher to teach. And then use the computer to help him with his job. My remarks concerning games were asides. They were not specifically germane to the major premise of the article, except to this extent: in practice, games too often surplant meaningful work with computers in the public schools. This is even true in colleges.

Games certainly have their place in learning. Any teacher knows that. And I would suspect that this is especially true in the home environment, where the number of computers available for the task is not an overriding consideration. My high school, however, has the use of only one computer for all of mathematics and science. We simply cannot afford games. And unless a particular school is especially affluent, *neither can the average public school.*

Now about drill: here again, I was — shall we say — misunderstood. It is my contention that if basic skills are acquired as a result of computer games, it is precisely because the program had in some way made drill palatable. These are the only games in Computer Aided Instruction, (CAI,) that to me are of any consequence. These are precisely the games Mr. Thornburg decries. The "Star Treks and "Othellos" that are played and toyed with in school are the domain of the very fine students. These latter have no need of CAI. I teach them computer programming.

The notion that drill "turns a student off" was also not my idea. Quite the reverse. I was quoting the pedagogues; that pervasive philosophic tilt in education generally attributed to John Dewey, which has produced what promises to be the least educated generation in the history of this country. It is exemplified by what is sometimes called "The Sesame Street Syndrome," the notion that something of consequence — aside from various vulgarities — can be derived from a school atmosphere of fun and games.

I teach Title I classes in remedial mathematics. If there is one common thread that unites all these students — aside from their inability to do basic arithmetic — it is their almost universal lack of personal discipline. Nobody has ever required them to do anything of consequence, certainly not in academics. There is absolutely nothing theoretical about their needs. They need to be "told," first. Then they need to acquire skills; much of it by-rote type skills like multiplication and addition facts. We provide those skills. We do it with drill, individualized and scored, with the computer helping to make it all possible. Standing over it all is the most important ingredient of all — the teacher, flesh and blood type, with all the attributes of patience, concern and even empathy for his students, that brought him to the profession." Alfred D'Attore

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DTL-BASIC is a disk based system requiring a 32K PET/CBM and comes complete with an in-depth user manual and a Compiler Security Key. Three versions of the compiler exist for CBM 3032, CBM 4032, and CBM 8032 machines. Please specify machine type and disk type (4040 or 8050) on which compiler is to be supplied.

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Ask The Readers

Robert Lock, Richard Mansfield and Readers

We are grateful for the many readers who have sent questions and answers in to this column. Please keep on letting us know what your problems are and helping us solve the questions raised by other readers. Here is this month's exchange:

" 'My Apple II: It does not compute!' wrote to complain about excessive TV interference from his Apple II computer. Recently I've dealt with a similar problem — keeping an exceedingly noisy laser from interfering with my computer! Radio-frequency interference (RFI) can be a pesky problem, but the following measures may help the situation:

If you use your TV set for a computer display, be sure you disconnect the antenna while using the computer. This is especially important in apartment buildings, where many apartments share one antenna system! You can disconnect the antenna wires with a screwdriver, or insert an antenna/computer switch between the computer, antenna, and TV set. These switches are available at many electronics and TV repair shops.

Insert an "EMI filter" in series with the AC power cord. These filters are available from several manufacturers, notably Corcom. *Interference frequently travels to other apartments through the power lines. Early Apples, with their switching power supplies, may be especially susceptible to this problem.*

Try moving the computer to a different spot in the apartment, plugging it into a different AC outlet.

If desperate, you might try wrapping printer and disk cables, and perhaps the computer itself, in aluminum foil (!). Ground the foil to the computer chassis, the AC ground, or a cold water pipe.

Find out whether you're really the guilty party. I live in an apartment with a PET, and OSI, and a Motorola computer. The OSI runs with its case open much of the time, and the Motorola computer has no case. Neither machine causes perceptible TV interference." Mark Bernstein

---

Our thanks to INSIGHT: ATARI columnist Bill Wilkinson for the following information. McBee Barbour asked (**COMPUTE!** #15) about any AMWAY distributor software which would work on the Apple II. We can suggest that one source of such a package is OnLine Microcenters, 5636 Blackstone, Fresno, CA 93710. The Atari package is currently available and an Apple version is planned if demand warrants it.

"I purchased an old OSI system consisting of a 500 CUP board (revision A), a model 430B I/O board, 12K of memory and a Teletype model ASR-33 terminal with tape reader. The system is also currently cassette based.

In 1977, OSI sold a video board (model 440) and two video support ROM's (65V prom monitor and 500VB prom) for use with a Black-and-White monitor. These items are no longer available from OSI.

Since I purchased the above for next to nothing purely as a learning tool in conjunction with my studies, I wish to establish a video terminal for minimum cost.

I would greatly appreciate hearing from any of you who may have had a similar situation." Frank Koelbl

---

"I have been using a Commodore Pet Computer now for some time together with a 3040 Floppy Disk Unit and was wondering whether you or one of your associates, e.g. Jim Butterfield, can answer a few questions for me. alternatively, a source of such information would be useful.

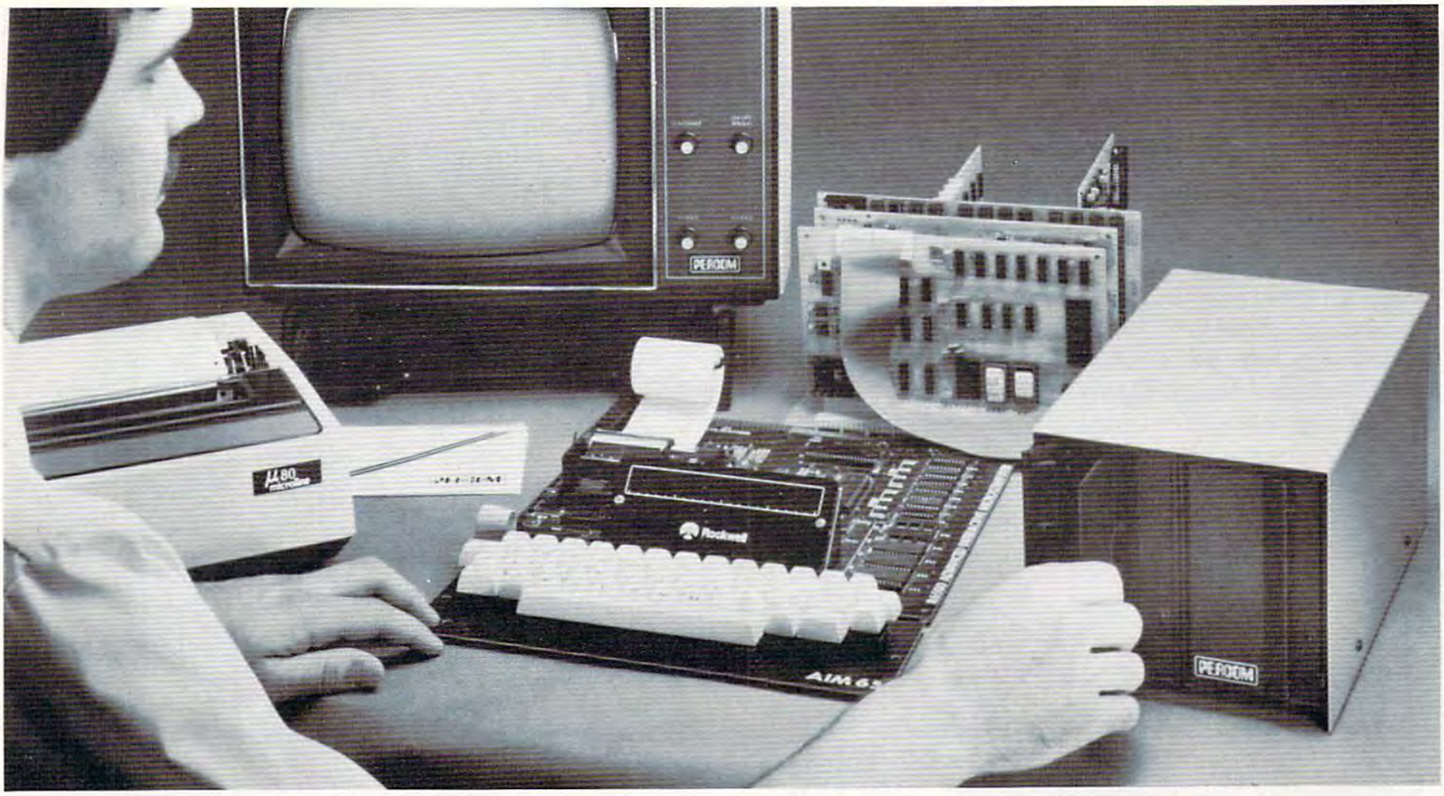
My questions concern the Disk Drive for which Commodore appears to publish very little other than the Handbook.

I think a Manual which gave some (if not all!) of the subroutines would be a useful item.

The point of most interest to me concerns the individual blocks on a formatted disk. It is possible to change the ID on a particular track & sector to be different to the main ID shown in the directory? How can one go about this? Once changed, can this be altered back again?

My other point concerns the 'U' commands. We know from the manual that 'U1' will 'READ' & 'U2' will 'WRITE,' but what other commands are there involving 'U' and what do they do which is useful. Are the routines available only by MACHINE-CODE access?

May I say I find **COMPUTE!** *the best magazine of its kind on the market, but I have great dificulty in obtaining it. I would be grateful if you would tell me if it is directly obtainable from you on a regular basis, or where the best*



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source in London would be.

I hope you do not find my questions impertinent — they are not intended to be." M. J. Band

COMPUTE! expects to publish a program shortly which will permit easy viewing and changing of any byte on a disk including the directory, BAM, etc.). In reference to your question about the "U" commands, they are "user-defined" and described briefly on page 53 of Commodore's *User's Manual for CBM Dual Drive Floppys* (Part Number 320899).

Thanks for the compliment. **COMPUTE!** subscriptions are available from: Circulation Department, **COMPUTE!** Magazine, P.O. Box 5406, Greensboro, NC 27403 USA. The cost is $25 surface mail anywhere in the world, $38 airmail to Europe.

"Regarding Edward Sweeney's letter to you (in your August issue), VOTRAX has made every attempt to insure that every customer has received sufficient information to use Type-'N-Talk. We received a letter dated 7-6-81 from Mr. Sweeney and tried to contact him. Unfortunately, our attempt to reach him by phone was futile since his phone was found to be disconnected. We immediately responded to his letter by forwarding to him both the basic program lines necessary to use T-N-T with an Atari, as well as the necessary cable configuration (since Atari uses a non-standard cable). We subsequently received a letter dated 7-26-81 from Mr. Sweeney thanking us for fulfilling his requirements.

In order to eliminate connection problems that may arise, VOTRAX is and has been offering RS232C compatible cables for many of the personal computers including: Apple, Atari, Heath, Ohio Scientific, and Radio Shack models I, II, III and the color computer. As far as driving software is concerned, access to the RS232 Port (and thereby the T-N-T) is accomplished (in most systems) by using a simple print statement. In other words, if you want T-N-T to say "Hello", you simply print "Hello". Additionally, many of the major software houses are currently either converting existing programs or developing new programs to utilize this new dimension now available to virtually any computer.

If any of your readers have purchased T-N-T, or are contemplating purchasing T-N-T, technical questions should be directed to me at (313) 588-0341."

Douglas A. Porath
Applications Engineer, Votrax.

Our thanks to VOTRAX for the prompt clarification above. Here's a helpful answer from a reader:

Re: Edward Sweeny,

"Your Atari 800 is quite compatible with your Votrax Type'N Talk speech synthesizer. If the TNT is properly connected to a speaker, it should say, "SYSTEM READY," when you turn it on.

You also must have the Atari 850 interface and its initialization software. Set the baud rate switch #6 down on the TNT and plug TNT into your interface port #1.

If you have already run into trouble, contact Votrax. If you are sure that TNT and 850 are OK up to this point, the following little Atari Basic routine will get you started.

```
1 OPEN #2,8,0, "R1:"
2 XIO 36,#2,12,0, "R1:"
3 XIO 34,#2,48,0, "R1:"
4 PRINT #2; "TALK 2ME"
5 STOP                    "
```

Jerry White

"I have been told that there is a computer device which duplicates the tossing of the coins process associated with The I Ching, Book of Changes. *I imagine that the device provides a random selection of numbers from 1-64 which is basically what the procedure of tossing coins is all about.*

If you have any information on such a device, I would like to hear from you about it." Robert Mahon

We know of no machine dedicated to I Ching coin tossing. Computers can do it, however, with a line similar to: 10X = INT (RND(1) * 64) + 1.

"I saw a cryptic comment — I think in **COMPUTE!** *#10: "PET Exec Hello" by Gordon Campbell. Second paragraph: POKE 59458,62 (this may damage your machine). Can I damage a PET with POKES?? It scared me. We just got a (used) PET—Original ROMs. I heard you have published a PET book based on old issues of* **COMPUTE!**. *How can I get this?" Felix Rosenthal*

You *can* damage the computer with this POKE. Luckily, it is the only POKE which is known to be risky, as far as we know. You can POKE freely anywhere else. For a more complete explanation of this peculiarity, see the warning in **COMPUTE!** #14, pg. 63. To answer your second question: yes **COMPUTE!** is publishing two such collections, one for PET and one for ATARI. These books contain much from the early, out-of-print **COMPUTE!** issues (as well as some previously unpublished pieces). For ordering information, see the ads elsewhere in this issue.

"Is there a spelling program that checks spelling of words in a Applewriter file? Is there a mailing label program that drives files in Applewriter format?"
John Hudson Tiner

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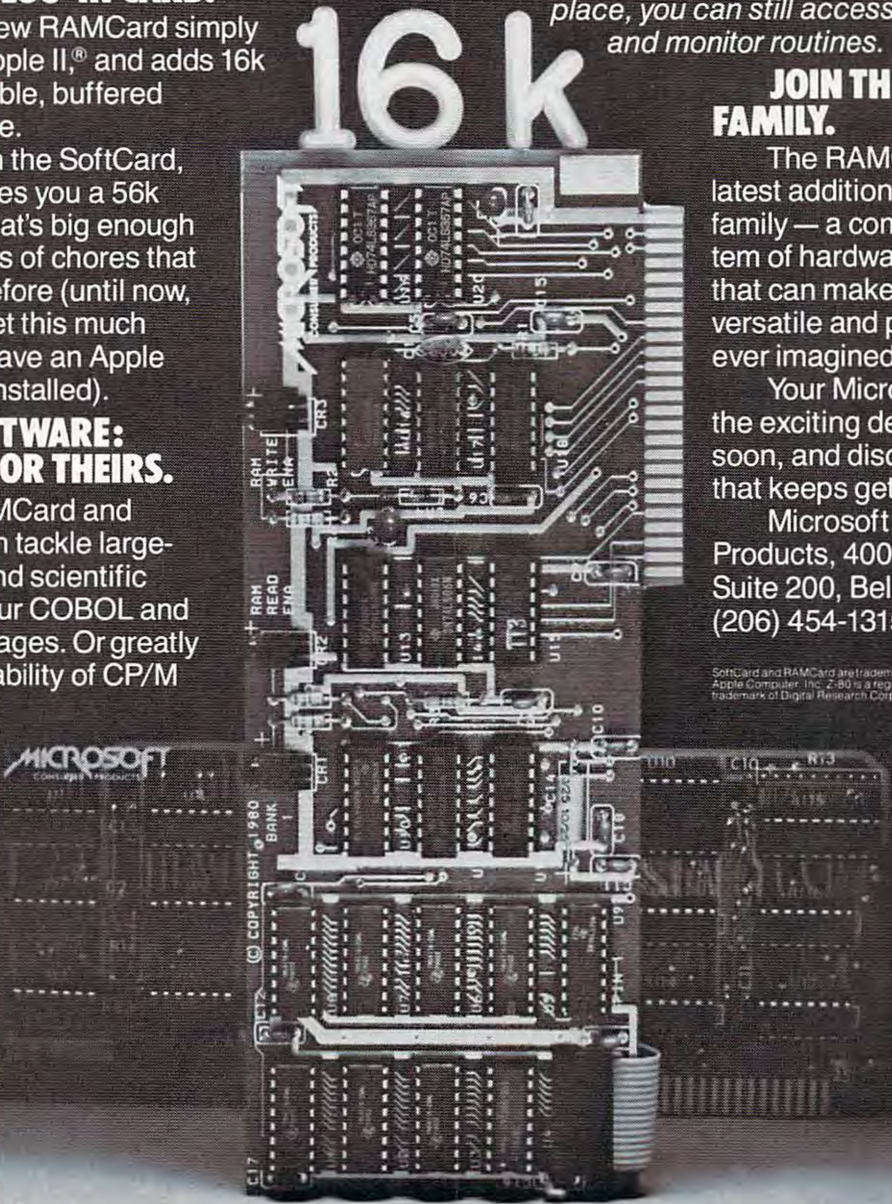

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Basically Useful BASIC

Automatic DATA Statements For CBM And Atari

Dr. Harald Linder
Krefeld, West Germany

The following BASIC program converts a program from machine language into BASIC DATA statements by means of the "dynamic keyboard." For the Original PETs, the numbers 623,624,158 in the last line, must be replaced by 527,528,525.

```
1 INPUT"START ADDRESS";A:INPUT"END AD~
  ~DRESS";E:Z=2000
2 PRINT"{CLEAR}{2 DOWN}"Z"DATA";:IFA>E~
  ~THENEND
3 FORA=ATOA+15+(E<A+15)*(A+15-E)
4 PRINTMID$(STR$(PEEK(A)),2)",";:NEXT~
  ~
5 PRINT"{LEFT} ":PRINT"A="A":E="E":Z=~
  ~"Z+10":GOTO2{HOME}";
6 POKE623,13:POKE624,13:POKE158,2:END~
  ~
```

Program 1. CBM Version

```
0 BEG=7*4096:FIN=BEG+759:? "{CLEAR 2 DOW
N }"
1 FOR I=BEG TO FIN STEP 6
2 ? I;" DATA ";
3 FOR J=I TO I+5
4 ? PEEK(J);",";
5 NEXT J:? CHR$(126)
6 NL=NL+1:IF NL<15 THEN 9
7 ? "CONT":POSITION 2,0:POKE 842,13:STOP

8 POKE 842,12:NL=0:? "{CLEAR 3 DOWN}"
9 NEXT I:? "CONT"
10 POSITION 2,0:POKE 842,13:STOP
11 POKE 842,12:NL=0:? "{CLEAR 2 DOWN}"
12 FOR I=0 TO 12:? I:NEXT I:? "POKE 842,
12":GOTO 10
```

Program 2: Atari Version ©

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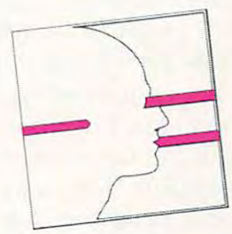
While state of the art programmers exist, they must feel confident that their efforts will be developed and marketed by a company with the experience and strength to assure complete success for their products.



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The Beginner's Page

Richard Mansfield
Assistant Editor

From Chaos To Bits

Computers are sometimes called *data processors.* Data is processed by programs. You might type in a list of all the articles in this year's **COMPUTE!** and then write a program which will show you only the articles on, say, computer music. We will write such a program next month. What we want to see now is how data can be set up in *files* to make it easier for the computer to process it.

Our list of articles, while interesting in itself, is *raw data.* It sits in the program as DATA statements (or it could be on a disk or tape *file*) — the important thing to realize is that a program will later operate on the list, refining it into more meaningful information. The *computing* (or processing) aspect of this program might be to generate a more specific list: perhaps all articles by a particular author. However, for the computer to process data, the data must be somewhat organized already.

Organizing Data

If you look at Figure 1, you will notice that there are a number of divisions, each nested within a larger division. Here is a DATA statement taken from our proposed **COMPUTE!** index program which will help to illustrate Figure 1.

```
500 DATA FILES-DATA STORAGE TYPES*
    MANSFIELD*17
```

We can start from the outer ring of chaos and work inward. You make a stack of this year's **COMPUTE!** If your stack of magazines were burned to ash, the molecules of ink and paper would no longer have any meaningful relationship to each other and could not be called "information." Taken as a whole (as a stack) it is not *data*, exactly, because data is special: it is information organized so that it communicates a particular meaning. Your computer cannot read (yet), so the articles in **COMPUTE!** do not become meaningful data for the computer until you type them in as DATA statements or put them on tape or disk files.

Data is divided into files. An entire list of all year's articles is one *file*. A list of your stocks and bonds would be another file.

Within files there are *records*. Our DATA statement (line 500 above) is a record. It is a subdivision within the "**COMPUTE!** Articles File" which refers to a single, logical grouping of information (in this case, the information on a single article). In the financial portfolio file, all the information about a particular stock would be a record. Records

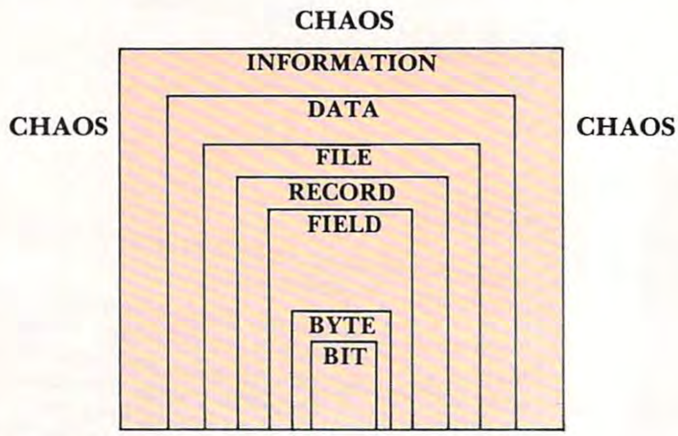

Figure 1.

are further divided into "fields" of information. We have chosen to use three fields: 1. A description of the article, 2. Author, 3. Issue Number.

As an aside, we should note that there is something special about the first word in our example record. To make it easier on the computer, one part of a record (often the first field, or part of it) is designated the *key*. Sometimes the key is a number, but we are using the first five characters of the first field ("FILES") as our key. We have decided to key this file by topics. We chose each topic name so that it would be only five letters long. FILES, MUSIC, ART , (notice the two spaces after "ART " to make it five long), ML , (machine language), BASIC, MAPS , INTER (interfacing), DISKS, TAPE , PRINT (printers), MODEM, and any other keys we want.

Bytes and Bits

Finally, the smallest units of information are individual symbols, letters, and numbers. Each single-character piece of information is called a *byte*. A byte is able to store the numbers zero through 255. Since there are 26 letters in the alphabet, 26 capital letters, and number symbols 0 to 9, and assorted other symbols such as commas and brackets — the number of symbols we use to communicate with is less than 255. So, since a byte can store up to the number 255, each byte can "hold" a number value which represents a particular letter of the alphabet, numeral, or punctuation mark. Your computer stores the number 65, not the letter "A." A code was devised (the ASCII code) which assigns the number 65 to capital "A" and 193 to small "a." Every letter is represented by a particular number. Lower case "b" is 194.

Each byte is made up of eight *bits*. Where a byte can mean the numbers from 0 to 255, a bit can

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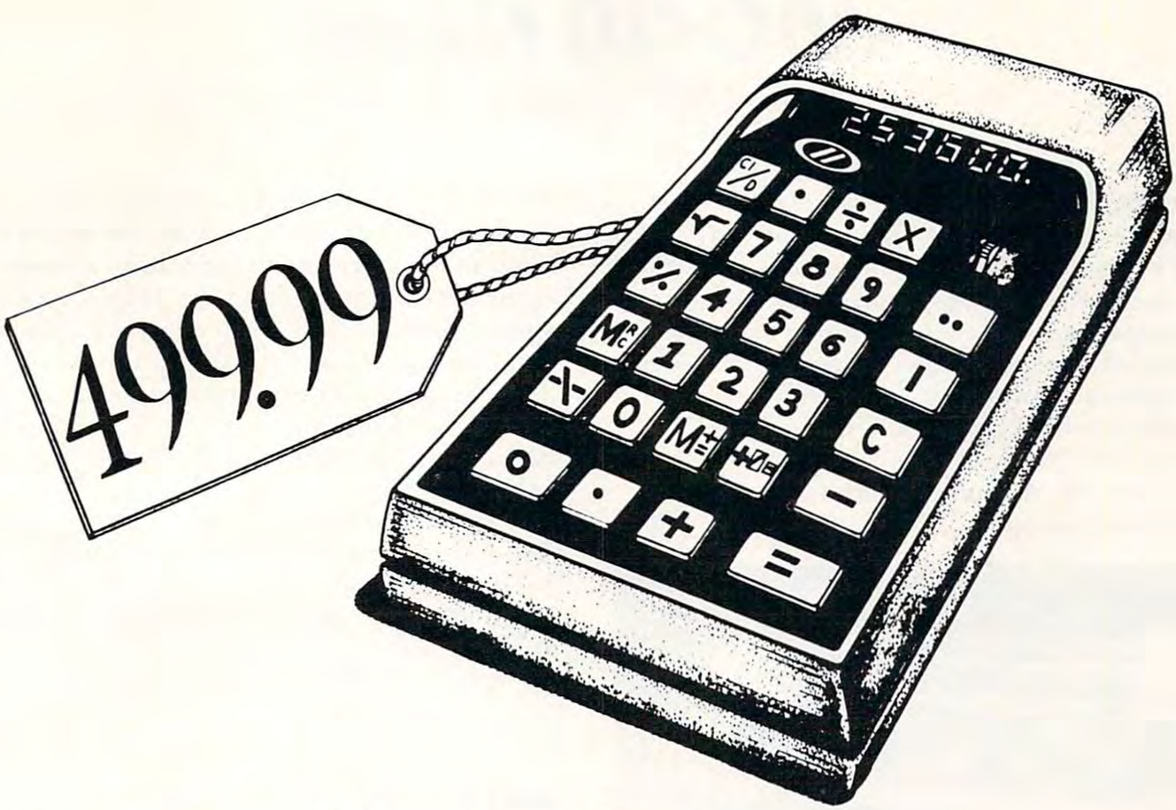
only have two meanings: zero or one. Sometimes it is useful to think of a bit as being either *yes* or *no, on* or *off, positive* or *negative*. This "two-state" (binary) bit is often mentioned as the smallest possible unit of information. Even though they have only two states, bits can add up quickly: eight bits together make up a 256-state byte. A grouping of only two bytes can have more than 65,000 possible states — in other words, you could count up to 65,535 using only two bytes.

Processing Data

We have moved down through data from chaos to bits, from the largest to the smallest units. There are many ways to organize fields within records, records within files, and files within a large collection of data (a *database*). Some thought must go into the structure of this organization so that a program can later process the data efficiently. We decided to use the first five bytes (characters) of each of our records as the key to our **COMPUTE!** file. Next month we will build a program which will demonstrate some of the techniques of database management. This program will also illustrate the importance of those string-manipulating BASIC commands: LEFT$, RIGHT$, and MID$. ©



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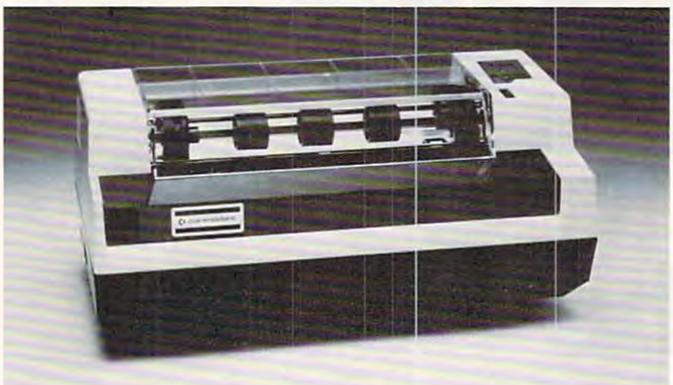
VIC-20 News

Compiled from sources by the editors.

VIC Printers, Software, Disks

Commodore has announced several software and hardware items for the VIC computer. Games, a printer, a disk drive, programmer's aid and assembly language cartridges, memory expansion modules, and an expansion interface are all coming. Release dates and prices are tentative. We expect Commodore to be shipping US produced, FCC approved, VIC-20s by October.

The new VIC Graphics Printers are expected to be released to dealers in September. It is an 80



column, twelve characters-per-inch, dot-matrix printer with 60 dots per inch (both horizontal and vertical) resolution. Its speed is 30 cps (characters per second) which means that an average typewritten page of about 275 words can be printed in about a minute.

The printer will permit the user to define his own characters. Each dot is programmable and the unit will also print the VIC graphics. It uses eight inch tractor feed paper, but can be narrowed to smaller widths for printing labels, etc.. It features a test mode and uses a ribbon cartridge (available from any Axiom distributer and soon from Commodore dealers). Seikosha manufactures the printer. Suggested retail is $395.

The VIC Disk

Sometime after Christmas, Commodore expects to begin selling a single disk drive which will attach to the VIC serial port. In addition, the drive is planned to be compatible with the 2040 disk drives used on the PET computers. An IEEE interface cartridge has also been announced which will permit PET peripherals to be attached directly to the VIC through the expansion port or an expansion module. This module will contain six slots and accept program cartridges, memory expansion cartridges, or interface cartridges.

The memory expansion cartridges are to be available in three sizes: 3, 8, or 16K (each K is 1024 bytes of memory). With expansion memory attached, however, another cartridge cannot be used simultaneously. The screen and color memory locations are affected by the addition of the 8 or 16K cartridges. From smallest to largest, these memory expansions are predicted to be available September, October, and November (respectively) of this year.

For telecommunications — attaching VIC to The Source or Compuserve, or the Dow Jones services via phone, or calling up other computers — an RS232 Terminal Cartridge and associated software will connect to the User Port. This permits the use of a MODEM by which the VIC can make and receive calls.

Early Software

Blackjack, Slither/Superslither, Biorhythm Compatibility, Space Math, Car Chase, and Blue Meanies from Outer Space are in release and will be reviewed in the fall issue of *Home and Educational COMPUTING!*. Planned for October release are: Jupiter Lander, Superslot, Night Driver, Draw Poker, VIC Avengers, and VIC Alien, a maze game.

BASIC programming will be assisted by another projected cartridge, Programmer's Aid, which will add new commands to BASIC for plotting, sound, color, music, and high resolution graphics. It will permit the user to define his keys however he wishes, provide simple music notation, color in an enclosed area, and so forth. The commands will be permitted in both BASIC programs and the immediate mode.

For machine language programmers, November is the target for a machine language monitor cartridge which will feature a simple assembler and disassembler. An intriguing feature of this software is a facility to swap zero page out and define a virtual zero page anywhere in memory. Machine language programmers know the value of zero page addressing on the 6502 microprocessor. BASIC will, of course, need its zero page when in operation.

A book, *The Programmer's Reference Manual*, is in the works too. It will contain a memory map, machine language and BASIC specifications, VIC chip details, and schematics. The title is tentative. It might be distributed as *The VIC-20 Reference Manual*.

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Various VIC Memory Locations

Jim Wilcox, Vienna, WV

Editor's Note: A Full VIC memory map will appear in the fall Home and Educational COMPUTING! *issue. Here are some PEEKs and POKEs to get you started. Descriptions in parentheses have been added. — RTM*

Listed below are as many memory locations in the VIC as I could find by PEEKing around the memory. I also found out how to stop the use of the RUN/STOP key by the statement POKE788,194 and to restore the RUN/STOP key, POKE788, 191. This also stops the TI and TI$ when POKEing 788,194. I hope these are as useful to you as they were to me.

0–2 — USR function vectors. (Here is where the memory address is placed for jumping to a machine language routine from BASIC when you want to transfer a number from BASIC to the machine language routine.)

43–44 — Start of BASIC. (These two bytes contain the address where your BASIC program starts. PEEK (43) + PEEK (44) * 256 will give the address as a decimal number.)

45–46 — End of BASIC, start of variables. (Using the formula above, you can find out where your program ends in memory. The VIC starts storing its simple variables wherever there is room just above the program.)

47–48 — Array table. (The arrays are stored here.)

49–50 — End of Arrays.

51–52 — Start of Strings. (String variables.)

55–56 — End of memory. (How much RAM is available for use in BASIC. Sometimes, machine language programs are put at the "top of available RAM." 55 and 56 must be changed to fool the VIC into thinking that it has less memory for a BASIC program so it will not "write over" the machine language program. Changing the definition of end-of-memory will "protect" the machine language.)

57–58 — Current line number. (BASIC keeps track of the program line number.)

115–138 — Charget RAM code. (There is a small machine language program placed into this location each time power comes on. It gets a character in BASIC, but machine language programmers can put a JMP in it to allow the addition of new BASIC commands. Like the clock, the keyboard, and a few other items, this routine is constantly checked by BASIC to see if anything needs to be done. It can be used, therefore, as a way to append things to BASIC. You could not append to the keyboard checking routine, for example, because it is frozen into ROM. This part of BASIC's housekeeping is in RAM.)

145 — Run/Stop keys pressed, left shift pressed, polls every other of the bottom row of keys. (You could PEEK this to see if these keys were being pressed).

160–162 — The clock. (Write: 10 PRINT PEEK (160); PEEK (161); PEEK (162) [cursor home] to see it running.)

197 — Last key pressed. (Write: 10 PRINT PEEK (197) to see what the VIC sees when you press keys.)

198 — Number of keys pressed (cumulative).

203 — Last key pressed.

204 — Tells if cursor is to blink (0) or not (1).

205 — Countdown for blinking of cursor.

246 — Tells if SHIFT, Commodore, or CTRL keys are pressed.

512–600 — BASIC buffer. (A "storage" buffer is a temporary holding area where bytes wait until there is time to use them. BASIC itself uses this area).

631–640 — Keyboard buffer.

651–652 — Repeat keys pressed.

788–789 — Interrupt address. (Important in machine language programming.)

4096 — BASIC starts. (Where the first byte of your BASIC program starts.)

Update
Floating Color Floating Screen

If you are writing software for the VIC — either professionally or for your own use — you should include a line in your program which locates the screen and color memories. As it comes from the factory, the VIC screen memory is located at addresses 7680 to 8191. Memory expansion modules are going to be available soon which can add 3 or 8 or 16K to the VIC. The 3K expansion will fill a hole from addresses 1024 to 4095, and will not affect the locations of color or screen memory. Adding an 8 or 16K memory expansion will, however, **move these important memories.**

What this means is that *any programs which manipulate color or screen data* (such as the direct POKEs to screen memory used in many games) *will not work correctly* when the larger two memory expansion modules are added to the VIC. To prevent problems later — to make your programs find VIC's floating screen and color memories — you should add the following formulae which will provide the true addresses:

S (starting address of screen memory)
S=4 * (PEEK(36866)AND128)+64 * (PEEK(36869) AND120)
C (starting address of color memory)
C= 37888+4 * (PEEK(36866)AND128)

To use these formulae in your programs, you should enter the two lines above as program lines at the start of your program. (10 S=4 * (PEEK...etc.) Then, whenever you are working with these memories, simply POKE to S + X or C + X. In other words, use the S and the C instead of a numerical address. For example, to POKE to the tenth screen location, you would POKE S + 10.

Adding a 3K (3072 additional RAM bytes for your use) expansion module will not change any of the normal, expected locations of screen or color memories. It simply fills in a currently empty space from addresses 1024 to 4095. This results in BASIC programs starting at address 1024 (as they do in PETs) instead of the normal VIC starting point, 4096. (See Table 1.) However, adding an 8 or 16K of additional memory floats the screen down to 4096 (from 7680). BASIC RAM floats to a starting address of 4608. And, since one of the bits which governs where screen memory starts also controls color memory, it moves too.

Character Memories

The starting address of the character set memory does not float, so you need not check for it in programs. However, the ability to define alternative character sets is valuable. There are sixteen possible locations in VIC for the start of *character* set memories. Of these, eight can be used (the others are not allowed). Here's the formula to change the character memory location:

POKE 36869, PEEK(36869)AND15OR(X*16)

X will be a number from 0 to 15. Here are the starting locations in memory for several values of X:

X=0 (32768) this is the normal "default" starting location.
X=1 (33792) where the upper case reverse characters normally are.
X=2 (34816) normally the lower case, unreversed characters.
X=3 (35840) normally lower case reversed.
X=4 to 11 (cannot be used).
X=12 (4096) normally the start of available BASIC RAM.
X=13 (5020) normally within BASIC RAM.
X=14 (6144) normally within BASIC RAM.
X=15 (7168) normally within BASIC RAM.

These last four values of X are where you would usually want to put any specially written character set you've invented.

Table 1. General VIC Map

0–1023 — Operating System and BASIC Overhead
1024–4095 — Empty memory (3K Expansion area)
4096–7679 — BASIC RAM memory
7680–8191 — Screen Memory
8192–32767 — 24K Additional expansion RAM area ©

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CARD GAMES

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

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

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

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

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

THOUGHT PROVOKERS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

ADVENTURE

CRANSTON MANOR ADVENTURE (North Star and CP/M only) — **Price: $21.95 Diskette**
At last! A comprehensive Adventure game for North Star and CP/M systems. 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.

SPEECH SYNTHESIS

DYNACOMP is now distributing the new and revolutionary TYPE-'N-TALK™ (TNT) speech synthesizer from Votrax. Simply connect TNT to your computer's serial interface, enter text from the keyboard and hear the words spoken. TNT is the easiest-to-program speech synthesizer on the market. It uses the least amount of memory and provides the most flexible vocabulary available anywhere!

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TNT Software

The following DYNACOMP programs are available for use with TNT

STUD POKER (Atari, 24K)
NOMINOES JIGSAW (Atari, 24K)
TEACHER'S PET I (Atari and North Star)
BRIDGE 2.0 (North Star)
CHOMPELO (Atari, 24K)

Please specify 'TNT' versions when ordering

ABOUT DYNACOMP

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

BUSINESS and UTILITIES

SPELLGUARD™ (CP/M only) — **Price: $219.95 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 (1, 2, or 3 up), 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 rel. 2 (Atari, North Star and Apple Diskettes only) — **Price: $34.95**

FORM LETTER SYSTEM (FLS) is the ideal program for creating and editing form letters and address lists. It contains an easy-to-use text editor which produces fully justified text. Special codes are used in the address list to obtain personalized salutations. 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 and sort your address files.

FLS and MAIL LIST 2.2 are available as a combined package for $59.95.

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

SORTIT is a general purpose sorting 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 diskette, menu-oriented system composed of ten different programs. Besides recording your expenses and tax deductible items, PFS will sort and summarize expenses by payee, and display information on expenditures by any of 26 user defined codes by month or by payee. PFS will even produce monthly bar graphs of your expenses by category! This powerful package requires only one disk drive, minimal memory (24K Atari, 32K North Star) and will store up to 600 records per disk (and over 1000 records per disk by making a few simple changes to the programs). You can record checks plus cash expenses so that you can finally see where your money goes and eliminate guesswork and tedious hand calculations.

FAMILY BUDGET (Apple only) — **Price: $34.95 Diskette**

FAMILY BUDGET is a very convenient financial record-keeping program. You will be able to keep track of cash and credit expenditures as well as income on a daily basis. You can record tax deductible items and charitable donations. FAMILY BUDGET also provides a continuous record of all credit transactions. You can make daily cash and charge entries to any of 21 different expense accounts as well as to 5 payroll and tax accounts. Data are easily retrieved giving the user complete control over an otherwise complicated (and unorganized!) subject.

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

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

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.

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

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

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

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

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

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

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

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

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 1½ 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.

MISCELLANEOUS

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

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

NORTH STAR SOFTWARE EXCHANGE (NSSE) LIBRARY

DYNACOMP now distributes the 23 volume NSSE library. These diskettes each contain many programs and offer an outstanding value for the purchase price. 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: $39.95 Cassette/$43.95 Diskette**

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

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

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

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

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

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 1 (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. See review in Dr. Dobbs.

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.

ACTIVE CIRCUIT ANALYSIS (ACAP) (48K Apple only) — **Price: $25.95 Cassette/$29.95 Diskette**

ACAP is the analog circuit designer's answer to LOGIC SIMULATOR. With ACAP you may analyze the response of an active or passive component circuit (e.g., a transistor amplifier, band pass filter, etc.). The circuit may be probed at equal steps in frequency, and the resulting complex (i.e., real and imaginary) voltages at each component juncture examined. By plotting the magnitude of these voltages, the frequency response of a filter or amplifier may be completely determined with respect to both amplitude and phase. In addition, ACAP prints a statistical analysis of the range of voltage responses which result from tolerance variations in the components. ACAP is easy to learn and use. Simply describe the circuit in terms of the elements and their placement, and execute. Circuit descriptions may be saved onto cassette or diskette to be recalled at a later time for execution or editing. ACAP should be part of every circuit designer's program library.

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.

ORDERING INFORMATION

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Guest Commentary:

A Software Publisher's Position On Software Pricing And Service Policies

Mr. Sherwin A. Steffin
Canoga Park, CA

I. Problem

A position paper appearing in **COMPUTE!**'s June issue advanced the views of Computer Using Educators (CUE) regarding commercial software protection and licensing policies. CUE would propose a licensing arrangement that would allow software "to be copied and used by any and all teachers in that one school regardless of the number of computer stations or type of installation."

A misperception is at work here. This organization appears to hold the fundamental view that copying computer software is a right. CUE recommends that schools should not purchase software material unless it is copyable.

II. Position

In 1980, congress amended title 17, the United States Copyright Law to include the "computer program". The amended code reads:

> 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 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 (17 USC 106).

The provisions of this law, capsulized in the phrases "essential step" and "archival purposes," are clear. Software copyright infringement is illegal. Complaints and rationalizations abound: that "restrictive" policies are unjust; that such policies do not "invite" teachers to respect and honor them; or that those who "beat the system" by pirating software from big corporations are to be applauded. Yet no measure of complaint will make the crime any less a crime. When a teacher permits (even encourages) children and young adults to disregard federal law and engage in illegal activities, what is that teacher undermining?

No software publisher would deny the necessity that teachers have on-site backup copies of software...

Costly and intensive research and development are required to produce any good software system, from drill and practice to the most sophisticated computer-mediated instruction. Even the simplest program file contains a complex set of instructions. Research and development costs far exceed the trivial cost of the material, or the ultimate retail cost of the product.

No software publisher would deny the necessity that teachers have on-site backup copies of software to avoid media failures which interrupt classroom activity. Yet CAI is a tool, like any other instructional aid. The purchasing policies which govern other educational materials (books, audio-visual materials, and the like) should not be expected to undergo modification simply because a medium's format is new or unfamiliar.

No software publisher fails to understand that the computer software industry has yet to adopt consistent, balanced purchasing policies for the schools. Yet, the instigation of licensing agreements poses problems analogous to those encountered in nuclear arms limitation efforts. The geographic area involved is expansive; the diversity of management policies (even among neighboring school districts) is immense. Further, the ambiguity of relying upon individuals' ethical behavior makes an "honors system" untenable. In short, the implementation of the copying procedures which CUE proposes, even at the local district level, would be unfeasible.

III. Proposed Solution

Answers do not come easily. The problems en-

COMPETENCY EXAM PREPARATION SERIES

This comprehensive set of programs consists of simulated exam modules, a thorough diagnostic package, and a complete set of instructional programs. It is designed to teach concepts and operations, provide drill and practice and assess achievement levels through pre and post testing. The Competency Exam Preparation Series provides a structured, sequential, curriculum encompassing mathematical, reading and writing instruction.

The C.E.P.S. program is designed for individual student use or use in a classroom setting. Programs provide optional printer capability covering worksheet generation and performance monitoring. C.E.P.S. are available in three software formats.

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If desired separate Mathematics and Verbal packages are available for $799.00 ea. A Spanish language version of the Mathematics Instruction Package is available at no extra charge.

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Odyssey In Time includes all the challenges of Time Traveler plus 10 additional eras, including those of Alexander the Great, Emperor Asoka of India, Attila the Hun, Genghis Khan. Each game is unique, and may be **interupted and saved** for later play.

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ISAAC NEWTON

Perhaps the most fascinating and valuable educational game ever devised — ISAAC NEWTON challenges the players 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. Hofstadler, Chapter XIX and Martin Gardner's MATHEMATICAL GAMES column in **Scientific American,** October, 1977 and June, 1959. $24.95.

TIME TRAVELER

Confronts players 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.

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countered today cannot be solved by a simplistic licensing policy, and the future will present even more confounding issues. Yet the difficulties are not insurmountable. As the microcomputer industry expands and time sharing becomes commonplace, users and software publishers will have to look seriously (and cooperatively) at complex joint understandings.

Software purchase and use entails shared responsibilities: on the part of the software publisher, to provide the most trouble-free product possible; on the part of the user, to know how to use and operate that product carefully and effectively. With this in mind, we propose six components fundamental to any working policy:

1. Software publishers should be accountable for providing error-free instructional materials.

2. Software publishers should be responsible for rapid service (a two week turn around at most) when replacing defective materials.

3. Where schools have purchased multiple CPUs, software publishers may provvide software at sliding scale rates. An affidavit from a responsible district administrator would certify the number of CPUs purchased, protecting all parties. This sliding scale would permit educators to utilize multiple computers in one room, in multiple rooms, among several teachers, and even among several schools within a single district.

4. When intensive disk activity is connected with the use of a given system, software publishers chould allow the user to copy and archive the disk.

5. Software publishers need to make available options to the schools, offering not only the sliding rate scale, but "spare parts" (diskettes, documentation, workbooks, etc.) at a significantly reduced price. This after-sale activity could well cover little more than the costs of materials, processing, and handling. Software purchase can be made economically feasible for the school without resort to charity or criminality.

6. Software publishers need to provide free disclosure about their locked instructional systems and the policies which support them. From this, educators may choose systems appropriate to their needs.

The problems connected with software piracy, if unchecked, will create an unnecessary and unfruitful adversary relationship between software publishers and educators. This paper delineates solutions to this dilemma: better quality control of software, licensing agreements, rapid service, and available spare parts. ©

At long last. A complete line of Voice I/O peripherals for Commodore computers, starting at $119.

Let's face it. Voice I/O is a fascinating and efficient way to communicate with computers. And now, thanks to VOICETEK, Voice I/O peripherals are easily available, easy to use and very affordable.

If you own a Commodore computer, we give you a choice of three different peripherals that will enable your computer to understand your spoken commands. And two of these peripherals will talk back.

What's in a name.

We call each member of our family of Voice I/O peripherals COGNIVOX, from COGNItive and VOX. It helps you remember that when you talk, COGNIVOX thinks about what you say.

The top-of-the-line COGNIVOX model for the PET/CBM is VIO-1002. It offers natural sounding voice output and excellent performance as a speech recognizer. It costs only $249.

If the quality of voice output is not important for your application, then you can save $100 by ordering VIO-432. Priced at $149, VIO-432 is ideal for hobbyists or persons mainly interested in speech recogniton.

Finally, if you have an 8K PET, there is insufficient memory for voice response, so we offer a recognition-only COGNIVOX, model SR-100P. It costs $119, making it the lowest priced speech recognizer ever offered for sale. Yet its performance rivals that of units selling at much higher prices.

Which brings us to the next point we would like to make, namely, why we offer so much performance for so little money.

It's the technology.

Our Voice I/O peripherals are based on a technological breakthrough that made it possible to compress the required electronics onto a single integrated circuit chip. We are the only company so far that has achieved this remarkable feat. No wonder we offer such reasonably price voice peripherals.

In addition, COGNIVOX uses an exclusive non-linear, learning pattern matching algorithm to do speech recognition. Which means more reliable performance and ease of use.

What makes it talk.

COGNIVOX digitizes and stores in memory (using a data compression algorithm) the voice of the user. This gives three major advantages:

First, there are no restrictions to the words COGNIVOX can say. If you can say it (or sing it, or whistle it for that matter) your computer can do it too. Second, It is very easy to program your favorite words: just say them in the microphone.
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.

The Voice output vocabulary can have up to 32 words phrases. Data rate is approximately 700 byte per word.

Ready to listen.

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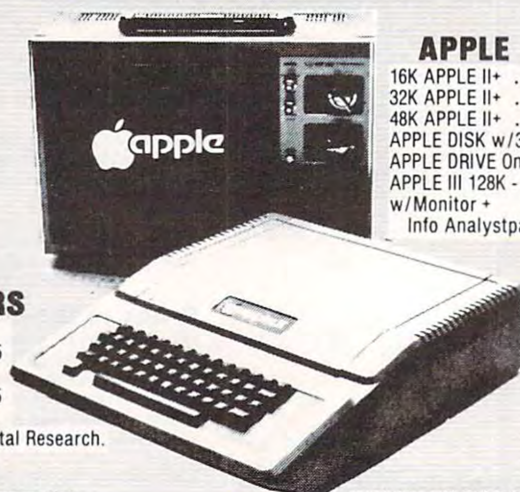

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Part II:

What Is A MODEM, And Why Do I Need One?

Michael E. Day
West Linn, OR

How To Use A Modem

The standard modem that the hobbyist normally encounters is the BELL 103 type modem. Additionally, the BELL 113A (originate) and the 113B (answer) are normally included in this group, with the specification of a 103 compatible modem often being used to indicate the 113A or 113B type modem. The 103 type modem is rated for speeds of 0 to 300 BPS, with most modems being able to operate up to 400 BPS, and the more expensive models being able to operate at up to 600 BPS. The maximum theoretical limit of the 103 type modem is 1000 BPS. However, due to the great amount of filtering and special line conditioning required to operate as the speed approaches this level, it becomes impractical to operate at these speeds. Due to this, 600 BPS is the maximum reliable speed that can be expected from the 103 type modem. It should be remembered, however, that 300 BPS is the maximum guaranteed speed of the 103 type modem. Speeds faster than this will not always work (depending on the phone line condition), and those modems capable of operating at greater speed generally cost twice as much as the lower speed types. The modem may be used at any speed less than 300 BPS. Dropping the speed to 150 or 110 BPS can often improve the reliability if the connection is very poor, and 300 BPS does not work.

The 103 has two modes of operation, the "answer" mode and the "originate" mode. The 113 modem will only work in one of the modes (113A for originate and 113B for answer) and not the other. Most of the acoustic coupled modems found on the surplus market are the originate type. This type of modem is what you need to talk to most of the computers that the hobbyist has access to (such as CBBS/NW). The originate modem is so named because it is used by the person or device that places the call (or originates the call) to the remote computer or person. The answer modem is used by the person or device that receives the call (or answers the call). The two modes could be reversed, as the phone line doesn't care. They were set that way to provide a standard as to which modem should use which mode. Since the 103 is a full duplex modem (two-day communications), two separate communication links must be established, thus the two different modes. The answer modem

Of all the generally available modems, the 103 is the most forgiving.

transmits on the high frequency link and receives on the low frequency link.

A true 103 type modem will be capable of operation in either mode depending on a control function. (This could be as complex as a control sequence or as simple as a switch).

Of all the generally available modems, the 103 is the most forgiving. It will operate at any speed less than its designed maximum. It is totally transparent to any protocols that might be used as long as it is asynchronous type transmission and it requires no special handshaking (control) signals in its basic configuration. This is ideal in a portable application where it might be used in a wide variety of configurations.

PIN 1	FRAME GROUND	Tied to the modem case (if metal). Can be ignored normally.
PIN 2	TXD	Transmit Data. The data to be transmitted is presented to this pin.
PIN 3	RXD	Receive Data. The received data is present on this pin.
PIN 4	RTS	Request to send. Generally ignored by modem, it can Sometimes be used to turn the transmitter on and off (1 = on; 0 = off).
PIN 5	CTS	Clear to send. This pin is normally held high (on). Alternately it can follow RTS, or DCD, or both (depending on modem).
PIN 6	DSR	Data set ready. This signal will always be on when the modem is operational (power on).
PIN 7	LOGIC GROUND	This is the common reference ground for all the signals listed.
PIN 8	DCD	Data carrier detect. This signal will be on when the communications link has been established (the carrier signal from the remote modem is being received.) On some modems this is always on.
PIN 20	DTR	Data Terminal Ready. Depending on the modem, this can be ignored, the modem on or off (1 = on; 0 = off). Also, in some turn modems, it is used in conjunction with RI to set the operating mode.

PIN 21	SQD	**Signal Quality Detector.** Generally this signal is not provided. On those modems that do provide it, it indicates that a poor communications link has been established, and that there is a high probability of errors occuring.
PIN 22	RI	**Ring Indicator.** Those modems that do not have mode control generally ignore this signal. Those modems that do use this signal generally use it to determine which mode to place the modem in. If the RI signal was present prior to the DTR signal, then the modem is placed in the answer mode. If the RI signal was not on prior to the DTR signal, then the modem is placed in the originate mode.

All other pins are undefined in their actions and no connections should be made to them to prevent possible malfunction of the modem.

Sometimes large amounts of data transfer is desired. With a 103 type modem limited to 300 BPS, this can get to be a bit tedious after a while. The 202 type modem serves as a compromise for this type of operation. By dropping one of the communication links, transmission speed can be boosted to 1200 BPS. This allows the data to be transmitted at a much faster rate, thereby improving the throughput.

Because of the lack of the other data link, however, the control of the communications flow becomes much more difficult. Since there is only one data link available, only one modem may transmit at a time (half duplex). This means that some sort of protocol must be decided upon to determine which modem may transmit. One of the more common ones is to send an ASCII "EOT" as the last character. This tells the receiving device that transmission is over and it may turn on its modem.

The operation of the control signals is very similar to the 103 type modem. Therefore only the differences will be discussed:

PIN 4	RTS	Request to send. This signal is used to turn the transmitter on and off.
PIN 5	CTS	Clear to send. This signal is generated from RTS, DCD, and an optional time delay and indicates when a valid transmission link has been established, and transmission may begin.
PIN 6	DCD	Data carrier detect. This signal is used to indicate that a carrier is being received.
PIN 12	SDC	Secondary data carrier detect. Optional reverse channel detector signal is present when reverse channel is present.
PIN 19	SRTS	Secondary request to send.
(On some BELL 202's this is PIN 11)		This signal turns the reverse channel carrier on and off (1 = on; 0 = off). If this PIN is tied high, then the reverse channel is controlled by the request to send (when request to send is on, reverse channel is off, and vice versa).

The reverse channel option is normally used as a circuit assurance or interrupt channel since, as long as the reverse channel is present, the transmitting modem can be assured that the data link is being maintained, and the receiving modem can use it to request an early termination of the transmission by turning it off.

The 202, like the 103, is quite flexible in its operation. It can be used at any speed up to its maximum allowable speed. It is transparent to most protocols as long as they are asynchronous. Some means must be provided, however, for turning the transmitter on and off.

Another modem that is becoming popular is the 212 modem. This modem combines the features of the 103 and 202. It has two data links (full duplex operation), yet can operate at 1200 BPS. It is, however, very limited in its operation. The transmission protocol is fixed, and the speed must be 1200 BPS exactly. For this you get full duplex operation, which means no transmitter control is required. Also, because of the transmission method used, it is inherently more difficult to build (i.e. more expensive). Transmissions between the two linked modems occur as DIBIT synchronous, and are then converted to asynchronous for transmission to and from the connected equipment. The PIN out of the 212 is the same as the 103 type modem. The operational mode (103 or 212) is determined by the signal applied to PIN 23 (0 = 103; 1 = 212). ©

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More Machine Language For Beginners

Richard Mansfield
Assistant Editor

This article has two purposes: to provide a way of insuring that private documents and programs cannot be seen or used by unauthorized persons and to explain some aspects of machine language programming. Readers who are familiar with M.L. might wish to skip the second part of the article.

The BASIC Program

The BASIC listing of Security Lock (Program 1) will run on any version PET. The M.L. routine goes into a "safe" area in the second cassette buffer, common to all ROM sets in Commodore machines, including the new 8000 series. This area is "safe" because it is below BASIC programs and is not used by PET unless a *second* cassette machine is used.

The uses of "Security Lock" are explained within the program. It is not necessary to type in the entire program. Simply copy lines 120, 130, and the DATA lines from 1000 up.

The three-letter code can be changed, as described in the program, to any combination. An additional security measure — making it virtually impossible to break into a protected program — is not in the BASIC LISTing in Program 1. The reason that it cannot be illustrated is simple: the purpose of this technique is to *prevent LISTings themselves from taking place.*

We must describe how to do this since it cannot be demonstrated via a printout. First, when you include "Security Lock" within a program, you will be using a line similar to line 130 in Program 1 (REM statement removed). If you are calling the M.L. routine at the start of the program, you might type it in as line 1, thus — 1SYS867 (or, if you are not in the "graphics" mode, 1sys867).

Now, after the last character, type in a quotation mark and hit the RETURN key —: 1SYS867"

Then, using the cursor control keys, move the cursor back up to a position directly following the quotation mark. Holding the SHIFT key down, press the INSERT key nine times. Then release the INSERT and the SHIFT keys and press the DELETE key nine times. You will see nine reverse-character "t" 's which represent nine automatic deletions. Then press the RETURN key to enter this line into the rest of the program.

As you can see, any attempt to LIST the program will now delete line 1 from view, as if it were not part of the program. A brief flash on the screen is the only clue that something exists there, yet this line will operate normally during a RUN of the program. To eliminate the flash, you can use the quote/delete rub-out further into the program (as in line 130, Program 1) where it will be unlikely to be noticed.

Before turning to some observations on M.L. programming, it might be worthwhile to mention one modification to "Security Lock" which may prove useful. The M.L. program always prints "code?" on the screen to remind you that it is the Lock hanging up the program, not an endless loop or a hardware failure. If you simply want to freeze a program or file, without giving a clue as to why it's locked, eliminate the prompt word in the M.L. routine by typing in the following and then hitting RETURN:

... machine language routines can be listed in four ways ...

```
FOR I=867 TO 880: POKE I,234: NEXT
```

This puts NOP (no operation) instructions into the routine, and when the SYS lands PET at 867, it slides up to 881 with no ill effects, where the input routine starts.

If you save frequently-used routines on a "Utilities" tape or disk for easy appending to future programs, this routine, like all M.L. routines, cannot be SAVEd normally (as BASIC is SAVEd). The following procedure will save M.L. routines which can later be LOADed in the usual way. Go into the Machine Language Monitor by typing SYS 1024. (If you have an Original PET, follow the instructions which came with your MLM tape.) Immediately after the dot, where the cursor should have landed, type —

```
s"Security Lock",01,035a,0399
```

and hit RETURN (for tape). For disk: .s"0:Security Lock",08,035a,0399. Note that the upper limit address must be one higher than the actual upper limit which was 0398 hex.

The Four Types Of M.L. Listings

In books and magazines, machine language routines can be listed in four ways: as BASIC DATA statements (sometimes called a "BASIC loader") as a memory dump, as a simple disassembly, and as an annotated assembly. This can be confusing to the novice, so the four Programs which accompany this article illustrate the four kinds of listings possible for the same M.L. Program: Security Lock.

As a series of BASIC DATA statements (Pro-

gram 1), M.L. code is a part of a larger BASIC program. This gives little or no information about the nature of the M.L. section. It is typed, then RUN, as a subroutine of the host program. And the reader is frequently cautioned to type the program *exactly* as it appears. This is because a single error in M.L. will usually crash the entire program. But much typing time can be saved, if the M.L. routine is all that's wanted from the BASIC program, by looking for three things: a READ-loop, a SYS, and DATA statements. Line 120 is a READ-loop which POKEs the M.L. routine into memory and line 130 contains the SYS to enter that routine at the proper address. In BASIC, the DATA for an M.L. routine are decimal numbers.

The next step up toward clarity, though the program's meaning is still not easily recognizable, is a "memory dump" (Program 2). (This is sometimes called a "hex dump.") It is a table of hexadecimal numbers. The first number is the address of the first datum on its line. In Program 2, the "dump" shows that address 035a contains a 43, address 035b contains 4f, etc. As before, to make such a program your own, you copy in the information, being careful to copy precisely. In this case, however, you must first enter the M.L. Monitor and then type:

.M 035a 0392 (RETURN key)

This will put a memory dump on screen of what currently exists in these memory cells. To put in the new data, you just type over what appears on the screen, observing the spaces between each hexadecimal number and hitting RETURN when each line has been changed.

A third type of M.L. printout is a list of each machine language instruction in terms of its function. This is a *disassembly*, (Program 3), and resembles a LISTing in BASIC, though in a highly abbreviated form. Any series of numbers can be examined by a *disassembler*, a program which translates raw data into M.L. instruction mnemonics. A disassembler can be found on pg. 81 of **COMPUTE!** #8. If the numbers are part of an M.L. routine, the disassembler will list them as in Program 3. If it cannot make sense of what it sees (if it were examining memory which contained BASIC code for example) it would print a series of question marks.

A disassembler usually prints out four *fields*, or zones of information. It is easy to see that the first four characters in Program 3 represent memory addresses. This is the "address field" and is similar to the first four characters of Program 2, the memory dump, except that here the number of bytes in the second field, the "data field," can be 1, 2, or 3 — so the numbers in the address field will increase irregularly. The second, "data field," also corresponds to Program 2's dump, but there is the same irregularity as different numbers group themselves together. This grouping is then *translated* in the third and fourth fields — the "instruction" field and the "operator" field. These last two fields are "mnemonic" (easy to remember) representations of the information contained in the raw hex numbers of the "data field" which precedes them. The "instructions" tell the computer what to do and the "operators" tell the computer what to do it *to*. In the phrase, "drive a car," *drive* is the instruction, *car* is the operator. In LDY #$00, LDY (load the Y register) is the instruction, #$00 (zero) is the operator. The same structure exists in BASIC — POKE 32768,41 or PRINT "Hello."

The reason that the disassembly must group its information irregularly is that different instructions are designed to work with different sized operators. INY, (increase the value of the Y register by 1), has no explicit operator since the "1" is implied within the instruction itself. LDY #$00 has a one-byte operator, 00, so it is two bytes long: LDY and 0. To instruct the computer to compare the number in the accumulator with the number in address $0360, we need three bytes, CMP plus two bytes to represent a number as large as 0360. Any one byte can only hold a number up to 255.

Full Source Code

Finally, Program 4 illustrates the clearest way that an M.L. program can be presented: as an annotated assembly listing. (It is also called "source code.") This contains within it the four fields of the disassembly, but adds three more fields — line numbers, labels, and comments.

Such listings represent the program rather elaborately by M.L. standards. Such programs are written using an "assembler" program which accepts mnemonics such as INY, translates them, and puts them in memory. Assemblers are either "single-pass," (simple translators of mnemonics) or complex, label-oriented powerhouses. Unfortunately, the M.L. Monitor within PET does not contain a disassembler or an assembler, but the monitor can be made to include these functions (and others) with a program such as "Supermon" or "Extramon." For short routines, simple assemblers will work well. For larger jobs — an entire arcade game would be a large job — a power assembler is needed. To my knowledge, the most advanced assemblers available to PET users are "MAE" and "ASM/TED," written by Carl Moser. (Available from A.B. Computers or Eastern House Software.)

A printout from such an assembler is much easier to understand because it contains labels and comments. Using such an assembler, it is also easier to write large programs since some of the problems associated with programming in M.L. are handled automatically by the computer.

Mnemonics are easier to manipulate than numbers, but whole words (labels) are often an improvement over mnemonics, particularly when a

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program is lengthy. To clarify the additional fields found in large assembly programs, we can examine line 0180 (Program 4). It begins with two fields which are identical to the disassembly in Program 3, but the third field is a BASIC-like consecutive numbering of each line of the program. This allows the programmer to manipulate the instructions more easily, since renumbering can open up new space for additional instructions or whole sections of the program can be conveniently rearranged.

Following the line number is the label field, in this case the label, "START," since it is the beginning of the program. This is better than BASIC. Several locations (lines 350, 380, 410) are able to say IF THEN GOTO *START*, where a comparable BASIC program would need to use the line number instead of a word: IF THEN GOTO 180. This relieves the programmer of having to look up line addresses for his subroutines or major entry points as well as eliminating a frequent cause of errors.

The next two fields are the instruction and operator fields (as in a disassembly) except that now some of the operators have been replaced by labels. If, as in line 190, we see LDA (load accumulator) *TEXT* we can find the value or meaning of the label, TEXT, in three ways. We can look over to the second field, where the raw numbers are, we can look earlier in the program where TEXT is defined (line 80), or we can look at the end of the program in the "Label File." TEXT refers to data which starts at address $035A and which line 80 defines as being the word "code?"

The last field holds comments which describe the function of the line where they appear (and sometimes, subsequent lines). The semi-colon is the same as REM — anything which follows it serves to document the program, but is ignored by the assembler. This makes later modifications easier, debugging faster, and also helps to reveal the meaning of the program to others.

To review, we see a progress toward clarity, from Program 1 to Program 4, largely due to the addition of new fields of information. Program 1 contains a single field: decimal data. Program 2 adds an address field. Program 3 adds fields three and four — a translation into instruction mnemonics and operators of the raw data from field two. And Program 4 adds line numbers, labels and comments — for a total of seven fields. We have now examined the *horizontal* organization of a M.L. program, from its simplest form to its most complex. Using the most complex example, (Program 4), let's twist ourselves sideways and go on to investigate the *vertical* organization of M.L. programs.

The Four Parts Of A Computer Program

All programs — in fact, all thinking — can be broken down into four essential parts: 1. Initialization and Protection, 2. Data Tables, 3. Main Loop, 4. Subroutines. Before learning a new word (thinking), a person must: 1. not be being shot to death, 2. have a dictionary, 3. start looking up the word, and 4. move his thumbs correctly, know or guess the spelling, keep his balance, etc. The order of these elements is important. Without protection, any M.L. routine between addresses 1024 and the screen RAM at 32768 can be overwritten by a BASIC program either by a LOAD or because BASIC puts some of its variables up at the top of available RAM where M.L. programmers like to stick routines.

Protection can be achieved by telling PET that its memory size has shrunk — changing the numbers in addresses 52 and 53 (134,135, in Original ROMs). Then all BASIC activity will be confined to RAM below the address resulting from (PEEK (52) + PEEK (53)*256). Or, a short M.L. routine can be nestled into a space where BASIC doesn't usually go, such as the second cassette buffer. BASIC protects itself, so that is not of concern in BASIC programming.

A *table* is a collection of information (data) which the program will need. In Program 4, and in M.L. generally, the tables are placed at the beginning of the program (but sometimes at the end). It is good to get into a habit of keeping tables together and putting them at the start. In line 80, instead of an ordinary mnemonic, we have a pseudo-op, .BY, (pseudo-ops are preceded by a period). A pseudo-op is a request to the assembler program to perform some task for the programmer. In this instance, the programmer is requesting that an ASCII word, *CODE?*, be translated into bytes and stored to be used by the program later. Line 90 contains the pseudo-op, .DE, which defines the label, *SENDCHAR*, as the address in BASIC ROM which prints a character to the screen. The .DS in line 110 tells the assembler to define some storage space, three cells large, called *STORAGE* which the program will later use as a place to hold the codeword PET.

A main loop is a series of steps which control the program as a whole. It is distinct from subroutines in that it *calls* subroutines, they do not call the main loop. In a complicated M.L. program, the main loop can be a series of JSR (Jump to Subroutine) instructions which defines the order in which subroutines are performed. In BASIC, it can take the form of an ON GOTO list of addresses, a series of GOSUBS, or a loop. In simpler programs, the main loop is often merely implicit — each subroutine is already arranged within the program in the desired order of execution. The program runs more or less sequentially from start to finish. In such cases, a governing loop is only implied.

In Program 4, the instructions break into two divisions: initialization and subroutine. Since it is a simple program, there is only a fragment of what would be a main loop in a larger program. The initialization zone is often at the start of a main loop, and sets up whatever preconditions the pro-

gram will later expect (including protection). In this case, the word *code?* must be printed to the screen until the correct code is entered and the loop can be exited.

The phrase "cold start" refers to an entrance into a program at the very beginning of the initialization section. This will reset all flags, pointers, counters, etc. to their virgin condition. A "warm start" enters the mail loop beyond initialization, so that various kinds of information, modified during a program RUN, are left undisturbed. There is some ambiguity to these terms since initialization is sometimes unnecessary, or is sometimes refreshed on every entrance to the main loop (the warm start and the cold start would then be identical), or other anomalies. It is valuable, however, to develop a sense that a program has two distinct active parts and one passive part. The main loop *governs* the action of the subroutines. Data tables are passive zones of information which perform no tasks. And, before all else, an M.L. program must protect itself from a BASIC invasion. (M.L. can also require protection from interruptions, but this concept is outside of the purview of this article.)

How Security Lock Works

The main loop begins at line 180 (Program 4) and sets the Y register to zero so that it can act as an "offset" to the address called "TEXT" (a little table holding the word "CODE?"). This is much simpler than it sounds. "Offset" means *add this number to a fixed number.* TEXT has already been defined as a fixed address (035A) which is the start of the table holding the word "CODE?" So, in line 190, we LDA (load the accumulator register, a temporary resting place for bytes of data) with whatever is in the address TEXT + Y. Since Y was just loaded with a zero (LDY #0), the byte that we are putting into the accumulator will be at $035A itself. Line 200 tests to see if the whole word, CODE?, has been printed. BEQ means branch if you just loaded (LDA) a zero into the accumulator. But we didn't. Since address 035A has a 43 in it, now the accumulator also has the 43. We will only branch (go somewhere else) if it's a zero. So the branch is ignored and we continue to line 210 which jumps to a subroutine (JSR) in BASIC ROM which puts the character in the accumulator on the screen. The 43 (letter "C") will then appear and the control of the computer is returned to line 220, as in a BASIC RETURN command. Line 220 increases (increments) the number in the Y register by 1 (INY). It was a zero, so now it's a 1. Then, like a GOTO, line 230 jumps (JMP) to the line we've labeled LOOP (line 190) where the value of TEXT and Y are again added together to give the address where we will find what to put into the accumulator. This time, however, since Y now equals 1, the "effective" address is 035B, where the letter "O" is waiting to be picked up. After looping this way for a while, increasing the address each time by increasing the value of Y, we will eventually pick up a zero which we thoughtfully placed in address 035F, the end of our TEXT table (see line 80). This is a "delimiter" to let the loop know that we are finished and that it should now BEQ (branch if equal to zero) to COMPARE, line 270.

Here we load the accumulator with the code letters and put them into the previously defined (line 110) storage area within our tables. This time, rather than setting up a loop and a delimiter, we add the offset directly to the labels: STORAGE + 1, STORAGE + 3. At line 330 we again jump to subroutine in BASIC ROM which will input a single letter from the human and leave it in the accumulator, returning from the subroutine to line 340. Here, we compare (CMP) this letter in the accumulator with the first letter in the STORAGE zone, a "P." If the accumulator does not match "P," then the instruction in line 350 (BNE, branch if not equal) takes effect and the computer is thrown back to START. If it was equal, we "fall through" to line 360 where the same comparison is done for "E." Any failure of equality causes a branch to START. If all three letters match, the instruction RTS (return from subroutine) puts us back into BASIC just beyond the SYS which threw us into the M.L. routine in the first place. SYS is merely a GOSUB to M.L. subroutines.

Program 1: BASIC Loader

```
1ØØ REM                    SECURITY LOC~
   ~K BY RICHARD MANSFIELD
11Ø POKE59468,14:PRINT"{CLEAR}";
12Ø FORI=858TO92Ø:READR:POKEI,R:NEXT
13Ø REM  SYS 867
14Ø REM                      /ON-SCREE~
   ~N INSTRUCTIONS/
15Ø PRINT"{Ø2 DOWN}    {REV} THIS IS ~
   ~A SECURITY LOCK "
16Ø PRINT"{Ø5 DOWN}FROM 858 TO 92Ø IN~
   ~ YOUR MEMORY
17Ø PRINT"IS A MACHINE LANGUAGE PROGR~
   ~AM WHICH
18Ø PRINT"WILL NOT ALLOW THE PROGRAM ~
   ~TO PROCEED
19Ø PRINT"UNTIL THE WORD 'PET' IS TYP~
   ~ED."
2ØØ PRINT
21Ø PRINT"{DOWN}{Ø5 RIGHT}THIS CAN BE~
   ~ USED TO INSURE THAT
22Ø PRINT"A FILE OR DIARY IS PROTECTE~
   ~D FROM
23Ø PRINT"PRYING EYES.
24Ø PRINT"   IN ORDER TO DEMONSTRATE ~
   ~THIS...
25Ø PRINT"SIMPLY ELIMINATE THE REM
26Ø PRINT"FROM LINE 13Ø AND THEN TRY ~
   ~TO RUN
27Ø PRINT"THE PROGRAM WITHOUT TYPING ~
   ~IN 'PET'
28Ø PRINT"{DOWN}{16 RIGHT}PRESS ANY K~
   ~EY"
```

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```
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
```

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```
290 GOSUB71Ø
300 GETA$:IFA$=""THEN3ØØ
310 PRINT"{CLEAR}"
320 PRINT"{DOWN}{Ø5 RIGHT}OF COURSE, ~
   ~THEN THEY COULD
330 PRINT"TYPE LIST, TO SEE YOUR PROG~
   ~RAM,
340 PRINT"AND NOTICE THAT SUSPICIOUS ~
   ~SYS YOU'VE
350 PRINT"GOT AT THE BEGINING...AND T~
   ~HEN,
360 PRINT"WITH ENOUGH WORK, EXTRACT T~
   ~HE
370 PRINT"CODE WORD FROM THE DATA STA~
   ~TEMENTS.
380 PRINT"BUT THE ACCOMPANYING ARTICL~
   ~E GOES
390 PRINT"FURTHER YET.  IT DEMONSTRAT~
   ~ES A WAY
400 PRINT"TO EVEN HIDE THE SYS STATEM~
   ~ENT FROM
410 PRINT"ANY LISTING OF THE PROGRAM.~
   ~
420 PRINT"{DOWN}    WHAT'S MORE, YOU C~
   ~AN GO STILL
430 PRINT"DEEPER INTO A PARANOIAC'S W~
   ~ONDERLAND
440 PRINT"BY USING THIS LIST-PREVENTI~
   ~ON TRICK
450 PRINT"TO ELIMINATE ANY OTHER PART~
   ~S OF A
460 PRINT"PROGRAM FROM LISTINGS...INC~
   ~LUDING
470 PRINT"THE DATA STATEMENTS THEMSEL~
   ~VES.
480 PRINT"ANYBODY WHO CAN GET TO YOUR~
   ~ DIARY
490 PRINT"AFTER ALL THIS SECRECY IS S~
   ~O
500 PRINT"BRILLIANT THAT THEY DESERVE~
   ~ TO
510 PRINT"READ IT!
520 PRINTSPC(19);"ANY KEY"
530 GETA$:IFA$=""THEN53Ø
540 PRINT"{CLEAR}   SINCE 'PET' IS PE~
   ~RHAPS AN OBVIOUS
550 PRINT"CODE, YOU MAY USE ANY OTHER~
   ~ 3 LETTERS
560 PRINT"BY POKEING DIFFERENT VALUES~
   ~ INTO ADDRS:
570 PRINT"882, 887, & 892.  (A=65...Z~
   ~=9Ø)
580 PRINT"{DOWN}"SPC(19);"ANY KEY"
590 GETA$:IFA$=""THEN59Ø
600 PRINT"{CLEAR}{Ø3 DOWN}     ANOTHER~
   ~ USE WOULD BE TO LOCK
610 PRINT"UP YOUR PET WHEN YOU ARE NO~
   ~T THERE.
620 PRINT"SIMPLY LEAVE THE SECURITY P~
   ~ROGRAM
630 PRINT"IN ITS LOCATION (NO PROGRAM~
   ~ YOU WRITE
640 PRINT"WILL DISTURB IT, NOT EVEN T~
   ~YPING NEW)
650 PRINT"WHEN YOU WANT TO LOCK, JUST~
   ~ TYPE SYS867
660 PRINT"(THE () ARE UNNECESSARY) AN~
   ~D WALK
670 PRINT"AWAY...NOBODY CAN GET INTO ~
   ~THE PROGRAM
680 PRINT"EXCEPT YOU.
690 PRINT"{DOWN}  NOW, PLEASE REMOVE ~
   ~THE REM FROM 13Ø
695 PRINT"AND THEN RUN THE DEMONSTRAT~
   ~ION."
700 LIST 13Ø:REM    ------ START/GRAP~
   ~HICS ------
710 FORI=33767TO32925STEP-4Ø:POKEI,3Ø~
   ~:POKEI+4Ø,32:FORB=1TO95:NEXTB:NEX~
   ~TI
720 FORI=32927TO32917STEP-1:POKEI,31:~
   ~POKEI+1,32:FORT=1TO2:NEXTT:NEXTI
730 FORI=32917TO32925:POKEI+1,31:POKE~
   ~I,32:FORT=1TO5Ø:NEXTT:NEXTI:X=X+1~
   ~
740 IFX<3THEN72Ø
750 POKEI,32
760 FORI=32925TO33767STEP4Ø:POKEI,3Ø:~
   ~POKEI-4Ø,32:FORT=1TO1ØØ:NEXTT:NEX~
   ~TI
770 REM            ------   END/GRAP~
   ~HICS   ------
780 RETURN
1000 DATA 67,79,68,69,63,Ø,Ø,Ø,Ø
1100 DATA 16Ø,Ø,185,9Ø,3,24Ø,7,32,21Ø~
   ~,255,2ØØ
1200 DATA 76,1Ø1,3,169,8Ø,141,96,3,16~
   ~9,69
1300 DATA 141,97,3,169,84,141,98,3,32~
   ~,2Ø7
1400 DATA 255,2Ø5,96,3,2Ø8,219,32,2Ø7~
   ~,255
1500 DATA 2Ø5,97,3,2Ø8,211,32,2Ø7,255~
   ~
1600 DATA 2Ø5,98,3,2Ø8,2Ø3,96
READY.
```

Program 2: Memory Dump

```
.
.:  035a 43 4f 44 45 3f 00 00 00
.:  0362 00 a0 00 b9 5a 03 f0 07
.:  036a 20 d2 ff c8 4c 65 03 a9
.:  0372 50 8d 60 03 a9 45 8d 61
.:  037a 03 a9 54 8d 62 03 20 cf
.:  0382 ff cd 60 03 d0 db 20 cf
.:  038a ff cd 61 03 d0 d3 20 cf
.:  0392 ff cd 62 03 d0 cb 60 58
.
```

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Program 3: Disassembly

```
.
035a 43          ???
035b 4f          ???
035c 44          ???
035d 45 3f       eor $3f
035f 00          brk
0360 00          brk
0361 00          brk
0362 00          brk
0363 a0 00       ldy #$00
0365 b9 5a 03    lda $035a,y
0368 f0 07       beq $0371
036a 20 d2 ff    jsr $ffd2
036d c8          iny
036e 4c 65 03    jmp $0365
0371 a9 50       lda #$50
0373 8d 60 03    sta $0360
0376 a9 45       lda #$45
0378 8d 61 03    sta $0361
037b a9 54       lda #$54
037d 8d 62 03    sta $0362
0380 20 cf ff    jsr $ffcf
0383 cd 60 03    cmp $0360
0386 d0 db       bne $0363
0388 20 cf ff    jsr $ffcf
038b cd 61 03    cmp $0361
038e d0 d3       bne $0363
0390 20 cf ff    jsr $ffcf
0393 cd 62 03    cmp $0362
0396 d0 cb       bne $0363
0398 60          rts
.
```

Program 4: Assembler Source Code

```
                0010 ; -------- SECURITY LOCK ASSEMBLY -- MAE ----------
                0020 ;
                0030                .BA 858           ;START ASSEMBLY AT ADDRESS
                0040                .OS               ;PUT ASSEMBLED CODE THERE.
                0050 ;
                0060 ; --------------   T A B L E S   ----------------
                0070 ;
035A- 43 4F 44  0080 TEXT           .BY 'CODE?' 0 ;DEFINE TEXT
035D- 45 3F 00
                0090 SENDCHAR       .DE $FFD2         ;OUTPUT CHARACTER
                0100 FINDCHAR       .DE $FFCF         ;GET CHARACTER INPUT
0360-           0110 STORAGE        .DS 3
                0120 ;
                0130 ;
                0140 ;       ******* START OF INSTRUCTIONS *******
                0150 ;
                0160 ;### INITIALIZATION ###
                0170 ;
0363- A0 00     0180 START          LDY #0            ;INITIALIZE COUNTER
0365- B9 5A 03  0190 LOOP           LDA TEXT,Y        ;GET A LETTER
0368- F0 07     0200                BEQ COMPARE       ;IF ZERO, TEXT FINISHED
036A- 20 D2 FF  0210                JSR SENDCHAR      ;PRINT ON SCREEN
036D- C8        0220                INY               ;INCREASE COUNTER
036E- 4C 65 03  0230                JMP LOOP          ;GET NEXT CHARACTER
                0240 ;
                0250 ;### SUBROUTINE ###
                0260 ;
0371- A9 50     0270 COMPARE        LDA #$50          ;PUT   "P"   INTO STORAGE
0373- 8D 60 03  0280                STA STORAGE
0376- A9 45     0290                LDA #$45          ;      "E"
0378- 8D 61 03  0300                STA STORAGE+1
037B- A9 54     0310                LDA #$54          ;      "T"
037D- 8D 62 03  0320                STA STORAGE+2
0380- 20 CF FF  0330                JSR FINDCHAR      ;GET A CHARACTER FROM HUMA
0383- CD 60 03  0340                CMP STORAGE       ;IS IT A  "P" ?
0386- D0 DB     0350                BNE START         ;NO? START OVER AGAIN
0388- 20 CF FF  0360                JSR FINDCHAR
038B- CD 61 03  0370                CMP STORAGE+1     ;IS IT AN "E" ?
038E- D0 D3     0380                BNE START
0390- 20 CF FF  0390                JSR FINDCHAR
0393- CD 62 03  0400                CMP STORAGE+2     ;        "T" ?
0396- D0 CB     0410                BNE START
0398- 60        0420                RTS               ;CORRECT! GOTO BASIC.
                0430                .EN               ;END OF ASSEMBLY
ENDPASS
```

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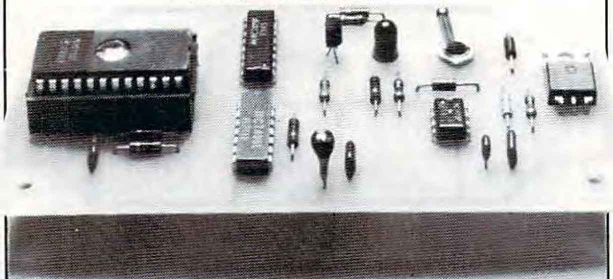

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Wyomissing, PA

Editor's Note: Though described for Applesoft, this crafty technique works on CBM computers as well. For PETs, type SYS1024. Then .M 0400 041F and hit RETURN (where the author mentions CALL-151). — RTM

Did you ever wish that you could put your name into a program in such a way that the average computer user could not delete it and claim the program as his own? Well you can. In APPLESOFT, you normally cannot enter program lines greater than 63999, but I will show you how you can. First we have to see how the APPLE stores your program lines in memory.

The APPLE stores APPLESOFT program lines beginning at memory location $800. (The '$' sign before a number indicates that the number is in hexadecimal). Let's enter the following small program to illustrate the way a program is stored.

```
1 REM
2 A=8
3 PRINT A
4 END
```

To see how the APPLE stores this program, we have to enter the monitor with a CALL -151. However, before we list the program, there is one other piece of information that we need to determine. To add lines to an existing program, you need to know where the current program ends in memory. You can accomplish this in one of two ways. You can page through the memory to find the program's last byte. (Hint: This is the hard way.) The APPLE also stores the location of the last memory byte in locations $69 and $6A. Let's enter the monitor now to check our program.

```
CALL -151
*69.6A
0069-1E 08
*800.81F
0800-00 07 08 01 00 B2 00 0F
0808-08 02 00 41 D0 38 00 16
0810-08 03 00 BA 41 00 1C 08
0818-04 00 80 00 00 00 FF FF
```

Although you may not recognize it, the above listing is a memory dump of your program. Let's examine how our BASIC lines were translated to the above hex dump.

The first byte $00 at location $800 has no special meaning to our program. In fact, location $800 will always contain $00. The program lines begin after this point. Each line is prefixed by four bytes. The first pair of bytes stores the starting byte address of the next line. In our example, locations $801 and $802 indicate that the next line will begin at memory location $807. (Remember that the location is split into two bytes which are stored in what seems, to us humans, to be in reversed order.)

The second pair of bytes contains the line number assigned to the program line. In our example we started with the line number "1." Thus memory locations $803 and $804 indicate that the first line number is "1." In addition to the four bytes which prefix each line, each line is ended with single byte '00' to separate it from the next line. Therefore, there is a five byte overhead for each program line used. If multiple statements are combined with a colon (using one byte) on a single line, you can save four bytes for each extra line you eliminate. If you have any doubts, try it yourself with the above program.

... though described for Applesoft, this crafty technique works on CBM computers as well.

The second program line begins at memory address $807. The first four bytes indicate that the next statement will begin at location $80F and will have statement number "2." The next three bytes "41 D0 38" represent the tokens for the equality: A=8. The information we will need to understand these tokens is found in Appendix F and Appendix K of the APPLESOFT Reference Manual. I'll wait while you go get your copy.

Appendix F lists the decimal tokens for all of the keywords used by the APPLE. However, when we are in the monitor, we need the hexadecimal equivalent of the tokens. For example, the hex equivalent for END is $80, REM is $B2, and PRINT is $BA, etc. You might want to take the time now to write the hexadecimal equivalents next to the decimal values for all of the tokens.

Variable names, numbers and strings are not listed in Appendix F. These must be constructed by using the individual ASCII character representations. Appendix K lists the ASCII character set with the decimal and hexadecimal codes. Again, we are interested in the hexadecimal codes. In our example, we need the "A" or $41 and the "8" or $38.

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I have now explained all of the hex codes used in our example except one, the equal sign (=). The problem is that both Appendix F and K contain an equal sign, but each has a different hex code. Which one is correct? We need a rule which will guide us with this and similar problems, so here it is. To construct a variable name, number, or string of characters, use Appendix K. Any symbol used in an arithmetic expression (such as =, (,), etc.) should be taken from Appendix F.

Finally, even though we end our program with an END statement, the APPLE does not know that this is the end of the program (for, indeed, it does not have to be). The end of the program is indicated by the byte pair '00 00' in the locations where it expects to find the next line number.

Now that we know how the APPLE interprets our APPLESOFT program and stores it in memory, we are ready to begin adding lines to our program which will be undeletable to the average APPLE user.

Normally, only program line numbers from 0 to 63999 can be used and referenced in an APPLESOFT program. Converting 63999 to hexadecimal we get $F9FF, but we *can* write larger hexadecimal numbers than in two bytes. In fact, we should be able to use the numbers from $FA00 through $FFFF or 64000 through 65536. Even though the APPLE will prevent us from entering these line numbers through the keyboard, we know enough about how the APPLE stores program lines to sneak them in.

Let's keep this example simple and assume that I just want to store my name and the date as remark statements. We could just as easily make them PRINT statements if we wanted to. The statements we want are:

```
64000 REM MICHAEL P. ANTONOVICH
64001 REM JUNE 28, 1981
```

Now enter the monitor (CALL -151) and type the following:

```
81C:37 08 00 FA
820:B2 4D 49 43 48 41 45 4C
828:20 50 2E 20 41 4E 54 4F
830:4E 4F 56 49 43 48 00 4A
838:08 01 FA B2 4A 55 4E 45
840:20 33 30 2C 20 31 39 38
848:31 00 00 00
```

Before you return to APPLESOFT, we must reset the end of program pointer. If we do not do this, the first time you run your program, any variables you store will write over the new lines you just added. Our program now ends at memory location $84C. This information must be put into locations $69 and $6A.

```
69:4C 08
```

We can now reenter APPLESOFT using CNTL-C RETURN, and list the program. There are lines 64000 and 64001 at the end. Try to delete them. HA! You cannot touch them. You can SAVE this program, reload it, RUN it, and copy it, and still those two lines will be there. In fact the only way to get rid of them is to enter the monitor, find where you want the program to end, change the last two bytes to "00 00," and change the program ending location in addresses $69 and $6A. It's easy, but only if you know how.

Remarks are not the only things that you can put into undeletable lines. You can store anything you want from program lines using tokens and character strings to machine language programs using this method.

I would like to clear one thing up before anyone gets the wrong idea. The tokens we have been using above are NOT machine language. All microcomputers use tokens to store keywords. All BASIC program lines are stored in the above manner, not in machine language. The program lines must be interpreted each and every time that they are run. However, there is a lot that you can do with undeletable lines.

[Manipulating BASIC using your monitor can also hide lines from LISTing, but they will RUN normally. To make this program print the 8, but without *line 3 appearing in the program LISTing — simply change the one hexadecimal number to 16 like this:*

```
.: 0800 00 07 08 01 00 B2 00 16
   Apple Version
.: 0400 00 07 04 01 00 8F 00 16
   PET Version
```

Also notice that PET and Apple versions are similar (both are Microsoft BASICs), but the hex number for REM is $B2 for Apple, $8F for PET. The location of the last BASIC memory byte (the top of a BASIC program) is different in the PET, too. For Original PETs, this address is found in $007C, $007D. For Upgrade and 4.0 PETs: $002A, 002B. Another difference is that Apple starts its BASIC programs at $0800, where PET starts at $0400. You will notice this reflected in the line links which contain the starting byte address of the next line. (In PET, the first links are at $0401 and $0402, and they point to $0407 where the next link points up the chain once again. It is this $0407 (or Apple's $0807) which we changed to skip over line three in our "hidden line" technique above.) Here is the complete program as it would appear in the PET:]

```
.: 0400 00 07 04 01 00 8F 00 0F
.: 0408 04 02 00 41 B2 38 00 16
.: 0410 04 03 00 99 41 00 1C 04
.: 0418 04 00 80 00 37 04 00 FA
.: 0420 B2 4D 49 43 48 41 45 4C
.: 0428 20 50 2E 20 41 4E 54 4F
.: 0430 4E 4F 56 49 43 48 00 4A
.: 0438 04 01 FA B2 4A 55 4E 45
.: 0440 20 33 30 2C 20 31 39 38
.: 0448 31 00 00 00 AA AA AA AA
```

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Inverting A Matrix

Brian J. Flynn
Vienna, VA

Editor's Note: Although this is programmed for the TRS-80, the ideas can be quickly adapted to any computer. RM

Have you ever wanted to solve a set of simultaneous equations, or perform regression analysis, or learn a bit about how these routines work? Well, the essence of such procedures is inverting a matrix. And in doing this, an accurate and dependable routine is desirable. One such algorithm is names for the king of 19th century mathematics, Carl Friedrich Gauss, and for his French counterpart, Camille Jordan, pronounced "zhoȓ đaṅ." Gauss, you may recall, was the German genius who at age two detected and corrected an arithmetic slip that his father was making in tallying up a payroll. And he did this without the assistance of even a hand-held calculator!

A Level II BASIC program for Gauss-Jordan matrix inversion is presented here. The algorithm uses complete pivoting to minimize round-off error and to insure that every invertible matrix is in fact inverted, within limits of the TRS-80's computing capability.

A matrix is a rectangular array of numbers or variables, usually displayed in brackets. A square matrix is 2-dimensional with, as you guessed, as many rows as columns. And an identity matrix is square with 1's in the principal diagonal and 0's everywhere else. The principal diagonal is the line segment running from the upper left corner to the lower right corner of the matrix. Only a square matrix can be inverted, with the inverse equal to that array which when multiplied by the original matrix gives an identity matrix. In symbols, this is:

$$X \cdot X^{-1} = I.$$

X is the original matrix. X^{-1} is its inverse. And I is the identity matrix. The dot between the two X's means multiplication. For example:

$$X = \begin{bmatrix} 1 & 4 & 8 \\ 2 & 1 & 3 \\ 6 & 9 & 4 \end{bmatrix}, \text{ and } X \cdot X^{-1} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

To calculate X^{-1}:

Tack onto matrix X an identity matrix of equal size:

$$\left[\begin{array}{ccc:ccc} 1 & 4 & 8 & 1 & 0 & 0 \\ 2 & 1 & 3 & 0 & 1 & 0 \\ 6 & 9 & 4 & 0 & 0 & 1 \end{array}\right]$$
$$\underbrace{\hphantom{1\quad 4\quad 8}}_{X} \qquad \underbrace{\hphantom{1\quad 0\quad 0}}_{I}$$

The dotted line separates or partitions what is now a 3 row x 6 column matrix into two smaller matrices of equal size, X and I. The partition, in this case, is like the equator: it enables us to talk more easily about the halves of a whole.

Is the matrix nearly inverted?

"Not yet, not yet!" the Rabbit hastily interrupted. "There's a great deal to come before that!"[1]

Namely:

Transform the left portion of the 3x6 matrix into I, using row and column operations on the entire matrix to do this. What is initially the identity matrix will emerge as X^{-1}. In more detail, the following three steps are performed for as many times (iterations) as there are rows in X:

1. Search would-be key elements, illustrated below, for the one of highest absolute value.

2. Place this element in the pivot position, if it is not already there, by switching rows or columns. The pivot position for iteration #1 is the first spot in the principal diagonal, going from upper left to lower right. For iteration #2 it is the second spot, and so on.

Keep track of columns that switch place, and interchange corresponding rows in the next-to-final form inverted matrix.

3. Make the diagonal element in a column equal to 1, and make the other elements in the same column equal to 0.

For example:

Step 1:
Would-be key elements are circled.

$$\left[\begin{array}{ccc:ccc} 1 & 4 & 8 & 1 & 0 & 0 \\ 2 & 1 & 3 & 0 & 1 & 0 \\ 6 & 9 & 4 & 0 & 0 & 1 \end{array}\right]$$
$$\underbrace{\hphantom{1\quad 4\quad 8}}_{X} \qquad \underbrace{\hphantom{1\quad 0\quad 0}}_{I}$$

Module 2 in the computer program tacks I onto X. The solid circle is the position to pivot on in the first iteration. Would-be key elements, besides 1, are in the dashed circles. They are the members of X that can be moved into the pivot position by switching a row or column.

Module 3 identifies 8 as the would-be key element of highest absolute value.


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Step 2:

$$\begin{array}{c}
\begin{array}{ccc} \text{Old Column 3} & & \text{Old Column 1} \end{array} \\
\left[\begin{array}{ccc|ccc} 8 & 4 & 1 & 1 & 0 & 0 \\ 3 & 1 & 2 & 0 & 1 & 0 \\ 4 & 9 & 6 & 0 & 0 & 1 \end{array}\right]
\end{array}$$

To place 8 in the pivot position, columns 1 an 3 are switched (lines 3120 and 3130). Vector M "remembers" the column interchange.

Step 3:

$$\left[\begin{array}{ccc|ccc} 1 & 0.5 & 0.125 & 0.125 & 0 & 0 \\ 3 & 1 & 2 & 0 & 1 & 0 \\ 4 & 9 & 6 & 0 & 0 & 1 \end{array}\right] \begin{array}{l} \textbf{Row 1 divided by 8.} \\ \\ \\ \end{array}$$

The pivot element becomes 1 by dividing the first row in the entire matrix by 8 (lines 3140 to 3190). Next, the second and third elements in column 1 become 0's:

$$\left[\begin{array}{ccc|ccc} 1 & 0.5 & 0.125 & 0.125 & 0 & 0 \\ 0 & -.5 & 1.625 & -0.375 & 1 & 0 \\ 0 & 7 & 5.5 & -0.5 & 0 & 1 \end{array}\right]$$

This is done by multiplying row 1 by -3 and adding the product to row 2, and by multiplying row 1 by -4 and adding the product to row 3. Lines 3200 to 3270 accomplish this.

This completes the first cycle of steps 1, 2, and 3. The circle is the new position to pivot on. The process continues as before. Skipping a few steps:

Step: Pentultimate

$$\left[\begin{array}{ccc|ccc} 1 & 0 & 0 & 0.11 & 0.13 & -0.06 \\ 0 & 1 & 0 & 0.09 & -0.39 & 0.12 \\ 0 & 0 & 1 & -0.20 & 0.50 & 0.04 \end{array}\right]$$

This matrix finally emerges. Recall, however, that columns 1 and 3 were interchanged in the second step of the first cycle. Hence, rows 1 and 3 must now be switched (module 4):

Step: Last

$$X^{-1} = \begin{bmatrix} -0.20 & 0.50 & 0.04 \\ 0.09 & -0.39 & 0.12 \\ 0.11 & 0.13 & -0.06 \end{bmatrix}$$

Module 5 is easily changed to display X^{-1} differently, e.g., to show more decimal places or to accommodate a large number of rows and columns, say 8 or more.

Finally, as an example of the routine's speed, inverting a 10 by 10 identity matrix takes about 45 to 50 seconds. This is not very fast. However, some of the algorithm's time is spent checking columns for the highest key element and for switching rows, when necessary, in the next-to-final-form inverted matrix. Some programs omit this check. But when they do, a danger arises that X will not be inverted when it really can be. And further, the elements of the inverted matrix may be of lessened precision. The preference here is for effectiveness rather than speed. But Gauss, always the perfectionist whose motto was "Few, but ripe," might challenge us: "Can't we have both?"

[1]Lewis Carroll, **Alice's Adventures in Wonderland.**

```
10 REM GAUSS-JORDAN MATRIX INVERSION; B. FLYNN; WINTER 1981
20 REM MODULE 1:ENTER DATA
30 GOSUB 1000
40 REM MODULE 2:TACK IDENTITY MATRIX ONTO DATA MATRIX
50 GOSUB 2000
60 REM MODULE 3:BEGIN INVERTING MATRIX
70 GOSUB 3000
80 REM MODULE 4:SWITCH ROWS IN THE NEXT-TO-FINAL-FORM MATRIX, IF APPROPRIATE
90 GOSUB 4000
100 REM MODULE 5:DISPLAY INVERSE MATRIX
110 GOSUB 5000
120 END
```

```
1000 REM MODULE 1
1010 DEFINT I-R:DEFDBL B,C,D,H,X
1020 CLS:PRINT"GAUSS-JORDAN MATRIX INVERSION WITH COMPLETE PIVOTING.
1030 INPUT"PLEASE ENTER THE NUMBER OF ROWS (COLUMNS) IN THE MATRIX";K
1040 DIM X(K,2*K),M(K)
1050 REM ENTER DATA
1060 FOR I=1TO K
```

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```
1070 CLS:PRINT"PLEASE ENTER DATA.
1080 PRINT"ROW #";I;":"
1090 FOR J=1TO K
1100 PRINT"COL #";J:INPUT X(I,J)
1110 NEXT J,I
1120 RETURN
2000 REM MODULE 2
2010 REM ASSIGN 1,2,...,K TO VECTOR M
2020 FOR I=1TO K
2030 FOR J=I TO K
2040 X(I,K+J)=0:X(J,I+K)=0
2050 NEXT J
2060 X(I,K+I)=1:M(I)=I
2070 NEXT I
2080 RETURN
3000 REM MODULE 3
3010 FOR Q=1TO K
3020 IF Q=K THEN 3140
3030 REM SEARCH WOULD-BE KEY ELEMENTS FOR HIGHEST ABSOLUTE VALUE
3040 HE=ABS(X(Q,Q)):HROW=0:HCOLUMN=0
3050 FOR I=1TO K-Q
3060 DUMMY=ABS(X(Q+I,Q)):IF DUMMY>HR THEN HR=DUMMY:R=Q+I
3070 DUMMY=ABS(X(Q,Q+I)):IF DUMMY>HC THEN HC=DUMMY:C=Q+I
3080 NEXT I
3090 IF HE>=HR AND HE>=HC THEN 3140
3100 REM SWITCH ROWS, IF APPROPRIATE
3110 IF HR>=HC:FOR J=1TO 2*K:HOLD=X(R,J):X(R,J)=X(Q,J):X(Q,J)=HOLD:NEXT J
3120 REM SWITCH COLUMNS, IF APPROPRIATE
3130 IF HR<HC:FOR J=1TO K:HOLD=X(J,C):X(J,C)=X(J,Q):X(J,Q)=HOLD:NEXT
     J:H1=M(Q):M (Q)=M(C):M(C)=H1
3140 REM ADJUST KEY ROW
3150 B=X(Q,Q)
3160 IF B=0 PRINT"SINGULAR MATRIX":END
3170 FOR J=Q TO 2*K
3180 X(Q,J)=X(Q,J)/B
3190 NEXT J
3200 REM ADJUST REMAINING ROWS
3210 FOR L=1TO K
3220 IF L=K AND K=Q THEN 3280
3230 IF L=Q THEN L=L+1
3240 D=X(L,Q)
3250 FOR J=Q TO 2*K
3260 X(L,J)=X(L,J)-D*X(Q,J)
3270 NEXT J
3280 NEXT L,Q
3290 RETURN
4000 REM MODULE 4
4010 FOR I=1 TO K
4020 C=0
4030 FOR J=1 TO K
4040 IF M(J)=I THEN C=J
4050 NEXT J
4060 IF C<>I THEN FOR L=1TO K:HOLD=X(I,K+L):X(I,K+L)=X(C,K+L):X(C,K+L)=HOLD:NEXT
 L:H1=M(I):M(I)=M(C):M(C)=H1
4070 RETURN
5000 REM MODULE 5
5010 CLS
5020 FOR I=1TO K
5030 FOR J=1TO K
5040 PRINT USING"##.## ";X(I,K+J);
5050 NEXT J:PRINT
5060 NEXT I
5070 RETURN
```

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Budgeting On The Apple

William R. Swinyard
Provo, UT

When I sat down at one of the University's dozens of Apples six weeks ago, someone had to show me where the on/off switch was. But I learned fast and, within a few weeks, I was doing pretty well at what I believed the Apple to be best at. I had maintained several "high score" records on Apple Invaders ... I was terrific at judging angle and windspeed in the Bombs game ... and I was even learning how to back away from brick walls in Maze. But I had not entered even one real line of programming.

One other thing I did discover, though, was how ... well, *nice* the Apple is. True, I had spent a little programming time on our DEC installation (and a *lot* of time on it using canned analytical software packages), but I always felt inhibited about getting too intimate with that machine because of its so formal, even intimidating, way of speaking — or should I say "shouting" — back. "FATAL PROCESSING ERROR. ILLEGAL CHARACTER IN DATA (K) [OCTAL 113] UNIT=8/ACCESS= SEQUIN/MODE=ASCII," was typical of the helpful way the DEC had about it. What a contrast with the Apple! It almost seemed to *invite* me to stay with it just a bit longer, and even to try running a few little programs on it.

And so I did. This article is about one of the first. It simply permits the user to enter a monthly income figure then displays a budget, along with the discrepancy between the budget and the income. It has a few nice touches, I think. Program requests for budget changes are highlighted in a new budget display, there is a short subroutine to align the decimal points, and percentages of total budget are also displayed.

Briefly, here are what the sections of the program do:

Line 115 — Displys the title of the program on an otherwise blank screen for a few seconds.

Line 120 — Requests monthly income information.

Lines 240-570 — Lists out, with illustrative budget figures, the items appropriate for *my* budget. Yours may be different, and you will need to change the program listing where appropriate.

Lines 600-680 — Prints the output headings, the budget name and corresponding value, the total budget figure, and the deviation between income and budget.

Lines 690-775 — The above information is displayed for about 10 seconds, followed by requests for updated expenditures originating in these lines. If updates are made, a new display table is printed which highlights (with underlining) the updated expenditure figure.

Lines 780-830 — A subroutine for lining up the decimals.

Lines 835-900 — Prints out the fully revised expenditures table, but accompanied this time with percentage allocations of budget, if requested.

The tabular display has been arranged to just fit into the Apple screen, so a line printer is unnecessary to get full use of this program.

Several refinements to the program might make it yet more appealing for your use, but seemed like overkill for me. With little modification the program could be designed to display budget values and percentages in the first tabular display — only one extra FOR-NEXT loop would be required. The program could easily be rewritten to make it interactive in budget-area development, though this seems unnecessary for a family whose budget allocations typically fall into the same areas each month. Or the program could be easily modified to accommodate input of *gross* monthly income, and incorporate federal and state tax withholding information, FICA withholding, tax-deferred income, etc. by building in the appropriate withholding proportions (income level, number of exemptions, and claimed marital status would be required as input values). However, since Uncle Sam has been changing the FICA rates annually, I passed this improvement by in favor of the relative permanency of the program as it now stands. Still, if you are interested in simulating the effect of increasing or decreasing your number of exemptions, this modification could be worthwhile.

Figure 1 shows the initial output display after entering a net monthly income figure. Figure 2 shows the output following the program's request for any changes. You can see that the change was

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made ("Med. and Dent.") and was highlighted with a short underline. After all changes have been made, the program gives you the option of requesting percentage breakdowns by budget area. This table is shown in Figure 3, which concludes the budgeting routine.

There is nothing very sophisticated about any of this, but the program has been a useful one for our family; there is nothing quite so engaging as seeing an inanimate "object" spring to life at your bidding. And the program was just a lot of fun to write. Let me know of your improvements of it.

Program 1.

```
10  REM  ************************
20  REM  *HOME BUDGETING PROGRAM*
30  REM  *CREATED JUNE 10, 1981 *
40  REM  *BY WILLIAM R. SWINYARD*
50  REM  *SHOWS AND CALCULATES  *
60  RÉM  *DISTRIBUTION OF INCOME*
70  REM  *INTO BUDGET CATEGORIES*
80  REM  *INCLUDING REQUESTS FOR*
90  REM  *UPDATED EXPENDITURES &*
100  REM *FOR PERCENTAGE DISPLAY*
110  REM ************************
115  HOME : PRINT : PRINT : PRINT
     : PRINT : PRINT : PRINT  TAB(
     10)"HOME BUDGETING PROGRAM":
      FOR I = 1 TO 1000: NEXT I: HOME
120  INPUT "WHAT IS NET MONTHLY I
     NCOME? ";SALARY
130  PRINT
232  DIM DD(17),DD$(17)
236  REM  **BUDGETED ITEMS IN LIS
     TING **
237  REM  **TO CHANGE BUDGET YOU
     MUST ACCESS THE LISTING DIRE
     CTLY**
240 DD$(1) = "HOUSING"
250 DD(1) = 500
260 DD$(2) = "HEAT"
270 DD(2) = 50
280 DD$(3) = "LIGHTS"
290 DD(3) = 35
300 DD$(4) = "DONATIONS"
310 DD(4) = 50
320 DD$(5) = "TELEPHONE"
330 DD(5) = 35
340 DD$(6) = "LOAN PAYMNTS"
350 DD(6) = 100
360 DD$(7) = "MED & DENT"
370 DD(7) = 35
380 DD$(8) = "GROCERIES"
390 DD(8) = 300
400 DD$(9) = "AUTO MAINT."
410 DD(9) = 25
420 DD$(10) = "GASOLINE"
430 DD(10) = 100
440 DD$(11) = "INSURANCE"
450 DD(11) = 50
.
470 DD$(12) = "CLOTHING"
480 DD(12) = 50
490 DD$(13) = "EDUCATION"
500 DD(13) = 20
510 DD$(14) = "HOME REPAIR"
520 DD(14) = 50
530 DD$(15) = "RECREATION"
540 DD(15) = 60
550 DD$(16) = "SAVINGS"
560 DD(16) = 50
570 DD$(17) = "OTHER"
580  REM  ***PRINT OUTPUT***
590  HOME
600  PRINT "MONTHLY INCOME",SALARY
605  PRINT "=============="
610 SUM = 0
620  FOR I = 1 TO 17
630  GOSUB 790: PRINT  TAB( A)I; TAB(
     4)DD$(I); TAB( B)DD(I)
635  IF I = TT THEN  PRINT  TAB(
     18)"---"
640 SUM = SUM + DD(I)
650  NEXT I
660  PRINT
670  PRINT "TOTAL BUDGETED =    ";SUM
680  PRINT "NET AFTER BUDGET = ";
     SALARY - SUM
685  IF Q = 1 THEN  GOTO 910
690  FOR X = 1 TO 10000: NEXT X
700  PRINT "******************"
710  REM  ***CHANGES***
730  INPUT "WAS SPENDING OTHER TH
     AN ABOVE? ";B$
740  IF B$ = "N" THEN  GOTO 840
750  INPUT "TYPE ITEM NUMBER, ACT
     UAL EXPEND. ";I,X
760 TT = I
770 DD(I) = X
775  GOTO 600
780  REM SUBROUTINE FOR DECIMAL PLACEMENT
790 A = 2:B = 19:C = 25
800  IF I > 9 THEN A = A - 1
810  IF DD(I) < 10 THEN B = B + 1
820  IF DD(I) >  = 100 AND DD(I) <
     1000 THEN B = B - 1
825  IF DD(I) >  = 1000 THEN B =
     B - 2
827  IF PC > 9 THEN C = C - 1
830  RETURN
835  REM  ROUTINE TO COMPUTE & PRINT %'S
840  INPUT "WANT %'S OF BUDGET? ";C$
850  IF C$ = "N" THEN  GOTO 910
855  PRINT : PRINT
860  FOR I = 1 TO 17
```

```
865 Q = 0
870 PC = (DD(I) / SUM) * 100
880  GOSUB 790: PRINT  TAB( A)I, TAB(
     4)DD$(I); TAB( B)DD(I), TAB(
     C) INT (PC);"%"
890  NEXT I
895 Q = 1
900  GOTO 660
910  END
```

Figure 1.

```
          HOME BUDGETING PROGRAM
WHAT IS NET MONTHLY INCOME? 1600

MONTHLY INCOME   1600
==============
 1 HOUSING         500
 2 HEAT             50
 3 LIGHTS           35
 4 DONATIONS        50
 5 TELEPHONE        35
 6 LOAN PAYMNTS    100
 7 MED & DENT       35
 8 GROCERIES       300
 9 AUTO MAINT.      25
10 GASOLINE        100
11 INSURANCE        50
12 CLOTHING         50
13 EDUCATION        20
14 HOME REPAIR      50
15 RECREATION       60
16 SAVINGS          50
17 OTHER             0

TOTAL BUDGETED =    1510
NET AFTER BUDGET = 90
```

Figure 2.

```
WAS SPENDING OTHER THAN ABOVE? Y
TYPE ITEM NUMBER, ACTUAL EXPEND. 7,75
MONTHLY INCOME   1600
==============
 1 HOUSING         500
 2 HEAT             50
 3 LIGHTS           35
 4 DONATIONS        50
 5 TELEPHONE        35
 6 LOAN PAYMNTS    100
 7 MED & DENT       75
 8 GROCERIES       300
 9 AUTO MAINT.      25
10 GASOLINE        100
11 INSURANCE        50
12 CLOTHING         50
13 EDUCATION        20
14 HOME REPAIR      50
15 RECREATION       60
16 SAVINGS          50
17 OTHER             0

TOTAL BUDGETED =    1550
NET AFTER BUDGET = 50
```

Figure 3.

```
WAS SPENDING OTHER THAN ABOVE?
WANT %'S OF BUDGET? Y
 1 HOUSING         500    32%
 2 HEAT             50     3%
 3 LIGHTS           35     2%
 4 DONATIONS        50     3%
 5 TELEPHONE        35     2%
 6 LOAN PAYMNTS    100     6%
 7 MED & DENT       75     4%
 8 GROCERIES       300    19%
 9 AUTO MAINT.      25     1%
10 GASOLINE        100     6%
11 INSURANCE        50     3%
12 CLOTHING         50     3%
13 EDUCATION        20     1%
14 HOME REPAIR      50     3%
15 RECREATION       60     3%
16 SAVINGS          50     3%
17 OTHER             0     0%

TOTAL BUDGETED =    1550
NET AFTER BUDGET = 50
```

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Named GOSUB's

M.R. Smith

In a previous article, (**COMPUTE!** #12), I showed how to use the Ampersand instruction in Applesoft to permit instructions of the form:

```
10 FIRST=1000
20 DEUX=2000
30 THIRD=3000
40 & GOSUB FIRST
50 & GOTO THIRD
```

In Applesoft BASIC, named GOSUB's and GOTO's are not normally allowed.

The machine language program given in that article did not allow the use of names in ON... GOSUB or ON...GOTO statements. The following machine language program rectifies that problem.

The following statements are now permitted:

```
60 FOURTH=4000
70 NUM=INT(1+RND(2))
80 & ON NUM GOSUB FIRST, DEUX
90 & ON NUM GOTO THIRD, FOURTH
```

Using statements of this form makes it much easier to follow programs containing a large number of subroutines. In addition, it is much easier to remember the name of a subroutine rather than its number.

I am presently working on an extension to these statements to allow the passing of variables to a subroutine. That means statements of the form:

```
& GOSUB CALCULATE(A, B, C)
```

allowing the power of FORTRAN subroutine calls.

Description Of The BASIC Program

Line 20. Load the machine language program.

Line 20–100. Demonstrates the & GOSUB and & GOTO statements.

Line 110–180. Demonstrates the & ON... GOSUB and & ON...GOTO statements.

Lines 1000–3500. Demonstration subroutines and statements.

Lines 5000–6160. This subroutine loads and checks the machine language program. Every 17th number is the simple sum of the previous 16 numbers. This allows the entry of the numbers to be checked. The machine language program can be saved using the instruction:

```
BSAVE NAMED.GO,A$300,L$88
```

and called into your programs using the instruction:

```
10 PRINT CHR$(4);"BRUN NAMED.GO"
```

before any call to the ampersand (&) statements are made.

Program 1.

```
 300.387

0300- A9 4C 8D F5 03 A9 10 8D
0308- F6 03 A9 03 8D F7 03 60
0310- C9 B0 F0 0D C9 AB F0 29
0318- C9 B4 F0 31 A2 10 4C 12
0320- D4 20 B1 00 A9 03 20 D6
0328- D3 A5 B9 48 A5 B8 48 A5
0330- 76 48 A5 75 48 A9 B0 48
0338- 20 B7 00 20 44 03 4C D2
0340- D7 20 B1 00 20 7B DD 20
0348- 52 E7 4C 41 D9 20 B1 00
0350- 20 F8 E6 48 C9 B0 F0 0D
0358- C9 AB F0 09 C9 AF D0 BC
0360- 68 20 B1 00 48 C6 A1 D0
0368- 04 68 4C 10 03 A5 A1 48
0370- 20 B1 00 20 7B DD 20 52
0378- E7 20 B7 00 C9 2C D0 05
0380- 68 85 A1 D0 E0 68 68 60
*
```


Program 2.

```
1   REM  M. R. SMITH
2   REM  MAY 1981
3   REM
10   REM  LOAD THE ROUTINE - NORMAL
     GOSUB
20   GOSUB 5000
30   REM  ESTABLISH NAMES OF THE SUBROUTINES
40 FIRST = 1000:DEUX = 1500:THIRD = 2000
50 FOURTH = 2500:FVTH = 3000:SIXTH = 3500
60   REM  DEMONSTRATE NAMED GOSUB'S
70   &  GOSUB FIRST
80   &  GOSUB DEUX
90   REM   DEMONSTRATE   NAMED GOTO
100   &  GOTO FOURTH
110   REM   DEMONSTRATE   NAMED ON...GOSUB
120 NUM =  INT (1 + 3 *  RND (1))
130   &  ON NUM GOSUB FIRST,DEUX,THIRD
140   REM  DEMONSTRATE    NAMED ON...GOTO
150   FOR J = 1 TO 1000: NEXT : REM  DELAY
160 NUM =  INT (1 + 3 *  RND (1))
170   &  ON NUM GOTO FOURTH,FVTH,SIXTH
180   STOP
190   REM
970   REM  DUMMY SUBROUTINES AND LINES
980   REM
990   REM  FIRST SUBROUTINE
1000   PRINT : PRINT "IN SUBROUTINE FIRST": RETURN
1490   REM  SECOND SUBROUTINE
1500   PRINT : PRINT "IN A DIFFERENT NAMED SUBROUTINE"
1510   PRINT "IN SUBROUTINE DEUX": RETURN
1990   REM  THIRD SUBROUTINE
2000   PRINT : PRINT "IN SUBROUTINE THIRD": RETURN
```

```
2490  REM  LINE CALLED FOURTH
2500  PRINT : PRINT "LINE CALLED FOURTH": GOTO 120
2990  REM  LINE CALLED FVTH
3000  PRINT : PRINT "LINE CALLED FVTH": GOTO 150
3490  REM  LINE CALLED SIXTH
3500  PRINT : PRINT "LINE CALLED SIXTH": GOTO 150
4980  REM
4990  REM   LOAD IN MACHINE LANGUAGE PROGRAM
5000 LOW = 768:HIGH = 903
5010 OK = 1
5020  REM  LOAD IN GROUP OF SIXTEEN
5030  FOR J = LOW TO HIGH STEP 16
5040 CHECK = 0
5050  FOR K = J TO J + 15
5060  READ IT
5070 CHECK = CHECK + IT
5080  NEXT K
5090  REM   CHECK IF CHECKSUM OKAY
5100  READ SUM
5110 L$ = "OKAY": IF CHECK <  > SUM THEN L$ = "BAD":OK = 0
5120  PRINT L$
5130  NEXT J
5140  IF OK = 0 THEN  STOP
5150  REM  THINGS ARE OKAY - LOAD INTO MEMORY
5160  RESTORE : FOR J = LOW TO HIGH STEP 16
5170  FOR K = J TO J + 15: READ IT: POKE K,IT: NEXT K
5180  READ IT: NEXT J
5190  PRINT "BLOAD OKAY": PRINT : PRINT
5200  REM     SET THE AMPERSAND VECTOR
5210  REM  NOT NEEDED IF CALLED BY BRUN STATEMENT
5220  CALL 768: RETURN
6000  DATA 169,76,141,245,3,169,16,141,246
6010  DATA 3,169,3,141,247,3,96,1868
6020  DATA 201,176,240,13,201,171,240,41,201
6030  DATA 180,240,49,162,16,76,18,2225
6040  DATA 212,32,177,0,169,3,32,214,211
6050  DATA 165,185,72,165,184,72,165,2058
6060  DATA 118,72,165,117,72,169,176,72,32
6070  DATA 183,0,32,68,3,76,210,1565
6080  DATA 215,32,177,0,32,123,221,32,82
6090  DATA 231,76,65,217,32,177,0,1712
6100  DATA 32,248,230,72,201,176,240,13,201
6110  DATA 171,240,9,201,175,208,188,2605
6120  DATA 104,32,177,0,72,198,161,208,4
6130  DATA 104,76,16,3,165,161,72,1553
6140  DATA 32,177,0,32,123,221,32,82,231
6150  DATA 32,183,0,201,44,208,5,1603
6160  DATA 104,133,161,208,224,104,104,96,0,0,0,0,0,0,0,0,1134
```

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Part II:

A Tape "EXEC" For Applesoft:

Loading Machine Language Programs

Sherm Ostrowsky
Goleta, CA

Loading ML With BASIC

This has been an example of the simplest kind of EXEC file; it merely loads and runs a single ML program. Let's extend the procedure a bit more, now, and load both a ML program and an Applesoft program together. One of the most effective advanced programming tools has always been to combine higher level language (e.g., Applesoft) and lower level language (i.e., machine language) routines so that each does the jobs for which it is best suited. But it has long been a problem, much debated and written about in computing magazines, to get them both into the computer from external storage (i.e., cassette tape in this case).

Short ML routines can be included in DATA statements in your Applesoft program and POKEd into memory by a READ - POKE loop. The Lam technique, using strings rather than DATA statements, has also been used to accomplish this. But for ML subroutines of any significant length, this process takes an excruciatingly long time. Some articles have suggested "hiding" long ML routines in front of or behind Applesoft programs by changing certain "pointers" in memory before saving and after loading, to fool Applesoft into believing that they are all parts of one long BASIC program. For one reason or another, none of these techniques has proven very satisfactory.

With the advent of disk systems, this problem was at least solved for disk owners. They just write an EXEC program that loads an Applesoft program and ML subroutines individually stored on the disk. The EXEC program and DOS know where to find them (on the disk) and where to put them (in memory). It is all done automatically. Very simple — *if* you have a disk system. If not ... well, until now you were just sort of out of luck.

Now we cassette users can do the same kind of thing. It takes longer to load, named files are not available, and a little more work is required to arrange everything on the tape and set up the EXEC file (i.e., the loader) to read them and put them where they need to go, but this only has to be done once for any given set of cooperating programs. Thereafter, loading the whole group is just as simple as typing LOAD.

Let me give an example based on a previous article of mine "Clearing the Apple II Low-Resolution Graphics Screen," **COMPUTE!** #10. For those who may not have access to this issue, I'll give all the essential details as they are needed.

Consider the following short Applesoft program that simply calls a subroutine to fill the Low-Resolution screen with a random pattern of colors, asks you to select one of the sixteen low-res color numbers (0–15), then calls a ML subroutine which clears the screen to the selected color in an instantaneous flash. Here is the program:

... load both a ML program and an Applesoft program together.

```
  10 REM FLASH-CLEAR DEMO
  20 GOSUB 1000
  30 VTAB 23
  40 INPUT "SELECT COLOR (0-15):" ;C
  50 COLOR=C
  60 CALL 800
  70 FOR PAUSE = 0 TO 2000: NEXT: GOTO 20
  80 END
1000 GR
1010 FOR I=0 TO 39
1020 FOR J=0 TO 39
1030 COLOR=1 + INT (15 * RND (1))
1040 PLOT J,I
1050 NEXT J,I
1060 RETURN
```

Briefly, line 20 calls subroutine 1000 which fills the screen with random color squares. Line 30 positions the cursor in the text area below the graphics screen. Line 40 asks for your selection and line 50 sets it up to be used in the clearing operation which is performed when line 60 calls the ML subroutine which begins at location (decimal) 800. Line 80 pauses briefly and then loops around to try it all again.

In the original version, the flash-clear subroutine at 800 was stored as DATA within the main program and POKEd into memory using a READ - POKE loop; it's short enough so that this procedure is really quite adequate. But, for the purpose of this demonstration, we will have the Exec-Loader read the ML program in from tape and put it into memory where it is supposed to be. To see how to create the total tape package, you'll have to get the ML program into memory first somehow. The easiest way is to use the Monitor. Do this first, before you enter either the Applesoft loader or the Applesoft demo program. Type CALL - 151, and when you see the asterisk prompt ("*") type:

```
320:A5 30 A0 78 20 2D 03 A0 50 20 3D 03
60 88 99 00 4 99 80 4 99 00 5 99 80 5 D0
F1 60 88 99 00 6 99 80 6 99 00 7 99 80
7 D0 F1 60 (return)
```

Do it exactly as written, with a space between each pair of digits. Just keep right on typing, past the ends of lines, without stopping until you reach the end. The ML program is now in its place in memory. But where we want it to be is on tape.

The order in which things have to go on the tape is this: first the Applesoft loader, then the ML subroutine, and finally the Applesoft demo program. The demo program has to come last because, after the Exec-Loader program (which I will present below) has executed a LOAD for an Applesoft program (here, the demo), it will automatically be deleted out of memory. It is a standard part of an Applesoft LOAD to clear out any pre-existing Applesoft programs first and, although this can be circumvented, there is no reason to go to the trouble of doing so in this case. So the demo must be loaded last because the loader will cease to exist in memory at that time.

This loader is an extension of the one shown before, but with most of the "bells-and-whistles" left off to make it shorter. Aside from changing the memory locations in string Y$ to correspond to the present ML subroutine, the only other change made from the previous loader is the addition of a LOAD command for the demo program.

```
10 REM ML + AS LOADER
20 Y$="320.34CR D823G"
30 FOR I=1 TO LEN (Y$): POKE 511+I, ASC
   (MID$ (Y$,I,1)) + 128: NEXT
40 POKE 72,0: CALL - 144
50 POKE 214,85
60 LOAD
70 END
```

This version has no unnecessary features. If there's a loading error, you'll find out about it when the system prints "ERR" on the screen. Since it takes only a short time to load these little programs, there is no need to give you a message so you'll know what is going on during the loading process.

Now here's the procedure, written down in the form of an algorithm: a series of listed steps to be followed one by one.

1. Make sure that the ML subroutine is in memory locations 320 through 34C, as indeed it will be if you typed it in using the Monitor as described above.
2. Go into Applesoft (from the Monitor, type CONTROL-C (return)), and type in the Loader program, as given above.
3. Type: POKE 82,128
4. Start your cassette recorder in RECORD mode and type SAVE (ret). When the loader has been saved, stop the tape, but *do not rewind*.
5. Back to the Monitor (CALL -151). Type:
   320.34CW restart recorder in

RECORD mode, *then* press (return). Stop recorder when finished, but again do not rewind.

6. Back to Applesoft. Type NEW. Type in the demo program. SAVE it in the regular way.

That's it. To check it out, rewind the tape, turn your Apple off and back on (to make sure memory is cleared out), and LOAD the tape in the usual Applesoft manner. You'll hear five beeps before it finishes loading, but, in the end, it stops just the same as any regular Applesoft tape. You run the program by typing RUN.

... we have just written the tape equivalent of an EXEC file which performs the equivalent of a BLOAD.

Does this seem like a lot of trouble to go through just to load a short machine language subroutine along with an Applesoft program? Of course it is. But suppose the ML program were a lot longer. I have a "Print Using" subroutine that is over 1000 bytes long. Have you any idea how many DATA statements it would need to POKE all that into memory from within my calling program, and how long it would take to do it? The fact is that, before the method I have been demonstrating came along, there was no good way at all for a tape user to put long ML subroutines into his Applesoft programs. Only disk users could have that convenience, with their "BLOAD" and "EXEC" commands. Well, we have just written the tape equivalent of an EXEC file which performs the equivalent of a BLOAD. And that's far from all. The possibilities seem endless. I don't want this article to seem the same, so I'll mention just one more idea and then leave you to enjoy cooking up others on your own.

Protecting Programs In Memory

COMPUTE! #11 had an article (page 76) on resolving the memory conflicts between Applesoft programs and the locations of the two hi-res graphics screen memories. The problem is that a really long Applesoft program, starting at its usual location of $0801 (which is decimal 2049) can easily grow to overflow into the first hi-res screen starting at $2000 (decimal 8192), and some can even intrude into the second hi-res screen starting at $4000. An equivalent problem can occur if you want to make use of the second page of lo-res graphics (did you know that there is a second page?) which unfortunately starts at $0800 and thus *always* conflicts with an Applesoft program.

Among the solutions mentioned in the article, the one which seems to me to be the most flexible is to move the whole Applesoft program, variables and all, to a starting location above the memory region you want to protect from interference. For example, if you just want to use page two of lo-res graphics, it would suffice to move the program up so that it begins at $0C01 (decimal 3073). If you want to use both hi-res graphics pages, on the other hand, you'd have to move the program all the way up to $6001 (decimal 24566), assuming you even have that much memory to play around with.

As a matter of fact, you don't actually "move" an Applesoft program around in memory. Although this can be done, it would require doing some repair work on pointers and relinking the program lines which is too technical for most casual users to bother with. It isn't necessary. All you have to do is arrange to have the program go directly into the desired memory locations at the time it is being read in from tape. That is a much simpler procedure, requiring only a couple of POKEs from the keyboard before typing LOAD. Even so, that puts us right back into the situation we were in with ML programs: you can't just type LOAD — you have to refer to a set of written directions in order to get the program to load right. At least you do if your memory is as poor as mine is at recalling such details without notes. And there's another point: if the program is to be usable by a non-computerist, how would you instruct such a person in the loading procedure?

So, here's another job for the Tape-EXEC, alias a loader program. Let the loader do the POKEs for you. That way, once you have gone to a little extra trouble to set the tape up right to begin with, you (or anybody) can forever after just type LOAD and let the computer handle the details. If you think it likely that you might want to use the program more than once or twice, then the extra preparations are worth the trouble in the long run.

A loader for a single Applesoft program, to be entered into memory starting at (say) $0C01, would look something like this:

```
10 REM HIGH MEMORY LOADER
20 POKE 104,12: POKE 3072,0
30 POKE 214,85
40 LOAD
50 END
```

The algorithm for preparing the loader-leader and tape is similar to the one given for the Applesoft/ML conjunction; just omit steps two and five.

If you want the program to load above hi-res page 1, just change line 20 to:

```
20 POKE 104,64: POKE 16384,0
```

If you want it to load above hi-res page 2, change line 20 to:

```
20 POKE 104,96: POKE 24576,0
```

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Switching Cleanly From Text To Graphics

Brian Nakagawa
Fresno, CA

It is very distracting to watch the Apple II switch from TEXT to GRAPHICS mode or vice versa. Colored squares and grey lines appear briefly when switching from TEXT to LORES graphics while a screen full of inverse characters, usually @ signs, appear when switching from LORES graphics to TEXT. In going from TEXT to HIRES graphics, one sometimes sees the previous HIRES display flash on the screen then dissolve away. In most programs, the extra flash of graphics or characters is merely a distraction. However, to switch cleanly between TEXT and GRAPHICS mode would give the appearance of a more polished program.

This article will show the routines that switch cleanly from TEXT to LORES or HIRES graphics using Applesoft commands and machine level routines already available on the Apple II.

The commands given below can be typed in the immediate mode or run in a program.

TEXT To HIRES Graphics

The simplest way to turn on page 1 of HIRES graphics is to use the command HGR. This first turns the screen to that page then erases the graphics displayed. Type in the following sequence of commands to see this.

```
VTAB 24
HGR
HCOLOR=3
HPLOT 40,140 TO 240,60 TO 40,60 TO 240,140 TO
   140,20, TO 40,140
TEXT
HGR
```

Notice that when you typed in the last HGR the star reappeared briefly then was erased.

Now try these commands. (It is assumed that you are still in HIRES graphics.)

```
HPLOT 40,140 TO 240,60 TO 40,60 TO 240,140 TO
   140,20 TO 40,140
TEXT
POKE 230,32: CALL 62450: HGR
```

Notice that the screen went blank without the brief appearance by the star.

POKE 230,32 sets the HIRES page pointer to page one without changing the current screen display. CALL 62450 is a machine language routine in APPLESOFT that clears the HIRES page indicated by memory location 230. HGR then turns on page one of HIRES graphics.

HIRES page two can be switched to using similar commands. Use the above example and substitute "HGR2" for "HGR" and "POKE 230,64" for "POKE 230,32". Be aware that the text window at the bottom will not be seen.

Switching from HIRES graphics, page one or two, TEXT is easily accomplished typing in the "TEXT" command. If you wish to clear the text page first then use "HOME: TEXT".

TEXT To LORES Graphics

Fill the TEXT screen with text then type in the command "GR". The distracting display of grey lines and colored squares when switching from TEXT to LORES graphics can be avoided with the following commands. Fill the text screen with text before typing in the commands.

```
POKE 230,32: CALL 62450: HGR: CALL -1994: GR
```

If you wish to clear the text window at the bottom of the screen, type in "HOME" or add it to the end of the string of commands as follows:

```
POKE 230,32: CALL 62450: HGR: CALL -1994:
GR: HOME
```

Notice that it is first necessary to clear HIRES page one and go into that page just as was done in the TEXT to HIRES discussion. CALL -1994 changes the text page to inverse @ signs and GR put the screen into LORES page one.

If you are still in LORES graphics type in "TEXT: HOME" which will return you to a clear TEXT page. Did you notice the flash of inverse @ signs? This does not happen all the time so it may be necessary for you to go back into LORES page one with the "GR" command then type in "TEXT: HOME" again.

To avoid this, type in the following commands:

```
GR
HOME: HGR: POKE 34,0: HOME: TEXT
```

GR puts the screen into LORES page one, HOME then clears the text window at the bottom, HGR puts the screen into HIRES page one which is assumed to be clear, POKE 34,0 sets the top of the text window to the top of the screen, HOME clears the text page, and TEXT puts the screen into text mode.

Disadvantages

The code to switch from text to graphics takes more memory and executes slower. You may have noticed the pause when switching between TEXT and GRAPHICS. In a program that switches between TEXT and GRAPHICS often, one can put the switching code in a subroutine to save memory.

The additional code and slightly slower execution speed to switch cleanly is a very small price to pay for the more polished appearance of a program.

References

All of the above commands are documented in the *Applesoft Basic Programming Reference Manual.* Selected commands and the page number they appear on are listed below. POKE 230,32 and POKE 230,64 are documented as general use high resolution graphics locations on page 141. Decimal location 230 is equal to hexadecimal $E6. CALL 62450 and CALL -1994 are on page 134 and POKE 34,0 is on page 29. ©

Interfacing The CCS 7710A Asynchronous Serial Card

Sam Bassett
San Francisco, CA

The following is a list of the connections needed to set up the DT127 to work with the California Computer Systems' 7710A Asynchronous Serial Interface Card for the Apple II:

Pin on the Male DB-25P Connector			DT127 25 pin Molex		
Color Pin	**Name**		**Name**	**Pin**	**Recommended**
				1	No contact
3	RD	------------------>	RD	2	Red
6	DSR	------------------>	DSR	3	Green
5	CTS	------------------>	CTS	4	Brown
20	DTR	----------------	RTS	5	Blue
4	RTS	----------------	DTR	6	White
2	TD<	----------------	TD	7	Orange
1,7	GND<	------------------>	GND	8	Black
				9-25	No Contact

The CCS Asynchronous Board is defined as a *D*ata *C*ommunications *E*quipment (DCE) terminal, and the signals at its DB-25S (female) connector are defined in the same way that a modem's would be.

The CCS board transmits its *outgoing* signal on Pin 3 (RD). This must be connected to the DT-127's *incoming* signal connector on the CCS board — Pin 2 (TD).

So far so good — we have information signals being passed back and forth from the printer to the Apple. There is a possible problem, however — the printer can only print so fast, and the Apple can generate and send characters much faster than the printer can print them. Most printers run from 10 to 55 characters per second, which is equivalent to 100 to 550 baud. The Apple can transmit at well over 20,000 baud — 2,000 characters per second. The DT127 has a 625 character buffer built in (expandable to 16K), but if the Apple is sending characters faster than the NEC can print (55 cps), the buffer gets full, characters are lost, and weird things happen to the text that was to be printed.

All is not lost, however — the definition of RS-232 includes several hardware *"handshaking"* signals, and the CCS 7710A (unlike the Apple Inc. Serial and Intelligent Interface Boards) is set up to recognize and use these signals. When the Printer signals that it has enough characters in its buffer, the CCS board will stop sending characters until the printer sends an "OK" signal.

The DT-127 signals that it is OK to send characters to its input on Pin 2 (RD) by making Pin 6 (Data Terminal Ready — DTR) on the Molex connector high — +3 to +12 volts. The CCS board monitors Pin 4 (Request To Send — RTS) to see if the peripheral is ready to receive another character. If Pin 4 goes Low (-3 to -12 volts), the 7710A will *not* send another character until it goes High again.

The CCS 7710A board signals the peripheral that it can accept a character through its Pin 2 (TD) by making its Pin 5 (Clear To Send — CTS) High. The DT-127 watches its Pin 4 (CTS) to see if it is OK to send a message to the computer. If this signal goes Low, it will not send any characters until it goes High again.

Pins 1 & 7 on the RS-232 connector are connected to Ground, so Pin 8 of the Molex must be connected to one or both of them.

The last two signals are not absolutely necessary, but it is well to hook them up so that nothing is left hanging, or unconnected.

The DT-127's Pin 5 (Request To Send — RTS) is not implemented — it should be High at all times. It should be connected to the CCS board's Pin 20 (Data Terminal Ready — DTR), which tells the Apple: "Yeah, boss, there is somebody out there."

The CCS board's Pin 8 is also permanently at +12 volts, so it should be left unconnected, so that it does not accidentally short to ground and shut down the Apple's power. Pins 9 to 25 (except 20) are not implemented on the CCS board, so they should not be connected to anything.

The CCS board can transmit at any baud rate from 50 to 19,200, and matches the DT-127 perfectly — be sure to check Page 2-1 in the CCS manual for the correct Baud Rate Selector Switch settings, and Page 5 of the DT-127 manual, so that the baud rates being used by both your Apple and your Sellum are the same. ©

THE ATARI® GAZETTE

Cassette Boot-Tape Generation

From DOS 2.0S Binary-Load File

Raymond W. Polone
SYZYGY Microware of Texas

The binary-load file is a very easy-to-use method of accessing 6502 machine code instructions for ATARI users. The Model CXL4003 ASSEMBLER EDITOR User's Manual provides a method, using BASIC, to enter object code from a cassette tape. This article introduces a BASIC program technique that permits a user to generate a short-inter-record gap bootable cassette tape from a binary-load file. Such a tape then provides the option of using a language cartridge (i.e. BASIC or ASSEMBLER) or booting in the program with no cartridge — and no DOS!

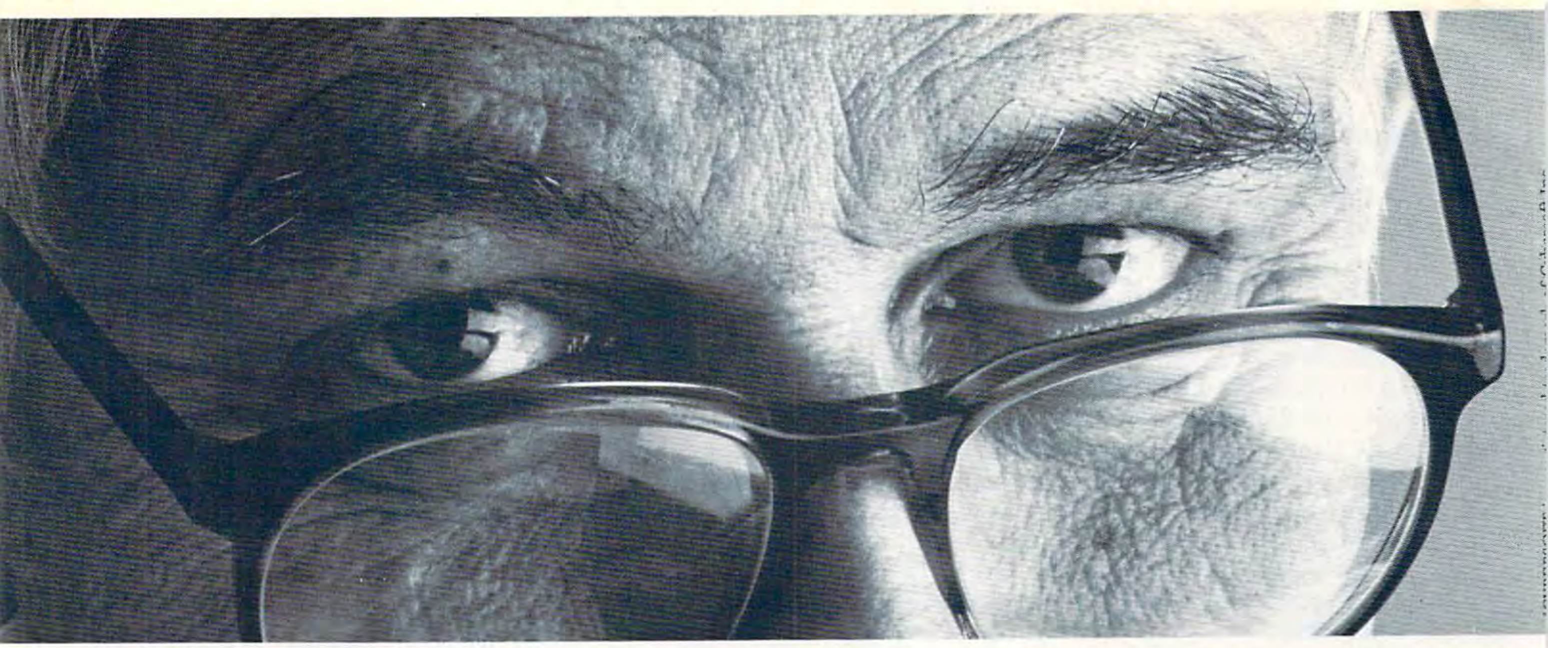
Program 1 is the ASSEMBLER/EDITOR text listing of an appropriate handler-record that must be written on the bootable tape. The initial byte of zero at statement 40 is a flag byte used by the OS in the cassette boot operation. I have assembled the second byte as a value one, but the BASIC program must provide the correct value. This byte is a count of 128 byte records in the boot process (i.e. a value of 1 indicates the boot is 128 bytes). A value of zero indicates the boot is 128*256 or 32,768 bytes. The BASIC program in Program 2 generates the correct SIZE value in statement 26. The object code of Program 1 is contained in DATA statement 56 of the BASIC program. (The BASIC program reads the DATA into BUF$ at statement 2.) The correct 128 count is then saved in BUF$ at statement 27.

The BASIC program must also provide the correct cassette boot load address in the value at statement 50 of Program 1. This BOOT value is calculated in statement 9 after the program has detected the two flag bytes of 255 ($FF) in the binary-load file. BUF$ is updated at statement 21 (the length of the boot-handler is subtracted from the binary-load file RAM location — this means that the boot-handler is appended in RAM at the beginning of the binary-load data).

The COLDSTART address or binary-load file-run address is provided to the value at statement 60 of the assembler routine by the BASIC program at statement 25 if the binary-load file is not load-and-go (no RUN-address appended to the binary-load file in locations $2E0 and $2E1). The user is prompted to enter the decimal value in statement 22. $A000 entered as decimal 40960 will result in the BASIC or ASSEMBLER cartridge gaining control (they must be resident, of course) following the cassette boot. The binary-load INIT address in $2E2 and $2E3 are not supported in this BASIC program, however, if the RUN-address has been appended to the file — that address will be used in statement 45 (RAY is a switch that indicates RUN-address has been found). The binary-load file must be a series of increasing RAM addresses! If there is a gap of addresses, the cassette boot will include the required block of zero RAM (ATARI hearts). (It may be desirable to DIMension BUF$ as the last variable in statement 1 to reduce the possibility that RAM used in the cassette put-character XIO operation will write extraneous data.) The only exception is the RUN-address which will not be included in the RAM block. (This cassette boot is not multistage.)

The remainder of Program 1 is the routine that will get control as a result of the cassette boot (POWER-ON with START depressed). BOOT? at RAM location 9 is set to 2 to indicate the cassette vector at RAM locations 2 and 3 is to be used on a SYSTEM-RESET. COLDSTART at RAM location $244 (decimal 580) is set to zero so that a SYSTEM-RESET will not result in a re-boot. The OS cassette-boot firmware stored the RUN-address at RAM vector locations $C (12) and $D (13). The reader may elect to modify the cassette SYSTEM-RESET vector to point to some WARM-START location or use the DOS vector at $A (10) and $B (11) by setting RAM location 9 to value 1. Additional features can be implemented by continuing the boot process to DOS by appropriate jumps to an OS location such as DOBOOT at $F2ED (62189).

DATA statement 57 in the BASIC program is the USR 6502 machine language routine that is used in statement 55. The ATARI IOCB use is adapted from the INTERFACE MODULE Opera-



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tor's Manual C015953 and modified for cassette so that the short-inter-record gap tape can be written. BASIC USR function is explained in detail in BASIC REFERENCE MANUAL C015307 along with some information on XIO PUT CHARACTERS. The C016555 User's Manual is of tremendous assistance in understanding the ATARI operation, also.

An adaptation of the Exclusive-Or function in Example 1 of Appendix 9 in the ASSEMBLER EDITOR User's Manual is used to illustrate the BASIC program of Program 2 in this article. The following program will generate a binary load-and-go file that will perform the logic function.

```
10 OPEN#1,8,0, "D:LOADNGO.BIN"
20 FOR I=1 TO 30:READ X:PUT#1,X:NEXT I
30 CLOSE#1
40 END
50 DATA 255,255,0,6,17,6
60 DATA 104,104,133,205,104,133,204,104,69
70 DATA 205,133,213,104,69,204,133,212,96
80 DATA 224,2,225,2,0,160
```

The DATA statement 50 is binary-load information that indicates the program will load at RAM location $600 (1536). Statements 60 and 70 are the BASIC USR function machine language program. Statement 80 is the RUN-address information for the load-and-go $A000 RUN-address for BASIC or ASSEMBLER cartridge. It is only necessary to RUN this program to generate an input file for the BASIC program in Program 2.

If the resulting cassette-boot tape is used with the BASIC cartridge, the familiar READY will appear on the screen after a successful cassette-boot "START, POWER-ON, RETURN" sequence. A BASIC direct POLONE = USR(1536,65535,0) :?POLONE and RETURN will provide the response "65535". If the cassette-boot sequence is used with the ASSEMBLER cartridge, it will be possible to disassemble the machine language code that was booted-in around $600 using the DEBUGGER. This illustration is only a very elementary use of the cassette-boot tape that can be generated from a binary-load file.

Program 1. Cassette boot from binary load file assembler/editor text listing.

```
0000          20        .PAGE
0000          30        *=    $2100      ;BASIC PROVIDES CASSETTE BOOT ADDRESS
2100 0001     40 HERE   .WORD $100       ;ZERO FLAG - BASIC PROVIDES 128 BLOCK
2102 0021     50        .WORD HERE       ;CASSETTE BOOT LOAD ADDRESS
2104 0021     60        .WORD HERE       ;BASIC PROVIDES  COLDSTART ADDRESS
2106 A93C     70        LDA   #$3C       ;STOP CASSETTE
2108 8D02D3   80        STA   PACTL
210B A902     90        LDA   #$2        ;INDICATE CASSETTE BOOT
210D 8509     0100      STA   $9         ;ENABLE CASSETTE SYSTEM RESET @ BOOT?
210F A900     0110      LDA   #0
2111 8D4402   0120      STA   COLDST     ;DISABLE COLDSTART
2114 A50C     0130      LDA   $C         ;OS SAVED COLDSTART DOSINI
2116 8502     0140      STA   $2         ;PREPARE SYSTEM RESET
2118 A50D     0150      LDA   $D
211A 8503     0160      STA   $3
211C 6C0C00   0170      JMP   ($C)
D302          0180 PACTL  =   $D302
0244          0190 COLDST =   $244
```

Program 2.

```
1 DIM RSTART$(7),YN$(3),NAME$(15):CORE=I
NT(0.89*FRE(0)):DIM BUF$(CORE),A$(114):R
AY=0
2 FOR I=1 TO 31:READ X:BUF$(I)=CHR$(X):N
EXT I
3 GRAPHICS 0:A$="DOS 2.0S BINARY-LOAD-DI
SK TO BOOT-TAPE by R. Polone (SYZYGY MIC
ROWARE OF TEXAS) REV1.0 1981":GOSUB 35
4 IOCB=16*2:FOR I=1 TO 7:READ X:RSTART$(
I)=CHR$(X):NEXT I
5 TRAP 5:A$="PLEASE ENTER BINARY LOAD FI
LE NAME     i.e. D1:LOADNGO.BIN (RETURN)"
:GOSUB 35:INPUT NAME$:TRAP 40000
6 TRAP 7:OPEN #2,4,0,NAME$:GOTO 8
7 ? :? "ERROR ";PEEK(195);" FILE ";CHR$(
34);NAME$;CHR$(34):CLOSE #2:END
8 TRAP 40000:GET #2,X:GET #2,Y:IF X<>255
 OR Y<>255 THEN A$="FILE NOT BINARY SAVE
 FORMAT":GOSUB 35:CLOSE #2:END
9 GET #2,X:GET #2,Y:FIRST=X+256*Y:BOOT=F
IRST-LEN(BUF$):GET #2,X:GET #2,Y:LAST=X+
256*Y:IF FIRST=736 AND LAST=737 THEN GOT
O 43
10 FOR I=FIRST TO LAST:GET #2,X:BUF$(LEN
(BUF$)+1)=CHR$(X):NEXT I
11 TRAP 18:GET #2,X:GET #2,Y:FIRSTA=X+25
6*Y:IF FIRSTA=65535 THEN GOTO 11
12 IF FIRSTA<=LAST AND FIRSTA<>736 THEN
GOTO 17
13 IF FIRSTA=736 THEN GET #2,X:GET #2,Y:
LASTA=X+256*Y:IF LASTA=737 THEN GOTO 44
14 IF FIRSTA=736 THEN GOTO 17
```

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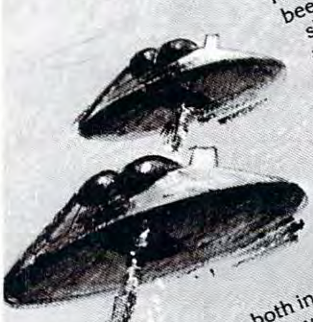

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```
15 FIRST=FIRSTA:X=FIRST-LAST-1:Y=LEN(BUF
$):IF X<>0 THEN BUF$(Y+X,Y+X)=CHR$(0)
16 GET #2,X:GET #2,Y:LAST=X+256*Y:X=LAST
-FIRST:IF X>=0 AND LEN(BUF$)+X<=CORE THE
N GOTO 10
17 TRAP 40000:A$="LOGICAL RECORD ERROR!"
:GOSUB 35:CLOSE #2:END
18 IF PEEK(195)=136 THEN TRAP 40000:GOTO
 21
19 IF PEEK(195)=5 THEN A$="RAM TOO SMALL
 IN THIS SYSTEM!  CANNOT GENERATE BOOT C
ASSETTE!":GOSUB 35:END
20 ? CHR$(155);" ERROR ";PEEK(195):END
21 CLOSE #2:X=INT(BOOT/256):Y=BOOT-256*X
:BUF$(3,3)=CHR$(Y):BUF$(4,4)=CHR$(X):IF
RAY=255 THEN GOTO 26
22 TRAP 22:A$="BINARY FILE IS NOT LOAD-A
ND-GO (NO RUN-ADDRESS APPENDED TO FILE)!
 PLEASE ENTER DECIMAL-ADDRESS":GOSUB 35
23 A$="$A000 HEX IS 40960 DECIMAL.":GOSU
B 35:INPUT AD
24 TRAP 40000:IF AD<0 OR AD>65534 THEN G
OTO 22
25 X=INT(AD/256):Y=AD-256*X:BUF$(5,5)=CH
R$(Y):BUF$(6,6)=CHR$(X)
26 SIZE=INT(LEN(BUF$)/128):IF SIZE*128<>
LEN(BUF$) THEN SIZE=SIZE+1
27 BUF$(2,2)=CHR$(SIZE)
28 A$="WRITE PREPARE BOOT TAPE!  BEEPS R
EQUIRE RETURN":GOSUB 35
29 AUX2=128:SIO=11:RW=8:LENTH=INT(LEN(BU
F$)/128)*128+128:BUF=ADR(BUF$):GOSUB 46:
CLOSE #2
30 TRAP 30:A$=" ANOTHER COPY OF BOOT TAP
E?  Y  N  RETURN":GOSUB 35:INPUT YN$:IF
YN$(1,1)<>"Y" AND YN$(1,1)<>"N" THEN GOT
O 30
31 TRAP 40000:IF YN$(1,1)="Y" THEN GOTO
28
32 TRAP 32:A$="ANOTHER BINARY DISK FILE?
  Y  N  RETURN":GOSUB 35:INPUT YN$:IF YN
$(1,1)<>"Y" AND YN$(1,1)<>"N" THEN GOTO
32
33 TRAP 40000:IF YN$(1,1)="Y" THEN RUN
34 END
35 X=PEEK(83)-PEEK(82)+1:I=X+1:Y=0:IF LE
N(A$)<1 THEN RETURN
36 IF LEN(A$)=X THEN ? A$:A$="":POKE 84,
PEEK(84)-1:RETURN
37 IF LEN(A$)<X THEN ? A$:A$="":RETURN
38 YN$=A$(I,I):IF YN$=" " OR YN$=CHR$(15
5) THEN I=I-1:? A$(1,I):A$=A$(I+2,LEN(A$
)):Y=255
39 IF Y=255 AND I=X THEN POKE 84,PEEK(84
)-1:GOTO 35
40 IF Y=255 THEN GOTO 35
41 I=I-1:IF I=0 THEN ? A$(1,X):A$=A$(X+1
,LEN(A$)):GOTO 35
42 GOTO 37
43 GOSUB 45:GOTO 9
44 GOSUB 45:GOTO 11
45 GET #2,X:BUF$(5,5)=CHR$(X):GET #2,X:B
UF$(6,6)=CHR$(X):RAY=255:RETURN
46 IF RW=8 THEN TRAP 47:LPRINT
47 TRAP 40000:OPEN #2,RW,AUX2,"C:"
48 POKE 832+IOCB+2,SIO
49 POKE 832+IOCB+4,BUF-(INT(BUF/256)*256
)
50 POKE 832+IOCB+5,INT(BUF/256)
51 POKE 832+IOCB+8,LENTH-(INT(LENTH/256)
*256)
52 POKE 832+IOCB+9,INT(LENTH/256)
53 POKE 832+IOCB+10,RW
54 POKE 832+IOCB+11,AUX2
55 RSTART=ADR(RSTART$):POLONE=USR(RSTART
,IOCB):RETURN
56 DATA 0,1,0,33,0,33,169,60,141,2,211,1
69,2,133,9,169,0,141,68,2,165,12,133,2,1
65,13,133,3,108,12,0
57 DATA 104,104,104,170,76,86,228
58 REM
59 REM -        FIGURE 2.  BASIC PROGRAM
 TO GENERATE CASSETTE BOOT
60 REM -                   FROM DOS 2.0S
 BINARY LOAD FILE
```

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Beware The RAMTOP Dragon

K. W. Harms
Danville, CA

You've just had a brilliant idea for a program which requires some protected memory. Perhaps a special display list or character set is needed, or maybe a direct access memory "file." This article explains how to set aside that memory so that nothing will fiddle with it. Further, we'll reveal the generally unknown habits of the RAMTOP Dragon and show you three ways to make sure he doesn't gobble up your data.

The Atari offers a simple way to control how memory is internally managed by the operating system. The *Atari Connection* (Premier Issue) discussed "moving" the top memory boundary. Jim Clark in **COMPUTE!** #14 showed how to move the lower boundary. Both methods protect memory from BASIC programs.

The map gives a very simple picture of Atari's memory management. Fixed memory boundaries are presented in decimal "addresses," but boundaries which vary according to the amount of memory in your machine or the program loaded at a particular time are given names such as "ramtop." The 400 and 800 both use the same system.

When you turn on the Atari with a BASIC cartridge, it takes a few seconds before "READY" to check out the machine and enter values for the boundaries into specific locations. PEEK allows you to look at those values. For instance, the value for RAMTOP is stored in address 106. The instruction "? PEEK(106)" will tell you where the Atari thinks the end of RAM is. Appendix I of the *Basic Reference Manual* explains that the value in 106 is in "pages" of 256 bytes. Multiplying number of pages times 256 gives the last address BASIC thinks it can use (e.g., a PEEK(106) of "32" equals an address of 8192 or "8K").

The 400/800 always places the display list and display data immediately below RAMTOP. If you alter the value in RAMTOP, the Atari will push the display list and display data "downward" in RAM. This reduces the space available for your program, but leaves free RAM above the new (fake) RAMTOP. Since the Atari doesn't know about this space, it doesn't use it, usually. This is the space usually considered "reserved" for you.

Program 1 shows how to lower RAMTOP by 4 pages (1024 bytes). Remember to issue a GRAPHICS command immediately after moving RAMTOP so that the display list and data are moved below the new RAMTOP. Since line 60 will clear the screen, write down the old amount of free RAM and RAMTOP. Comparing them to the new numbers from lines 80 and 90 will show that RAMTOP is now lower and that less space is available for programs. That extra memory is now above RAMTOP and "reserved" for your exclusive use. RAMTOP is reset only by the RESET switch (and powering down/up), so that successively RUNning Program 1 will keep lowering RAMTOP until you run out of memory.

Program 1.

```
10 ? "FREE RAM= ";FRE(0)
20 RAMTOP=PEEK(106):? RAMTOP= ";RAMTOP
   ;" PAGES":? "LAST ADDRESS= ";RAMTOP*256
30 FOR W=1 TO 1000:NEXT W
40 SMALLRAM=RAMTOP-4
50 POKE 106,SMALLRAM
60 GRAPHICS 0
70 RAMTOP = PEEK(106)
80 ? "NEW FREE RAM= ";FRE(0)
90 ? "NEW RAMTOP= ";RAMTOP:" PAGES":
   ? "LAST ADDRESS= ";RAMTOP*256
100 ? "RESERVED MEMORY BEGINS AT ";
    RAMTOP*256+1
```

Although others have described ways to use the reserved space, they have not warned you about the RAMTOP Dragon who will periodically visit your reserved RAM and gobble up memory. Extensive field observations have revealed that Dragon visits upper memory on three occasions:

1. A GRAPHICS command clears the visible screen and also the first 64 bytes above RAMTOP.

2. A CLEAR command (or "PRINT CHR$(125)") clears the first 64 bytes above RAMTOP.

3. Scrolling the *text window* of a graphic mode 3 to 8 screen clears up to 800 bytes above RAMTOP.

Program 2 lets you play with the RAMTOP dragon. Lines 100 to 140 move down RAMTOP and reset the display list and data. Answer "NO" for all except the first pass or the program will lower RAMTOP each time until you are out of memory.

After an initial questioning, the next section (lines 200 to 290 first turns off the "direct memory access" for the ANTIC processor so that the program will operate faster (see **COMPUTE!** #11). It then fills the 900 bytes after RAMTOP with a sequence of values between 1 and 255. Note that the values will remain there as long as there's power to the CPU (and nothing clears them). Therefore, it's not necessary to repeat this step on subsequent RUNs.

The "Choose Action" section (lines 300 to 340) GOSUBs to the three major program sections.

The "Screen Play" routine (lines 1000 to 1100) exercises all three of the actions which call the Dragon. It clears the screen, changes graphic modes and scrolls text windows. To scroll a window, enter graphic mode 3 to 8 and then enter numerical responses for as long as you wish to scroll (the amount of scrolling appears to affect the amount of memory cleared).

The "Check Memory" routine (lines 2000 to 2100) prints addresses for the first and last positions of reserved memory and requests the starting and ending addresses you wish to check. This section allows you to look at different ranges of locations to see how much memory has been cleared by displaying these memory addresses and their values. Knowing that Dragon always leaves 0's in his path, and remembering that we loaded memory with values between 1 and 255, 0's will appear only in areas he visited. (Actually, I'm not sure whether Dragon is a he or a she.) When you're done checking and want to enter a different set of actions, an "0,0" entry will return you to the "Choose Action" section.

The "Neat Trick of the Week" is found in lines 2055 and 2075. The memory address at 53775 can be used to tell you whether a key on the keyboard is being pressed at the time you PEEK it. If a key (any key) is depressed, 53775 contains the value 251. When the key is released, 53775 will show a 255. Line 2055, then stops the program whenever any key is pressed and restarts it when the key is released. The POKEing 764 with a 255 (line 2075) clears the "halt" character so that future INPUTs, GETs, etc. aren't confused.

How can one avoid the Dragon anyway? There are many ways. You could never change graphic modes or clear or scroll the screen. This is difficult if you have any significant screen output. However, since the screen clear erases only 64 bytes, you could always clear the screen before the text window scrolls and never use that first 64 bytes. Or you could skip the first 800 bytes after RAMTOP and allow both scrolls and clears. Taking the other path, you could move the bottom of memory up and use memory below the new bottom (see Jim Clark's article). However, this requires using a (simple) machine language subroutine.

If you are using the reserved memory in a *stable* program (one with no further coding), you have another choice. Program 3 shows how to use memory below RAMTOP as your special area instead of reserving memory above RAMTOP. In your program, wait until after *all* strings and arrays are dimensioned. Then, go to the highest resolution graphic mode and PEEK at the top of your BASIC program (line 10000). Since the Atari saves data on GOSUB and FOR/NEXT statements as it encounters them in a dynamic "stack" at the top of a program, you must provide some room for this storage. Figure on 4 bytes for each *active* GOSUB (one which hasn't been RETURNed) plus 16 bytes for each *active* FOR/NEXT (while it's FORing and NEXTing). Add this allowance to the previous address (line 10010) and use the total as the *bottom* of your reserved area.

Next, PEEK at MEMTOP, the top of RAM available for BASIC programs (line 10100), and use that number as the *top* of your area.

Program 3.

```
10000 PROTOP=PEEK(14)+256*PEEK(15)
10010 MEMSTART=PROTOP+24+1: REM START
      OF YOUR MEMORY — ALLOWS FOR 2
      GOSUBS PLUS 1 FOR/NEXT
10100 MEMTOP=PEEK(741)+256*PEEK(742)
10110 MEMFINISH=MEMTOP: REM END OF
      YOUR MEMORY AREA
```

This method gives you the greatest possible amount of RAM without special code, but brings three general risks. If your BASIC program grows (by encountering an unexpected DIM or FOR/NEXT, for instance) after you have set the lower boundary, it will gnaw into the bottom of "your" memory. If the graphic mode is changed to a higher resolution mode after the upper boundary is set, the display list will push down into the reserved memory. Last, a program loaded after the boundaries are set may be larger and run into the set aside memory.

The next time you see the RAMTOP Dragon, you'll be ready!

Atari Memory Management

57344–65535	ROM for character set, OS, etc.	
55296–57343	ROM, Floating Point ROM	
53248–55295	ROM, Hardware Registers ROM	
	Unused space(!)	
40960–49151	CARTRIDGE ROM for BASIC, etc.	
RAMTOP	END of RAM	PEEK (106)
	Display List and Display Data (usually 1K in Graphics 0, around 8K in Graphics 8).	
MEMTOP	Top of RAM usable by BASIC programs.	PEEK(741)+256*PEEK(742)
PROTOP	Program top for the current BASIC program	PEEK(14)+256*PEEK(15)
	Free RAM used for programs, data storage, etc.	
BASIC LOMEM	Start of BASIC program	
	Operating System, various buffers, hardware registers, etc.	
0	Start of RAM addresses	

Program 2.

```
50   REM SET UP VARIABLES FOR CALLS
60   CHECK=1000:SCREEN=2000:QUIT=3000:DIM AN$(10)

100  REM MOVE RAMTOP DOWN
110  RAMTOP=PEEK(106)
120  ? "MOVE RAMTOP DOWN";:INPUT AN$:IF AN$(1,1)="N" THEN 200
130  RAMTOP=RAMTOP-5:POKE 106,RAMTOP
140  GRAPHICS 0

200  REM FILL 900 BYTES ABOVE RAMTOP
210  FIRST=RAMTOP*256+1:LAST=RAMTOP*256+900
220  ? "FILL MEMORY ABOVE RAMTOP";:INPUT AN$:IF AN$(1,1)="N" THEN 300
230  POKE 559,0:REM TURN SCREEN REFRESHER OFF
240  FOR POSITION=FIRST TO LAST
250  IF VALUE=255 THEN VALUE=0
260  VALUE=VALUE+1
270  POKE POSITION,VALUE
280  NEXT POSITION
290  POKE 559,34:REM TURN SCREEN ON

300  REM CHOOSE ACTION
310  ? "WHAT ACTION? 1 TO CHECK RAM, 2 TO PLAY WITH SCREEN, 3 TO QUIT"
320  INPUT ACTION
330  ON ACTION GOSUB SCREEN,CHECK,QUIT
340  GOTO 300

1000 REM SCREEN PLAY
1010 ? "CLEAR SCREEN":INPUT AN$
1020 IF AN$(1,1)="Y" THEN ? CHR$(125)
1030 ? "CHANGE GRAPHICS MODE";:INPUT AN$
1040 IF AN$(1,1)="Y" THEN ? "WHAT MODE";:INPUT MODE:GRAPHICS MODE
1050 IF MODE<>0 THEN ? "ENTER ANSWERS TILL DONE, THEN NO";:INPUT AN$
1060 IF AN$(1,1)<>"N" THEN GOTO 1050
1070 IF MODE <> 0 THEN GRAPHICS 0
1100 RETURN

2000 REM CHECK MEMORY
2010 ?:? "FIRST POSITION = ";FIRST:? "LAST = ";LAST:? "ENTER POSITIONS TO
     CHECK OR 0,0 TO    RETURN"
2020 INPUT START, FINISH:IF START=0 THEN GOTO 2100
2030 POKE 82,7:POKE 201,11:? :REM MOVE MARGIN, SET TAB
2040 FOR POSITION=START TO FINISH
2050 VALUE=PEEK(POSITION):? POSITION;"=";VALUE,
2055 HALT=PEEK(53775):IF HALT=251 THEN GOTO 2055
2060 NEXT POSITION
2070 POKE 82,2:REM RESTORE MARGIN
2075 POKE 764,255
2080 GOTO 2000
2100 RETURN

3000 REM QUIT
3010 ?"NORMAL END OF JOB":END
```

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Documented Atari Bugs

Steve Hanson
Madison, WI

Although Atari has on the whole done an admirable job in getting out a bug-free computer system (at least compared to most of the other machines), there are a few bugs in the Atari computer software. This article is simply intended to be a list of bugs in operating system and BASIC software. It is intended mainly to be a guide to help you understand what is going on when unexplained things happen in your computer. Atari is aware of all of these bugs, and they will be corrected in the future.

Bugs In Atari BASIC

The Atari BASIC cartridge has a few problems. The currently known bugs include the following:

A. An input statement with no variable is not flagged as an error when input.

B. LPRINT loops cannot be stopped by hitting BREAK (This is not actually a bug in BASIC, but a bug in the OS cartridge.)

C. PRINT A = NOT B locks up the keyboard.

D. DIM L (10) generates DIM L10) as code. You must not leave a blank between a variable and its dimension or it will be interpreted incorrectly.

E. The following functions have wrong values:

LOG(0)
CLOG(0)
LOG(1)
CLOG(1)

MOST EXPONENTS (as an example, try to evaluate 2↑3. This problem is inherent in the polynomial expansion algorithm used. It is not likely to cause problems as the errors are very small, but will be noticeable when the expected value is something which is known. This is a simple rounding error, and can be handled by rounding the result when a non-integer result would be bothersome.)

E. Problems with BASIC boundary routine. This manifests itself in two bugs on the machine. Sometimes when doing line editing the machine will lock up. This usually occurs when deleting multiple lines from a program. The other problem is that any string which is an exact multiple of 256 bytes long will end up in the wrong place if moved in memory. This causes some very weird inexplicable errors in programs. It is hard to catch because it occurs when a string is a multiple of 256 bytes long, and only then. Please notice that it does not depend on the dimensioned length of a string, but on its actual length. Therefore, it cannot be avoided by never dimensioning strings to these values. Fortunately it rarely shows up since most strings are shorter than 256 characters.

F. A printed Control-R or Control-U is treated as a semicolon. I'm glad I finally found out about this as it was the cause of a great deal of trouble in a graphics dump routine I wrote.

G. You cannot use a function within a USR call line. That is, you cannot use a function to define an address for a user call or any of its parameters. You can do this if you evaluate them in a separate line, however.

H. You can dimension arrays larger than the available memory size without creating an error. Of course, there will be problems galore and error messages when you try to run the program.

These errors should mainly be corrected when the next revision of the BASIC cartridge is released. Errors caused in the operating system will be fixed with a new release of the operating system cartridge. Atari has no defiite plans as to when these will come out.

Errors In OS Cartridge

There are a few errors on the OS cartridge ROM in the Atari computer. These are the ones I know about:

As mentioned above, there is a bug in the OS which prevents the break key from interrupting LPRINT loops in BASIC.

There is another bug which you disk users have almost certainly noticed. A problem in the OS makes your disk drive "go to sleep" for a few seconds occasionally. Yes, there is a reason for this strange behavior. The same bug in the operating system is also the culprit responsible for the system occasionally retransmitting a block to the printer. Have you ever gotten a duplicate line or part of a duplicate line out to your printer (using the 850 interface.)? This is due to a bug in the OS cartridge and, at the moment, there isn't much you can do about it. However, Atari will have a fix for this eventually.

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Save
Merge
Screen Format
Printer
Lock
Unlock
Delete
Format Disk
Data Base Merge
Quit

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Press (Return) for selection

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Line Spacing
Lines Per Page
Form Stop
Set Page#
Top Margin
Bottom Margin

Delete a Character
Insert a Character
Delete a Line

Insert a Line
Headers and Footers
Shift Lock and Release
Global and Local Search and Replacement
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Graph It On The Atari

John Malcolm Neil
Portland, OR

One application for which the Atari is suitable is drawing accurate plots and graphs. With a minimum of programming effort, one can create graphs of any function — a handy aid for algebra and trigonometry homework.

The following listing is a 2K program to plot functions in graphics mode eight. It will run on either the Atari 400 or 800, providing that you have at least 16K of memory. A major feature of the program is that the user can look at any part of the Cartesian plane. One is not limited to the range of the graphics mode (320x160) when making graphs.

Line 500 sets the default limits for the range and domain of the function:

$-20<x<20, \ -10<y\leq 10$

This region is the user's *window* on the coordinate plane. To change these values, enter your own window when the computer prints "WINDOW?" in the form:

x_1,x_2,y_1,y_2

Where x_1 and x_2 are the minimum and maximum range, and y_1 and y_2 are the minimum and maximum domain.

To use the default values, just press RETURN.

The prompt "INTERVAL?" asks you to enter the interval at which to draw the tic marks. The default values are set in line 500 to one.

Enter the interval in the form:

x_1,y_1

Where x_1 is the interval on the x-axis, and y_1 on the y-axis.

Press RETURN to use the default values.

The relative positions of the x and y axes are drawn in lines 600-700; lines 800-890 draw the tic marks. The actual plotting of the function (lines 1000-1080) is rather unimpressive. The total range (Y2-Y1) is divided into 320 points, and the value at each is plotted. Should an error occur (divide by zero, cursor out of range), the program skips over that point.

Line 1030 contains the function to be graphed. To graph another, simply change it to read:

FUNCTION = (your function)

Any variables in it must be "X".

Now you are ready to graph! Try the functions in Appendix E for starters, and this one:

1030 FUNCTION = PEEK(53279)

Press some of the console keys (START, SELECT, OPTION). Wow!

A few words of warning — functions like f(x) = 0 will not be visible because the x-axis is drawn on zero. Also, if it is essential that your graph not be distorted, make sure that the range is twice the domain.

One idea I have for improvement is to couple this program with a machine language routine to dump the screen to a printer. I'm working on that one right now. In the meantime, happy graphing!

```
400 GRAPHICS 0
410 REM *** INITIAL CONSTANTS ***
500 X1=-20:X2=20:Y1=-10:Y2=10:XIN=1:YIN=1
510 LIST 1030
520 PRINT "WINDOW (X1,X2,Y1,Y2)";
530 TRAP 550
540 INPUT X1,X2,Y1,Y2
545 IF X2-X1=0 OR Y2-Y1=0 THEN 520
550 PRINT CHR$(125);"INTERVAL (X AXIS,Y AXIS)";
560 TRAP 590
570 INPUT XIN,YIN
580 IF XIN<=0 OR YIN<=0 THEN 550
590 GRAPHICS 8:SETCOLOR 2,0,0:SETCOLOR 1,0,
    10:COLOR 1:POKE 752,1
595 REM *** DRAW AXES ***
600 XTOP=Y2/(Y2-Y1)*159
610 IF Y2<0 THEN XTOP=0
620 IF Y1>0 THEN XTOP=159
630 YSIDE=ABS(X1)/(X2-X1)*319
640 IF X1>0 THEN YSIDE=0
650 IF X2<0 THEN YSIDE=319
700 PLOT 0,XTOP:DRAWTO 319,XTOP:PLOT YSIDE,0:
    DRAWTO YSIDE,159
710 REM *** DRAW TIC MARKS ***
800 TIC1=XTOP-1*(XTOP>0):TIC2=XTOP+1*(XTOP<159)
810 FX=INT(X2/XIN)*XIN
820 XV=(FX-X1)/(X2-X1)*319:IF XV<0 THEN 850
830 PLOT XV,TIC1:DRAWTO XV,TIC2
840 FX=FX-XIN:GOTO 820
850 TIC1=YSIDE-1*(YSIDE>0):TIC2=YSIDE+1*
    (YSIDE<319)
860 FY=INT(Y2/YIN)*YIN
870 YV=(Y2-FY)/(Y2-Y1)*159:IF YV>159 THEN 1000
880 PLOT TIC1,YV:DRAWTO TIC2,YV
890 FY=FY-YIN:GOTO 870
900 REM *** GRAPH FUNCTION ***
1000 PRINT CHR$(125):LIST 1030
1005 TRAP 2000
1010 C=0:FLAG=1
1020 FOR X=X1 TO X2 STEP (X2-X1)/319
1030 FUNCTION=SIN(X)
1040 IF FLAG THEN PLOT C,(Y2-FUNCTION)/(Y2-Y1)
     *159:FLAG=0:GOTO 1060
1050 DRAWTO C,(Y2-FUNCTION)/(Y2-Y1)*159
1060 C=C+1
1070 NEXT X
1080 POKE 752,0:GOTO 520
1090 REM *** ERROR HANDLER ***
2000 TRAP 2000:FLAG=1
2010 GOTO 1060
```

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Extending Player Missile Graphics

Eric Stoltman
San Antonio, TX

One of the best features of the Atari is Player Missile Graphics. Since it has been introduced, many people have started using it in their programs, (some improving upon it, such as Larry Isaacs). This article and example program will explain how to create excellent animation, such as a walking figure or a rotating ship, with just one player.

One way to perform animation is to alternate players back and forth, but problems arise. What if the player is moved up? The other players also have to be moved up. This takes time. Another method is to alternately POKE data into the player, thus changing its shape. This can be done slowly in BASIC or quickly and easily in machine language. This program will compare both the BASIC and machine language method for changing the data of a player.

After a player is set up, additional data for other shapes must be stored in RAM. I prefer to use memory locations 256 to 511, since they are empty and are protected. This data can be manipulated by setting up pointers in an array. A subroutine can then easily retrieve this data and place it in the player's data area. This can be done in BASIC:

```
C=0: A=PMBASE+512+Y TO PMBASE+519+Y:
  POKE A, PEEK(POINTER(FACING)+C) :C=C+1:
  NEXT A
POINTER(FACING)=Array containing addresses
  of data.
EXAMPLE: POINTER(1)=260, POINTER(2)=268,
  etc.
```

Or in machine language:

```
A=USR(XXX,PMBASE+512+Y,POINTER(FACING))
XXX=Address of Machine Language subroutine.
```

The machine language method is not only easier, but also executes 11 times faster and provides smoother motion.

The machine language code is relocatable and can easily be modified by changing the 22nd data element so more or less data can be poked into the player's data area. For machine language programmers, I have included the machine language listing:

```
          *=    $0600
CHANGE    PLA
          PLA
          STA   $CC
          PLA
          STA   $CB
          PLA
          STA   $CF
          PLA
          STA   $CE
          LDY   #$00
LOOP      LDA   ($CE),Y
          STA   ($CB),Y
          INY
          CPY   #$08
          BNE   LOOP
          RTS
```

Line Numbers	Explanation
110-130	Poke machine language subroutine for changing player into player.
140-170	Poke data for additional shapes into memory.
180-190	Set up pointers to data.
200-250	Set up player
270-330	If trigger is pressed change player by machine language.
340-400	If trigger is not pressed change player by BASIC.

In addition to providing animation, this subroutine can move a player up or down when the vertical value changes greatly. To do this, point to an empty area of RAM (thus erasing the player) and then change the vertical value and point to the desired data. An example would be if a player went off the top of the screen and, using the method mentioned above, quickly reappeared at the bottom.

I should point out that many false players, that is, data for alternate shapes, may be stored and rotated among the four players to provide excellent animation.

```
10 REM BY ERIC STOLTMAN
20 REM THE 'I' IN POINTER SHOULD BE A '1
' SINCE 'POINT' IS A RESERVED WORD
100 REM ** INITIALIZATION **
110 FOR A=1536 TO 1560:READ I:POKE A,I:N
EXT A:REM POKE DATA FOR MACHINE LANGUAGE
 SUBROUTINE INTO MEMORY
120 REM ** MACHINE LANGUAGE DATA **
130 DATA 104,104,133,204,104,133,203,104
,133,207,104,133,206,160,0,177,206,145,2
03,200,192,8,208,247,96
140 REM ** ADDRESS OF PLAYER DATA **
150 FOR A=260 TO 323:READ I:POKE A,I:NEX
T A:REM POKE DATA INTO PROTECTED RAM
155 REM ** PLAYER DATA **
160 DATA 28,62,62,28,73,127,73,65,7,23,3
9,88,154,36,8,16,240,38,47,127,47,38,240
,0,16,8,36,154,88,39,23,7
170 DATA 65,73,127,73,28,62,62,28,8,16,3
6,89,26,228,232,224,15,100,244,254,244,1
00,15,0,224,232,228,26,89,36,16,8
180 REM ** POINTERS TO DATA **
190 DIM P01NTER(8):FOR A=1 TO 8:READ I:P
01NTER(A)=I:NEXT A:DATA 260,268,276,284,
292,300,308,316
200 REM ** SETUP PLAYER **
210 GRAPHICS 0:POKE 752,1:POKE 710,0:POK
E 559,46
220 A=PEEK(106)-8:POKE 54279,A:POKE 5327
7,3:PMBASE=256*A:POKE 53256,1:X=124:Y=48
```