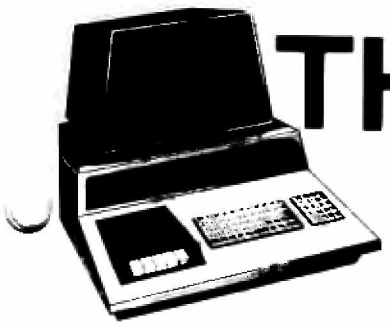

THE PAPER

FOR OWNERS OF THE COMMODORE PET™ PERSONAL COMPUTER

VOLUME II. ISSUE 1 | An ARESCO Publication | February, 1979 $2.00

THE PET IN THE CLASSROOM

by John Fultz, Lincoln School

The PET arrived in January — about one month after the order was placed, and about two months sooner than expected. With the third period math class (and the principal) looking on, the carton was opened — and out came a dream come true.

The PET was placed on a table, and the principal ordered, "Well, make it *do* something!" The PET did do something that day — but not exactly what I had expected. The keyboard had a small but meaningful problem — they keys didn't work. A quick call to Commodore resulted in opening up the new machine and jiggling around the connectors until the keyboard worked just right.

Things were going quite well now, and for the next six minutes, all thoughts of problems were gone. Then the screen went blank. After some checking, it was discovered that something was overheated and caused the video output to quit working. The PET was returned to Commodore for repair, and the problems were all solved, and the PET is now in use by a hundred and eighty 7th and 8th grade students in their math classes.

A computer can be used in the classroom for many things: teaching students how to program and operate a computer, assisting in instruction in a specific subject, and classroom management, for examples. The PET is used in our math classes to introduce the students to computing and to provide computer aided instruction (CAI) for all students. The new PET TUTORIAL Tapes will be used as CAI to teach the students programming in the near future.

The one PET has grown to two, with a 2020 printer on order (and scheduled for delivery in December or January). We have plans for memory expansion and perhaps an optical scanner. The PET is a part of each student's math class, and the students are rotated so that each of them has about 30 minutes of time with the PET every three weeks. The CAI programs that are used with the PET are related to the student's actual classroom activity. Some of the advanced classes are introduced to BASIC programming and have assignments to write programs.

In general, the response to the PET has been great. Often parents, administrators, teachers, and board members visit the classroom to see the PET in operation or watch demonstrations of the PET. The computer has been used for other things — a program has been developed to schedule students into classes,

WHAT REALLY MAKES YOUR PET TICK?

by Gary A. Maier

I'm sure many of you are reaching the point where you feel very confident working with the BASIC interpreter. If so, you are probably asking yourself these two questions:

How can I make sections of my program run hundreds of times faster?

What really makes my PET tick?

It would be impossible to present a course on machine language programming in one article, but maybe I can interest you enough to convince you to dig up more information on your own. In order to make this article appeal to a larger audience, I will start out with some fundamental ideas, and gradually get more technical; finishing with a discussion of multiple precision arithmetic.

THE 6502

The "brain" of your PET is the MOS Technology 6502 microprocessor. It is an 8-bit processor, which means that it can only process 8 bits (*bi*nary dig*its*) at a time. (Eight bits is also commonly referred to as one *byte*."

The 6502 has six internal *registers* which are used for various purposes while your program is running:

The Accumulator is the register used to store data on which operations will be performed. It can also be used for temporary storage and for moving data from one location to another. It is used by the microprocessor (the 6502) to store the results of most operations.

The X and Y Index Registers are counters, often used to control program loops. The 6502 has instructions which will increment (add to) and decrement (subtract from) the values stored in the X and Y index registers, and those values can be compared directly to values in memory. The registers are used as indexes for addressing, making it easy to handle data arrays. They are also used in two powerful modes of indirect addressing (or "computed" or "calculated" addressing).

The Program Counter is the only two-byte (16 bit) register in the 6502. It always points to the address which contains the next operation to be performed, or the data for the instruction which was encountered in the preceding address.

The Stack Pointer (and the *stack* concept) can be easily explained by a simple analogy: a deck of playing

EDITORIAL

by Terry L. Laudereau

Well, here it is — Issue #1 of Volume 2. Are you surprised? Not surprised because we're here — but surprised to see us all neatly typeset — with a real banners. We do want to let you know that we discovered that one page of typewritten text is equivalent to ½ page of *typeset* text — so there's more material here than was in any issue of Volume 1. However — we've changed a few things:

First — there's no Flea Market programs listed in this issue. There are two reasons for this: First, we plan to list the programs only on alternate months. When we can get a PET printer, we'll start printing more program listings, in the alternate months. Second, most of our FME programs were contributed by a single individual. This person has decided that we are not supposed to charge you $5.00 for a FME program you want when you don't have a program to send to us in exchange. We are permitted to continue to exchange programs with those of you who do have programs to send us, and our contributor himself charges the same $2.00 for expenses that we do on exchanges. (Just for interest, our costs are: cassette $.50
labels & package $.50
postage $.50 (more if the program includes written documentation, less if it doesn't — this is average)
bookkeeping $3.50 (this pays for the time and supplies involved in entering your order into the books, loading the right program into the PET, copying it, verifying it, loading it into the second PET to be sure it will work on both versions of PET, packing it up and shipping it to you, entering all the shipping data in the books, etc.)

I could break the "bookkeeping" down into "order entry, order fulfillment, office supplies, shipping, labor" etc., but I'm sure that's not interesting or important.) So we have to sort out the programs submitted by this individual and remove them from the FME — or stop "selling" programs to those of you who don't have programs to exchange. By the way — our costs are the same, whether you "buy" or "exchange" a program! Another change is that we've scattered your letters over the entire issue rather than collecting them in the PET Parade columns. We elected to do this because several of you have suggested that it would be more interesting to have the pages "broken" by short letters rather than have the pages full of "unbroken" text. We decided to try it — if we (and you) don't like it, we can change it again.

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Readers are encouraged to submit articles of interest to PET owners. (See comments regarding copyrights, above.)

Some of the articles in this month's issue are symptomatic of yet another change. "A PET In The Classroom", for example, and another one, the title of which occupies more than two typewritten lines of text. Neither of these articles contain "hard" facts — but they're both interesting and thought-provoking — and warrant responses from those of you who possess an interest in the topics covered. We have yet another of Roy Busdiecker's series of articles (and we'll have another in this series next month) — and the "kick-off" to our Intro To Machine Code series — this article was written by Gary Maier and introduces you to some of the terminology. A lot of other goodies are inside ..... we invite your comments and suggestions on even further improvements.

You should also note that we've changed our policy regarding the number of pages of advertising. Many of you (and boy, was I surprised by the number!) protested, saying that you really enjoy reading computer-related ads. Since the number of pages will probably change from issue to issue, we've decided on a percentage (25%) rather than a flat number of pages. This means that in a 32 page issue, we might carry as many as eight pages of advertising — but that in a 16 page issue, we'll only have four pages. Many of you chided us for suggesting that if we have a sufficient number of subscribers, we'd be able to charge less — as though we thought THE PAPER is overpriced! No, we don't think it's overpriced — but we'd rather make our profit on volume than on margin. Three people said they'd be willing to pay as much as $25.00 for the ten issues!

We have a limited number of Volume 1 sets left — and a few odd copies of some of the issues in Volume 1. If you want a complete set, the price is the same as the price for Volume 2 — $15.00 for all 10 issues, or $2.00 for a single issue. The last page in this issue (inside the back cover) contains a form to fill out and return. When we run out of Volume 1 sets, we'll just send your check back to you — or, if you order by credit card, we'll notify you that we aren't charging your card.

This is the very first issue of THE PAPER sent to Commodore for comments before being sent to press. Robert Webb, of Commodore CANADA, offered to go through the issue and offer comments and suggestions. Since this editorial is being written on January 5th, and we're going to press on January 15th, I'm not certain Robert will have time to get his comments back to us for inclusion in this issue. If not, we'll include them in #2. And we hope to be sending Robert a pre-press copy of every issue of this volume. If we're lucky, we can resume our "From The Commodore" column!

By the way — have you noticed that some of the "professional" computer magazines are advertising in our pages? If you elect to buy one of them (or the software they offer) please don't forget to mention that you saw their ad in THE PAPER — in fact, if you purchase any item advertised in THE PAPER, tell the vendor where you saw his ad. And read Dennis Costarakis's review of some of the vendors he's dealt with .... then send us reports of your experiences. If you are having trouble with a vendor, let us know — sometimes we can expedite things for you — or **at least** find out what's going on!

Hope you all had a happiest of holidays — and that you're all set for a super '79!

WHAT REALLY MAKES YOUR PET TICK? — continued

cards. If you stack one card on top of another, until you have all the cards stacked on the table, then the first card you will be able to pick up will be the last one you laid down (you pick up the card from the top of the stack). The stack pointer is used to remember an address to which the program must return after completing a specific job. The stack is very handy when you're using subroutines. The address of the instruction which calls the subroutine (in BASIC, this is the line with the GOSUB statement) is placed on the top of the stack. Then, when all the instructions in the subroutine have been executed, the program returns to the address on the top of the stack. The stack pointer is used to determine which memory location corresponds to the top of the stack (technically, it's normally pointing at the location where the next entry on the stack will go). The stack is always stored in page one of PET's memory (hex address 0100-01FF).

The Processor Status Register contains all the flags and status bits. It is treated as a single 8-bit register for programming convenience, but each bit really has its own meaning and its own set of instructions for testing and being modified. Here are the names of the flags or status bits contained in the processor status register:

Carry	Interrupt Disable	Decimal Mode	Negative
Zero	Break Command	Overflow	

Let's develop a simple program to fill the top six lines of the screen with solid squares. A BASIC program to do this might look like:

```
10 FOR I=0 TO 239
20 POKE 32768+I,160
30 NEXT I
```

Note that the variable "I" is being used as an index (to help calculate the location to be POKEd) as well as for a loop counter.

To write an assembly language program, you should have a copy of the 6502 OPCODE reference card, which you should be able to get from MOS Technology or one of their dealers. The OPCODES (operation codes) are mnemonic representations of the hex digits used to program the 6502 in machine language.

First, let's decide what it is we want the program to do.

1. Load the white square (ASC 160) into the accumulator so we can transfer it somewhere else later.
2. Load the X index register with zero to "clear it out".

3. Move the white square from the accumulator to the screen address 32768 + the value in the X register, so we can put the square in more than one place on the screen.
4. Increment the X register
5. Check to see if the value in the X register is equal to 240, since we only want 6 lines (40 characters by 6 lines = 240) on the screen.
6. If the value in the X register isn't 240, then we want the program to go back to step 3
7. If the value in the X register is 240, then we want to return to BASIC.

So let's write the program:

```
1.        LDA #160       (Load the accumulator with 160)
2.        LDX #0         (Load the X index register with 0)
3. LOOP   STA 32768,X    (Store the value in the accumulator at screen address 32768+X)
4.        INX            (Increment the X index register by one)
5.        CPX #240       (Compare the value in the X index register to 240)
6.        BNE LOOP       (Branch, if not equal, to instruction 3)
7.        RTS            (Return to BASIC)
```

The "#" in front of the numbers 160, 0, and 240 is the standard way of indicating the *immediate* mode of addressing (that is, the values 160, 0 and 240 will be loaded into the accumulator, not the values stores at addresses 160, 0 or 240). The X index register is used as both an index (to help calculate an address) and as a loop counter, just like the variable "I" in the BASIC program.

If you are lucky enough to own an assembler for your PET, the job is finished. Otherwise, the program must be converted from assembly language to machine language code. The 6502 OPCODE card will give you the hex values for each of the mnemonics we've used, but since the PET doesn't have the overt ability to communicate with people in either hex or binary, I will keep the program in decimal. Let's use address 6500 for the starting address of our program. Here it is, then:

ADDRESS	MNEMONIC	VALUE	COMMENT
6500	LDA	169	Load accumulator . . .
6501		160	With 160.
6502	LDX	162	Load X index register . . . . .
6503		0	With 0.
6504	STA	157	Store the value in the accumulator
6505		0	At address 32768+X (LSB)
6506		128	(MSB)
6507	INX	232	Increment the X index register
6508	CPX	224	Compare the X index register value . . . .
6509		240	To 240.
6510	BNE	208	Branch if not equal . . . .
6511		248	To address 6504
6512	RTS	96	Return to BASIC

The "values" here represent the decimal form of the OPCODES. The two bytes (at addresses 6504 and 6505) represent the ***absolute address*** to which the value in the X index register will be added. When specifying an absolute address, the least significant byte of that address (LSB) is always entered first, and the most significant byte (MSB) is entered second. The absolute address (in this case, 32768) can be calculated using the following formula:

Address = LSB + 256*MSB

And you can find the LSB and the MSB with these formulas:

MSB = INT(address/256) : 128=INT(32768/256)
LSB = Address-256*MSB : 0=32768-(256*128)

In location 6510, the BNE (branch if *not* equal) instruction used a mode of addressing called *relative* addressing. This means that the address to which the program will branch must be calculated and given in terms of its position relative to the BNE instruction. We can branch as many as 127 bytes forward or backward, and in this case, we want to move backward to address 6504, or 8 bytes. Remember, the program counter is always pointing to the next instruction to be executed, so it is pointing to 6512. 6512 - 6504 = 8. Because we are moving backward, an unusual method is used to calculate the number of bytes to be moved. It's called "two's complement arithmetic". The two's complement of any number is found by adding one to the one's complement. The binary representation of 8 is 0000 1000. The one's complement is 1111 0111 (all the 0's become 1's, and all the 1's become 0's). Then add 1 (in binary) to get 1111 1000. This is 248 in decimal. If you're confused, a good book on binary arithmetic can help. It isn't complicated, but it *is* new to you, and a local computer store will carry several books on the subject.

The following BASIC program will load the machine language program into the selected memory locations for you. Look at the data in the DATA statements, and see how they correspond to the program we just wrote.

```
10 DATA 169,160,162,0,157,0,128,232,224,240,208,248,96
20 FOR J=6500 TO 6512
30 READ I
40 POKE J,I
50 NEXT J
60 END
```

After running this BASIC program, the machine language program can be executed by typing in SYS(6500). The SYS command will transfer control of the PET to your machine language program. When the RTS is executed, control will be transferred back to BASIC.

Multiple Precision Arithmetic

Programming in machine language can be fun, if you don't mind having to do the assembling by hand. "Assembling" in our case means converting the program from the assembler language mnemonics to the decimal codes recognized by the PET. Most books on micros carry a section on converting hex values to decimal values, but you can just look it up in issue #2 of THE PAPER. The following program is in assembly language, and you can convert it to decimal and try it out if you like. The program adds two 16-bit numbers together. If we added only 8-bit numbers, we could only add up two numbers less than or equal to 255! So, for the first number, we'll call the LSB L1, and the MSB M1. For the second number, the LSB is L2, and the MSB is M2. Then, for the result, the LSB is L3, the MSB is M3. You can plug any numbers in and get whatever is the appropriate result.

Remember — to run the program, you must first look up the hex codes corresponding to the mnemonics on the OPCODE table. Then you have to convert the hex values to decimal, enter the decimal values into DATA statements in a BASIC program, RUN the program, then do a SYS to the address into which you poked the data.

	LSB	MSB
FIRST NUMBER	L1	M1
Second Number	L2	M2
Result	L3	M3

Mnemonic	Value	Comment
CLC		Clear the Carry Flag
LDA	L1	Load the least significant byte of the first number into the accumulator.
ADC	L2	Add L1 to the least significant byte of the second number. If the result is greater than 255, set the carry flag.
STA	L3	Store the result in memory
LDA	M1	Load the most significant byte of the first number into the accumulator
ADC	M2	Add M1 and the value of the Carry Flag to the most significant byte of the second number.
STA	M3	Store the result in memory.

The ADC instruction adds the value in the addressed memory location and the value of the Carry flag to the value in the accumulator. The result is stored in the accumulator and the old value is discarded. If the results of the addition exceed 255, the Carry flag is set (its value becomes 1). Since we don't know, before we start, just what the value of the Carry flag is, we use the CLC command to set it to zero.

You can do multiple precision subtraction in a similar manner, but remember the business of "two's complement arithmetic". The SBC instruction will add the Carry bit value to the complement of the addressed memory location, and that result to the value in the accumulator, discard the old value, and store the result in the accumulator.

SEC		Set the Carry flag
LDA	L1	Load the LSB of the first number
SBC	L2	Subtract the LSB of the second number from L1
STA	L3	Store the result. The carry flag is reset if it's necessary to borrow.
LDA	M1	Load the MSB of the first number
SBC	M2	Subtract (remember the borrow!) the MSB of the second number from M1
STA	M3	Store the result in memory.

Debugging

Bugs in a machine language program are very difficult to find, because they usually cause a system crash. The easiest way to trace the problem is to insert the RTS instruction into various places in the program. This way, you can tell how far your program gets before it crashes. You can also examine the registers to be sure your program is doing what you want it to do. Be careful, though, because when you remove the RTS instructions, you have to put something in their places. A machine language program cannot have "empty bytes" in it. You can insert a NOP (*no* operation) command in all those places, however, and it will solve *that* problem.

Adding instructions in the program must be done carefully, since it means that all the instructions following it will have to be relocated. An assembler can do that task for you, and if you're seriously interested in machine language programming, I recommend that you get an assembler. It will save you hours of converting mnemonics to hex to decimal!

REVIEW — BETSI (from Forethought Products)

by Wayne Reindollar

I considered getting a memory expansion for my PET and decided on the BETSI from Forethought Products. I ordered my BETSI kit from AB Computers along with a power supply. The boards I plan to use on the BETSI only require +8 volts unregulated, so AB Computers made a power supply for this need. The BETSI kit and power supply arrived about seven days after ordering.

The BETSI assembly/operating manual was very informative and gave good hints on assembling the kit. I ordered three extra S-100 edge connectors with my kit so I could assemble the whole kit at one time. I followed the testing procedure after assembly and all seemed to be in order. Assembly and testing were accomplished in one evening.

The memory board I selected was the Godbout Econoram II Un-Kit which has 8K of memory. The board arrived ten days from the time I ordered. The Un-Kit version has all the IC sockets and all the by-pass capacitors soldered in place. The only soldering that had to be done was to install two voltage regulators, two slide switches and four capacitors. Then came the tedious job of inserting 75 IC packs.

Upon completion of everything, I turned the power off the BETSI and the PET as is recommended in the BETSI manual. I inserted the memory card in the BETSI and attached the BETSI to the PET via the memory expansion port. On power up to the BASIC printed 15359 BYTES free.

On the BETSI board there is enough room to mount a push button switch close to the edge connector. I did this and wired one side to ground and the other side to the pin A27, reset lead. This way I can reset the PET without power down.

Micro Software Systems, P.O. Box 1442, Woodbridge, VA 22193 announces SWEE-PING — a ball-bouncing game that gives the player full directional control. Instructions are built into the program so you can't lose them, and the ball goes where you direct it by using the number keypad. The flyer received indicated that at least three games are available — at $5.95. Write to Roy Busdiecker for full information.

MORE PROGRAM LISTINGS?

Ron Longfellow writes: Have you thought of allotting space to printing out listings of programs submitted to the Flea Market — general games, business programs, etc., instead of just listing the names of the programs? I consider myself a novice, but even *I* could dream up programs for most of the titles in the Exchange! The first thing I do when I pick up a computer magazine or publication is to flip through it, looking for useable programs. You would certainly boost your circulation by becoming known as the best source for PET program listings around! Maybe 3 or 4 listings per issue, using PET's special features, etc., would be a real selling point. You could reward a contributor with free Flea Market programs. I'd contribute!

We've considered doing just that, but without the PET printer, (and since many of the cursor control characters don't print *at all* on our printer) it's difficult to list programs that will be useful. However, we're working on it. By the way; Flea Market programs *are* essentially free to anyone who contributes a program. We charge $2.00 (for time, packaging, postage, etc.) per program — and just break even. If someone wants to buy a program from the Exchange, we charge $5.00 — and the extra $3. is used to buy a little more time so we can do some program development (we contributed Codes, States & Capitols, and a few others) ourselves. The Flea Market is *intended* to be an open exchange — and we exchange more than twice as many FM programs as we sell. Yet, our usual shipment of FM programs in any one month is under 20 tapes! PET users are getting more sophisticated and want something more than adapted TTY programs, adapted arcade games, and adapted pen- and pencil games — even in exchange!

We've also had a considerable bit of difficulty with people who really want to exchange programs, but who haven't written any — so they send us someone else's copyrighted material! Of course we can't accept it — but it takes time to go through 21 programs on a single tape and determine whether they're all copyrighted — or whether the "contributor" made a little effort him/herself.

Dean Hillsman writes: I'm greatly puzzled about the relative unavailability of an interface between the PET and the IBM Selectric typewriter. Considering the availability and power of this hard copy device, I wonder why someone hasn't made the connections. Anybody out there have any suggestions?

Sawyer Software

Business Software for your 8K PET™

★★★ NEW ★★★

ACCOUNTING PACK I —
Accounting Pack 1 is a general ledger package designed for small businesses and homeowners. It contains check journal, general ledger, income statement (current ytd, previous month ytd and current month), balance sheet (current month and previous month). There are 15 commands and 6 reports that can be generated. The system uses an unique single-entry bookkeeping system and can hold up to 50 entries per period (month, week, day) and up to 40 different accounts. Each period's data is kept on convenient cassette tapes. Utilizing the general ledger command the user can view the general ledger entries for the month from Assets to Expenses or stop in midstream and view one particular account. Or the user can type in an account name such as "Advertising" and view the entries for that month. The Accounting Pack 1 program includes a checkbook reconciliation routine which aids in finding checkbook errors. **Sawyer Software** plans upgrades to Accounting Pack 1 to enable the user to use a printer, floppy disk or more memory. Accounting Pack 1 is well documented, with a newly updated User's Manual. Several businessmen are using Accounting Pack 1 and have written to us their satisfaction with the program along with their purchase of other software.
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..... **$45.00**

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..... **$30.00**

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ANOTHER MICROCHESS REVIEW

by John Hirsch

I purchased Personal Software's Microchess 2.0 tape recently and was surprised to find that it plays a pretty good game of chess. There are supposedly 8 levels of play, but the differences between intermediate levels are not discernible. At level 1, it plays very rapidly, but doesn't look very far ahead. Nevertheless, I find it more difficult to beat Microchess Level 1 at rapid-fire chess with a 10-second time limit than to beat level 8 with a 2 hour, 40-move limit. Level 8 is pretty strong tactically, but somewhat lacking in long-range strategy. I particularly noted that Level 8 handles rooks poorly, often leaving them undeveloped or placing them irrationally. It's also a pawn-grabber — and can be diverted from a potentially winning attack if you throw it a pawn.

Level 8 seems to favor certain openings, such as the Ruy Lopez and Queen's Indian, which (I believe) were the standard openings in the original Kim-1 program written by Peter Jennings. When playing black, it never responds 1 . . . P-Q4 to white's 1 . . . P-Q4. You can force it to do so by making the move for it and then seeing how it responds to a Queen's Gambit opening. It always takes the pawn (usually not a good idea) and then develops its Queen prematurely — rapidly getting itself into trouble.

The program is in machine code and no listing is supplied. The PET will only list the SYS command which initiates the machine code, and once the program is running, the STOP key is disabled. It is understandable that the author of the program would attempt to prevent it being copied, but disappointing that the user has no chance to play around and modify it. (Of course, one can always get around these restrictions.)

All in all, I think Microchess 2.0 is well worth the money — especially when compared to the "dedicated" microprocessor chess games retailing at up to $300. I haven't had the chance (yet) to play Microchess vs. Chess Challenger or Boris, but I suspect it would do very well.

Jim Parr writes: You should have told Dave Conley that he can use lower case or graphics in REM statements, if he puts them in quotes. As usual, the final quote on the line is optional. That is, if you enter

100 REM "A Remark In Upper & Lower Case

then the listing will look just like that instead of being expanded into BASIC keywords. But remember to POKE 59468,14!

C.K. Wheeler comments regarding the letter he sent in last issue regarding the PET RAM failures and voltage symptoms: That RAM failures can be relieved by lower voltages and cooler air is, I am sure, a valid finding. The symptom of cursor drop-out below 112 volts should be modified, however, even though that was what was happening last week. I started noticing an increased tendency for "lock-up" at even higher voltages (113, 114, 115). And I recalled some weeks back, when I was getting good operation with as low as 107 volts. I thought maybe the filter condenser might be losing capacity, but it checked out okay. I noticed that the 5-pin power-feed plug to the circuit board was getting quite warm. This is the disconnect plug from the transformer & filter condenser. I shimmed one of the connector spring pins and operation returned to normal. No more heat build up in the connector and the symptom of dropping the cursor at low voltages has been eliminated. It tolerates an input voltage as low as 102vac with no tendency to drop out when a cassette is used. Apparently a normal PET with good power plug connections will operate down in the neighborhood of 100 volts. It's entirely possible that other users could experience cursor lock-out at normal voltages, such as I had today. In such a case, it wouldn't hurt to check the temperature of the 5-pin power supply plug on the circuit board!

According to Gerald Balzano, here's a quick and easy way to program a round-off function from INT. It will round any argument to the nearest integer, rounding up from .5 or greater and rounding down otherwise.

```
DEF FNROU(A) = INT(2*A)-INT(A)  rounds to nearest integer
DEF FNRHF(A) = FNROU(2*A)/2     rounds to nearest half
DEF FNTEN(A) = FNROU(10*A)/10 rounds to nearest tenth
```

FNROU can be used to round to any fraction the user desires.

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Because we missed printing PET PROSE in issues #7 and #8, we will print the names of PET PROSErs in the first two issues of Volume 2 or refund each of them 1/5 of the money they paid for insertion.

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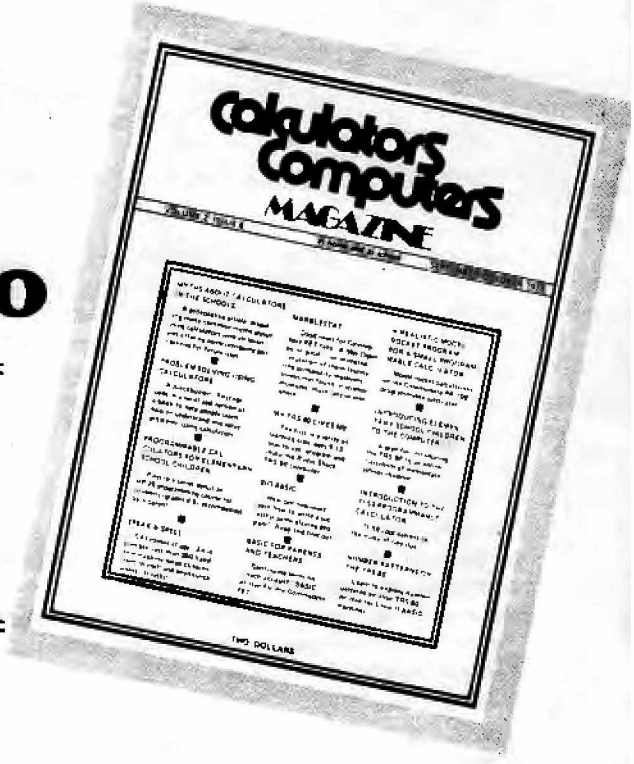

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A MICROPROCESSOR IS A UNIVERSAL ACTIVE DEVICE HAVING A TRANSFER FUNCTION WHICH CAN BE ALMOST ARBITRARY DEFINED[1]

Or

"BUT WHAT DOES IT DO?"

Have you ever written a program that you thought was "neat" — or even "clever"? In fact, you thought the program was so great that you decided to show some of your non-computing friends just how fantastic it was!

Here's the scene: your PET is plugged in, powered up. You key in "Shift/Run" and the display reads, "PRESS PLAY ON TAPE #1". You promptly obey the command — and then you w-a-i-t. "FOUND INVSQRHYPERTOTE" flashes on the screen and again, you w-a-i-t. Eventually, the program loads and executes the inverse square of the quadratic surface of a hyperbolic totem pole and the cursor reappears and flashes merrily below a screen full of alphanumeric characters and "READY". You turn to your friends, face beaming, awaiting accolades, and you w-a-i-t.

Friend Henry is the first to respond, "But what does it do?"

Only slightly daunted, you proceed to explain how you have increased the execution time by a factor of 1000 over an equivalent BASIC program, by using machine language routines. Also, if you had a disk system and a printer, the program would load faster and you could have hard copy of all the data that scrolled off the screen. And, if you were a maker of totem poles, you could use the program to compute a theoretical model.

Friend Mary replies, "Yes! But what does it *do*?"

What more can you say? How do you explain a program that works but does not physically show that something is being "done", i.e., something useful?

This question applies not only to your non-computing friends, but applies equally well to the micro-computer owner who purchased a "complete" system and expects it to "do something".

It's a difficult task to explain to the novice that a computer is really a "dumb device" and that you, the owner, are responsible for the programs that make it "do something". Not only are you responsible for programming, but also for the printer, memory expansion, disk storage system, and all the other hardware that interfaces with the world we live in.

The marketing people at Radio Shack and at Commodore are doing a fine job of selling their so-called "convenience computers". At last report, Commodore is said to be producing 4500 units per month, and starting to produce almost 1000 units per month at their facilities in the U.K.[2] Radio Shack is reported to be outproducing Commodore by a factor of 2:1.

Are we ready for this deluge of logical ANDs, ORs, and NOTs? I think not! The idea of a computer in every home is only valid if the computer can "do something" without constant help from the owner.

Technologically, the electronics industry is capable of putting a "logic machine" into every home at a reasonable price (under $700). But the device will remain a "games arcade" until useful applications programs are written to control inexpensive peripheral devices. As long as peripheral equipment costs remain at their present levels with respect to the cost of the computer, and application programs consists of Biorhythms, Star Wars, and calculating the cost of a mortgage, we'll have a lot of computer owners who will be asked, "But what does it do?"

So what's the answer? Being neither a hardware nor software engineer, but a computer user, I will step into a no-man's land of thesis and postulate my ideas.

I think the computer should return to the "Black Box" concept and be located somewhere in the basement (store in a cool, dry place). My system would be a time-sharing micro-computer with its background program and operating system in ROM or PROM. All the basic control and housekeeping routines would be in ROM/PROM and the user would simply key in the variables that apply to his/her system.[3]

In the family room (or wherever) would be an inexpensive video terminal that enables the user to monitor processes, key in new data, play games or receive the electronic newspaper from the cable TV without halting the background program. There *are* micro-computers on the market that can do all of the above, but the cost of such a system is well beyond the range of a "useful, do something" home computer.

The manufacturers of micro-computers are certainly not helping the situation. Of the three most popular micros (APPLE II, PET, and TRS-80), none of them interface with the real world in the same way. None of them can communicate with the others, and with the exception of the PET, they do not comply with any standard bus structure.

The reason, of course, is obvious. Profit! Without profit, no company will remain in business for very long. As long as you, the purchaser, are bound to their peripherals, they will make a profit on the higher margin add-ons. It may take an Act of Parliament (or Congress) to bring some sense and standards to the home computer market.[4]

It would be nice if all the home computers that use a CRT display and an ASCII keyboard used the same method for communicating between the keyboard and the computer. Although the RS232C serial communications interface will probably not be around in a few years, some such similar method should be standard for all manufacturers.[5] [6] In that way, your micro could serve as a terminal for a host system, a terminal for the electronic news services, etc.

Believe me, if the electronic news service ever becomes interactive, home owners are not going to want two computer devices in their homes. Two color television sets, yes. They *do* something! But two display devices that appear to do the same thing? I doubt it!

I think home computers should be control systems with the capability of being user-programmed, as well as being able to be connected to the telephone line or cable television for electronic mail transfer, library perusal, or electronic fund transfers.

Then our home computer will "do something".

I believe the home computer manufacturers had better start communicating with each other. If they don't, some enterprising telephone or television company may jump into the ball park and steal the ball — and the game.

They could call their new home computer "DIALOGUE", and just copy the sales literature from Radio Shack, Commodore, or Apple. At $695, *every* home should have one.

Enough! I could go on and on, but I think you get my point. What about my friend Henry? He sat patiently while I tried to explain the values of a computer in the home. Henry replied that he could do most of the control functions my computer can do, manually and at a considerable savings in money. As a matter of fact, with the money he just saved by *not* buying a home computer, he is going to buy a microwave oven. "You know, the one with the digital clock and 25 programmed functions?"

These are some of my views. I would be very interested in reading about *your* views in this journal. I will not be unduly upset if you (or no one else, for that matter) agrees with me. If you wish to communicate with me, I can be reached at:

U.R.A. Dreamer, P.O. Box 911, Disneyland

[1]A.J. Cote, The Open Channel, *Computer*, October 1978, p.75

[2]Gene Beals, *PET User Notes*, Issue 6, 1978, p.32

[3]Donn Mennie, Personal Computers For The Enterpreneur, Applications, *Spectrum*, September, 1978, p.32

[4]James Isaak, Standards For The Personal Computing Network, *Computer*, October, 1978, p. 60-63

[5]ANS document X534/589 (ADCCP) from CBEMA, 1818 L Street NW, Washington, DC 20036

[6]R.B. Hovey, Packet Switching Networks Agree On Standards Interface, *Data Communications*, May/June, 1976 pp. 23-39

REVIEW — SOFTWARE DEALERS

by Dennis Costarakis

Dennis Costarakis writes: Just received #9 — as usual, very informative. For your information, your outfit, NEECO, and Channel Data Systems are the only three "software sales" firms that have provided prompt delivery of their advertised products. Here's a list of other dealers I have done business with — and the results.

Computer Factory (NY) — the worst of all. In March, 1978, I ordered their annual Report Analyzer, Stock Screen, and annual report DATA BASE — (annual subscription — 1 tape/month). It took *six* months to receive a workable Annual Report Analyzer (at least twenty phone calls). The stock Screen, though promised several times as "next month" still is not available (my feeling is that it hasn't been developed yet). The DATA BASE doesn't work — I sent back the only two tapes I received. Two weeks ago they informed me they are going to a new format, etc., etc., etc., and will be available January '79. Very atrocious service — and they provide no information unless you call and ask them for it.

Apparat (Denver, CO) — had my order for six weeks. Two phone calls later they informed me they were no longer selling PET software and returned my money.

Sawyer Software (tape obtained through NEECO) I returned one tape of two purchased because the programming was atrocious — and the days-between-dates program was no good (it used the wrong algorithm).

Commodore (Palo Alto, CA) They *lost* my order. Things being what they were at Commodore, I just canceled the whole thing before they went any farther. I ordered in May and cancelled in August. No tapes available at that time.

Osborne & Associates — ordered the PET software ("Some Common BASIC Problems") at the West Coast Computer Faire November 3, 4, & 5, 1978. To date (12/19/78) have not received it. It was supposed to have been shipped "last week". Looks like his outfit is just like most of the ones in the PC business, despite his high-brow sounding statements in his Fountainhead editorials in *Interface Age*.

We especially thank Dennis for writing to tell us about his experiences with software firms. Not wanting to spoil his praise, however, we have to admit that our shipping schedule "slipped" a week or so over the holidays! Sorry.

We'd like to hear from more of you regarding your experiences with software — and hardware — dealers. Who's giving you the kind of service they promise? Who isn't? When considering your responses, however, remember that many of us run our businesses out of our homes in our "spare" time — and don't have eight hours a day to spend at it. Can you tell the difference between the products delivered by a "homebrew" company and a "professional" firm? What are these differences? How do they stack up against each other? Which delivers the better products for the best price in the least amount of time?

For Readers who might have difficulty using Michael Baltay's "CHECK CAPACITY OF DIMENSION" program on page 8 of issue #9, Dr. John Matarella offers this:

Remember a variable or an array is dimensioned by PET as *one more* than the number placed in the DIM parantheses — the 0th element. For example: DIM A(12) sets up 13 possible values of A; that is, A(0) through A(12).

Changing Michael's program by starting all FOR/NEXT loops with 0 will *really* show when and where wrap-around occurs.

i.e.	Lines 170 & 230	N=0: FOR I=0 TO N1
	lines 180 & 240	FOR J=0 TO N2

In my PET, if (N1+1)*(N2+1) 255, then wrap-around occurs.

A DECODER ADD-ON TO THE MEM-EXPLORER

by Roy Busdiecker

In the previous article, "The PET Symbol Table and Data Formats", there was a description of a program called MEM-EXPLORER©. That program allows examination of a block of 20 bytes of memory specified by the user. A display is provided, showing the location address, contents in both decimal and character equivalent, and several useful computations.

Since special reserved words used by the PET (e.g., RUN, GOTO, LOG) are stored as single-byte tokens rather than as character strings, the MEM-EXPLORER only provides the character equivalent of the token. One must then go to a table to determine the reserved word it represents.

Except for that shortcoming, it is possible to read a program (vertically, in the CHAR column) from its absolute location in memory, and know precisely where every character is located. If we could decode each token and print the reserved word in its place in the CHAR column, it would be handy indeed!

Fortunately, the designers of the interpreter tucked away the complete expanded form of each instruction in ROM, starting at location 49298. See the TABLE for locations of the expanded forms. The sequence in which the reserved words are stored is identical to the sequence of numerical values for the tokens used to represent them.

Unfortunately, the interpreter prevents PEEK access to the ROM area where the interpreter is stored. The command PRINT CHR$(PEEK(49298)), which ought to print the character "E", actually "prints" a null on the screen (no character or space), incorrectly implying that the address specified contains all zeros in binary.

Fortunately, in a previous encounter with this restriction on the PEEK command, the author developed a simple machine-language program to defeat it. All that was needed was an LDA (load accumulator) from an address in the "forbidden region", followed by an STA (stored accumulator) to an address where the PEEK could be used. An RTS (return from subroutine) gives control back to BASIC.

In the program listed at the end of the article, line 1000 sets the pointer from the USR function, and loads the data from line 1020 into the buffer area for the second cassette recorder. That data is the machine language routine described above.

To see how the routine is used, look at line 150 of the program. In the previous article, it was

```
150 M=PEEK(L)
```

which has now being replaced by

```
150 S9=L:GOSUB 2000:M=S9
```

The subroutine at line 2000 converts the value in S9 to two bytes which are poked into the machine language routine as the address for the LDA (load accumulator) command. The the USR function is called, which places a copy of the contents of the target address in the location 1023. Then setting S9=PEEK(1023) produces the desired value.

Now that the necessary tools are available, we can discuss the problem of turning tokens into their equivalent reserved words. Because of the identical sequences, we can simply subtract 127 from the value of the token to determine whether we need the first, second, or nth reserved word.

If we count the number of characters in each reserved word, and store those values in the same sequence in any array, we can then use that array to create a pointer to the beginning of each reserved word in the ROM. For example, if the token value is 131, then we want to find the 131 — 127, or 4th word in the table. Summing the first 3 values in the array gives 3+3+4=10, which is added to the table starting value of 49298.

STARTING LOCATION	CONTENTS
49298	END
49301	FOR
49304	NEXT
49308	DATA
49312	INPUT#
49318	INPUT
49323	DIM
"	"

The next value in the array, 4, tells how many characters need to be taken from the table to complete the expanded form of the word. The four characters starting at location 49308 are D, A, T, A, and DATA is the reserved word that token 131 is used to represent.

Lines 1100 — 1150 create the array A% which holds the lengths of the reserved words.

The pointer (PT) is calculated in lines 183 - 185.

Finally, to complete the example by printing out the expanded form of the reserved word, we add the equivalent of

```
FOR I=1 to A%(4):PRINT CHR$(PEEK(49297+PT+I));:NEXT I
```

except that we must make the previously described substitution for the underlined statement in order to PEEK into the "forbidden region". The equivalent code appears in lines 186 — 188 of the program.

Putting all these tools together, and weaving them into the MEM-EXPLORER described previously, yields the new program listed at the end of the article. If you have already typed in the MEM-EXPLORER, load it in the PET, then type in the lines which are new or changed.

When this program is run, it will ask LOCATION? If you answer 1025, then the first 20 bytes of the program will be displayed. The first two bytes contain a LINK ADDRESS pointing to the beginning of the second line of the program. The numerical value of the LINK ADDRESS is shown under the ADDRESS heading, in the first line displayed. The numerical value of the BASIC program line number assigned by the programmer to the first line of his program is contained in the third and fourth bytes (1027, 1028) of that program. It is shown in the third line of the display. Subsequent lines show the actual representation of the

TABLE

BASIC program statements as they are stored in memory, under the CHAR column. A value of 0 signals the end of a line of BASIC CODE, and always precedes the next LINK ADDRESS byte-pair. A LINK ADDRESS value of 0 indicates the end of a BASIC program.

LOCATION		CONTENTS
Decimal	Hex	
49298	C092	ENDFORNEXTDATAINPUT#INPUT
49323	C0AB	DIMREADLETGOTOFUNIFRESTORE
49349	C0C5	GOSUBRETURNREMSTOPONWAIT
49373	C0DD	LOADSAVEVERIFYDEFPOKEPRINT#
49400	C0F8	PRINTCONTLISTCLRCMDSYSOPEN
49426	C112	CLOSEGETNEWTAB(TOFNSPC)THEN
49453	C12D	NOTSTEP+-*/↑ANDOR = SGNINT
49479	C147	ABSUSRFREPOSSQRRNDLOGEXPCOS
49506	C162	SINTANATNPEEKLENSTR$VALASC
49532	C17C	CHR$LEFT$RIGHTMID@

MEM-EXPLORER/DECODER

```
  80    IF E1=1 THEN 110
  90    GOSUB 1000:GOSUB 1100:E1=1
* 100   B=256:POKE 59500,14
* 110   INPUT"LOCATION";K
* 120   PRINT"↓LOCAT'N DECIMAL CHAR ADDRESS VALUE↓"
* 130   FOR J=0 TO 19
* 140   L=K+J
  150   S9=L:GOSUB 2000:M=S9
* 160   PRINT L;
* 170   PRINT TAB(8);M;
  180   PRINT TAB(18);:IF M<32 THEN 195
  181   IF M=34 THEN PRINT CHR$(34);CHR$(20);
  182   IF M<128 OR M>202 THEN 190
  183   PT=0:ID=M-127:FOR I=1 TO ID-1
  184   PT=PT+A%(I)
  185   NEXT I
  186   FOR I=1 TO A%(ID)
  187   S9=49297 + PT+I:GOSUB 2000:IF S9>127 THEN S9=S9-128
  188   PRINT CHR$(S9);:NEXT I
  189   GOTO 195
* 190   PRINT CHR$(M);
  195   S9=L+1:GOSUB 2000
  200   PRINT TAB(25);M+B*S9;
  210   PRINT TAB(32);B*M+S9
* 220   NEXT J
* 230   PRINT
  240   GOTO 80
 1000   POKE 59500,1:X=0:POKE 1,58:POKE 2,3 :A=826:FOR I=A
        TO A+6:READ C:POKE I,C:NEXT I
 1010   RETURN
 1020   DATA 173,0,192,141,255,3,96
 1100   DIM A%(75)
 1110   FOR I=1 TO 75:READ A%(I):NEXT I
 1120   RETURN
 1130   DATA 3,3,4,4,6,5,3,4,3,4,3,2,7,5,6,3,4,2,4,4,4,
        6,3,4,6,5,4,4,3,3,3
 1140   DATA 4,5,3,3,4,2,2,4,4,3,4,1,1,1,1,1,3,2,1,1,1,
        3,3,3,3,3,3,3,3
 1150   DATA 3,3,3,3,3,3,4,3,4,3,3,4,5,6,4
 2000   D%=S9/256:E=S9-D%*256:POKE 827,E:POKE 828,D%:
        Y=USR(0):S9=PEEK(1023):RETURN
```

NOTE: * marks lines which are unchanged from original MEM-EXPLORER.

Entire article and program copyright October 29, 1978 by
Roy Busdiecker, Woodbridge, VA 22193.

FAST-FORWARD TO FIND YOUR PROGRAM

by Robert Buxton

Who wants to search through 30 minutes of tape looking for a program? A dumb tape counter on the PET would have been worth the front-end money! Without getting into more obvious and expensive hardware-type solutions, I have a program that has worked for me — and will work equally well for you.

The DIRECTORY merely fast-forwards the cassette until just before the program of interest, then stops. This enables you to load *just* the desired program. By accurately controlling the F. FWD capability of the cassette recorder, any program on a 60 minute cassette can be loaded correctly within two minutes instead of in as many as 30 minutes.

The program needs to be "educated" with the details of your particular cassette. Lines 40-90 of my example program shows 12 programs and their load points. The load point is the number of integer seconds that it takes your transport to fast-forward from the end of the DIRECTORY program (located at the beginning of the tape) to just prior to the desired program. I have found that integer seconds provide adequate resolution to do this task. If further resolution is desired, one might wade into the jiffy clock, but I believe that the uncertainty of the F. FWD capability overshadows this resolution.

Be sure to enter your load point time as a six-digit, right-justified string, in order to interface with the PET TI$ internal clock.

```
 10 REM              DIRECTORY
 20 REM                                  Program name
 30 INPUT "/C/FILE NAME";A$              and load point
 35 REM ************************************************
 40 DATA "POLE",                                "000003",
         "NF&IP",                               "000006"
 50 DATA "SENSITIVITY",                         "000008",
         "SPUR"                                 "000012"
 60 DATA "CURVE FIT",                           "000015",
         "#CONVERTER",                          "000018"
 70 DATA "AMORTIZATION",                        "000020",
         "FFT",                                 "000025"
 80 DATA "AFILT",                               "000029",
         "MATRIX INVERSION",                    "000033"
 90 DATA "MATRIX MULT",                         "000036",
         "FILT",                                "000037"
100 DATA "END",                                 "END"

105 REM
107 REM ************************************************
110 READ B$,R$:IF B$="END" THEN RESTORE
    :GOTO 10
120 IF A$=B$ GOTO 500
130 GOTO 110

500 PRINT "/CDDDDDRRRRRRRRR/PRESS /F/STOP
    /O/ THEN /F/F. FWD/O/"
510 IF PEEK (59411)  53 GOTO 510
520 TI$="000000"
530 POKE 519,52:POKE 59411,53
540 IF TI$  R$ GOTO 540
550 POKE 519,52:POKE 59411,61
600 PRINT"/CDDDDDRRRRRRRRRRRRRRRRR/PRE
    ESS /F/STOP/O/"
610 IF PEEK(519)  0 GOTO 610
620 PRINT "/CDDDDDRRRRRRRRRR/HIT /F/RETUR
    N/O/ & /F/PLAY/O/"
630 PRINT "/RRRRRRRRRRRRRRR/";
640 FOR I=1 TO 7:PRINT"/-0/-=/DLLL/";:NEXT I
650 PRINT "/- ←/-=/UUUUUUUU/"
660 FOR I=1 TO 25: PRINT "/R/";:NEXT I
670 FOR I=1 TO 10: PRINT "/-]/RL/";:NEXT I
680 PRINT "/-=/LL/";
690 FOR I=1 TO 3: PRINT "/-@/RL/";:NEXT I
700 PRINT "/- ←/"
710 PRINT "/UUU/LOAD/UUU/"
```

Graphics used:

/C/	clear screen	Line 640	/-0/ /-=/
/D/	cursor down		
/U/	cursor up	Line 650	/- ←/ /-=/
/R/	cursor right		
/L/	cursor left	Line 670	/-]/
/-0/=shift zero		Line 680	/-=/
/-=/=shift equals			
/- ←/-shift left arrow		Line 690	/-@/
/-]/=shift right bracket			
/-@/=shift "at"		Line 700	/- ←/

Tyson Richmond writes: I was told that leaving my PET on continuously, as long as the screen was off, wouldn't hurt it. Now it won't SAVE programs, although it LOADs fine. Any suggestions? The answer is "Only one suggestion — it sounds like cassette problems — probably not caused by leaving the PET turned on. All you can do is return the cassette unit (or the PET) to Commodore for repair.

MOEBIUS STRIP CASSETTES FOR PET?

John Hirsch writes: I recently got the brilliant idea (?) of using one of those endlessly repeating cassettes (with a moebius strip foldover) to record data files. The files could then be located and searched under program control without rewinding — giving very slow but sure access to any field. With the files loaded, I then ran my program and got an "? ILLEGAL QUANTITY ERROR" after a certain point. The READY message which followed was REDY — without the "A". I assume this problem occurred when the tape looped back. Does anyone have an explanation? Without one, I'm up the creek without a (CH CK) P DDLE!

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CS-1003. Logic Games-2. Six challenging puzzles including **Rotate**, in which you order a matrix of random letters. **Strike-9**, try to remove all nine digits without striking out. The classic number game, **NIM.** In **Even-Wins** try to take an even number of chips. **Hi-Lo**, a number guessing game with a jackpot. **Batnum**, the super "battle of numbers!" $7.95.

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creative computing software

CS-1005. Graphics Games-2. Six favorite games. **LEM**, lunar lander with a graphic display and optional auto-pilot. **Nuclear Reaction**, a game of skill for two players. **Artillery**, in which two players shoot it out over computer-generated terrain. **Bounce** traces the path of a ball bouncing around the screen. **Checkers**, with graphic display, from our *BASIC Games* book. **Dodgem**, try to outmaneuver another player or the computer to get your pieces across the board first. $7.95.

CS-1006. Conversational Games-1. Talk to **ELIZA**, the computerized psychoanalysis program. Compose poetry with **Haiku.** Challenge your vocabulary and word-guessing skills with **Hangman. Hurkle**, try to find the hurkle on the 10 by 10 grid in five moves. In **Hexletter**, you compete to capture more letters on a hexagon than your opponent. $7.95.

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BASIC IN ROM

by Robert H. Wind

These tables list the addresses where the BASIC routines reside. The addresses are stored as pairs of bytes (low-order byte first, then high-order byte) in two tables at ROM locations 49152 thru 49221 and 49222 thru 49267.

The first table lists the routine address minus one, and the second table lists the routine address exactly. I believe the list is accurate, but I haven't thoroughly checked out all the routines. I invite corrections, extensions, and comments. My phone is (313) 694-1699, and my address is 4092 Knollwood Drive, Grand Blanc, MI 48439.

TABLE 1

ROUTINE ADDRESS HEX	ADDRESS DECIMAL	BASIC COMMAND
C551	50513	NEW
C5A8	50600	LIST
C649	50761	FOR
C70D	50957	RESTORE
C71C	50972	STOP
C71E	50974	END
C745	51013	CONT
C770	51056	CLR
C775	51061	RUN
C780	51072	GOSUB
C79D	51101	GOTO
C7CA	51146	RETURN
C7F0	51184	DATA
C920	51232	IF
C833	51251	REM
C843	51267	ON
C89D	51357	LET
C97F	51583	PRINT#
C985	51589	CMD
C99F	51615	PRINT
CA9F	51871	GET
CAC6	51910	INPUT#
CAEO	51936	INPUT
CB24	52004	READ
CC36	52278	NEXT
CF71	53105	DIM
D295	53909	DEF
D6F9	55033	POKE
D702	55042	WAIT
FFC0	65472	OPEN
FFC3	65475	CLOSE
FFD5	65493	LOAD
FFD8	65496	SAVE
FFDB	65499	VERIFY
FFDE	65502	SYS

TABLE 2

ROUTINE ADDRESS HEX	ADDRESS DECIMAL	BASIC COMMAND
0000	0	USR
D264	53860	FRE
D285	53893	POS
D349	54089	STR$
D5C4	54724	CHR$
D5D8	54744	LEFT$
D604	54788	RIGHT$
D60F	54799	MID$
D654	54868	LEN
D663	54883	ASC
D685	54917	VAL
D6E6	55014	PEEK
D8BF	55487	LOG
DB0B	56077	SGN
DB2A	56106	ABS
DB9E	56222	INT
DE24	56868	SQR
DEA0	56992	EXP
DF45	57157	RND
DF9E	57246	COS
DFA5	57253	SIN
DFEE	57326	TAN
E048	57416	ATN

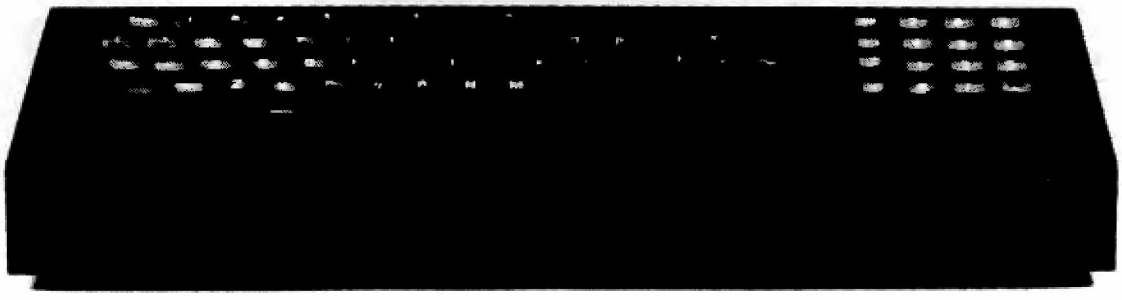
Note: In my PET, these addresses appear to be 00 when PEEKed. However, by transferring these locations to RAM with a machine language program, the location in RAM can be PEEKed to observe these tables.

Robert H. Wind

Ed Steinfeld asks if the CmC IEEE/RS232 interface is truly a bidirectional interface — and can he connect any RS232 device to it and use the terminal for data entry & output? Unfortunately, the answer is "No — it's not a true bidirectional interface. Its RS232 is output only."

George Risk Industries, GRI Plaza, Kimball, NE 69145 announces PERK — the Professional Encoded Remote Keyboard — for PET. It's a plug-in, typewriter style, alphanumeric keyboard, sharing the PET's internal keyboard interface with the PET's own keyboard — making both boards fully active and useable. No soldering or assembly required, no charges or modifications are needed, and a plug-in, UL listed power supply is provided. Standard CRT terminal control functions are implemented for cursor control, more than one keyboard at a time may be attached to the PET, and full screen editing capabilities are provided. Custom steel desktop enclosure, plug-in interface card, power supply, full instructions, handy reference card, and 90-day warranty are all included (along with the keyboard itself!) for $229 — wired and tested. Write to Robert Nichols for more details

You love your PET, but wouldn't you love it more with this BigKeyboard?



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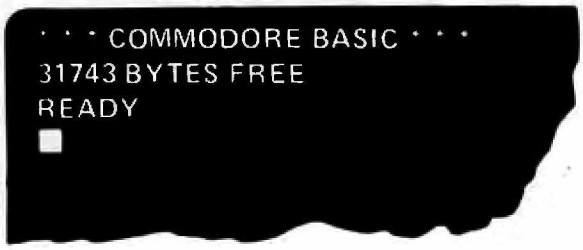

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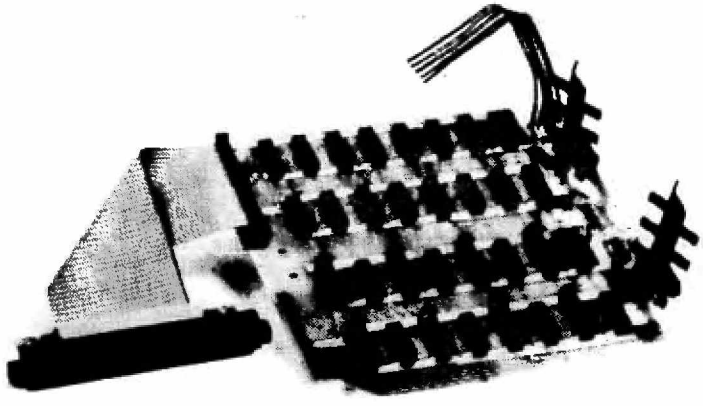

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d. *2wayanova* is similar to 1wayanova, but each case is subjected to two treatments A and B simultaneously. For example, treatment A might be different drugs (or different dosages of the same drug) and treatment B different diets; alternatively, the treatment B can be blocks of a block design.
e. *Anova2wayr* is the same as 2wayanova, but there are two or more cases (replicates) for each treatment combination. All the analyses of variance programs including tests of significance.
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is written in BASIC, not in machine language, so you can see how it is done. Functions: Write to memory, read memory/disassemble, save memory on tape, load from tape to memory, execute a machine language program, exit to BASIC. Four pages of documentation.

TUTOR $19.95
A beginner's guide to PET BASIC and to the cursor control features which make PET the #1 personal computer available. Over 400 screensful of information are presented in 20 lessons, provided on both sides of each of two C-45 cassette tapes, five lessons per side. All the major BASIC keywords, plus exercises, quizzes, and a few wisecracks. A must for all beginners.

PET BASIC COMPLEAT $29.95
This 170+ page manual is the companion for the TUTOR tapes. The manual is drilled for a standard 3-hold binder, is indexed for easy reference, and reproduces (so far as is possible without a PET printer) exactly the data presented in the tape and displayed on the screen.

PET TUTORIAL PACKAGE $39.95
Because we feel that the TUTOR' tape and the PET BASIC COMPLEAT manual constitute an unbeatable learning tool for beginning PET people, we offer the set as a package deal — you get the 170+ page manual (as of this writing, there are 183 pages) plus the two C-45 cassette tapes, for under $40. Save almost $10.00 on the set.

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The object of the game is to survive an eight-hour day — for as many days as you can — as supervisor in the Warehouse. Select level of expertise: 1 minute of playing time = 1 hour of "real" time. If you make a mistake, you'll get a memo from the Boss — and if you let your workboard overflow, you'll be fired!

THE PAPER guarantees that each of these programs will perform as claimed herein. If your copy of any program fails to load, send it back to us — we'll ship you a new copy. Record a program of your own on the back of the tape, however, so we can check the tape head alignment.

MORE ABOUT RESEQUENCE

by Brian Brane

The RESEQUENCE program (page 20, issue #8) is a big help, but it cannot accomodate some of the longer programs. To overcome that problem, I added the following lines to the program.

@=CLEAR SCREEN &=CURSOR UP $=CURSOR DOWN

```
570  T=33647:S=T-879:E=S+23:?"@$$$$$$$$$$$$$$$$$$$$"
641  FORK=826TO1017:A=PEEK(K+32630):POKEK,A:
     POKEK+32630,0:NEXTK
642  ?"PRESS PLAY ON TAPE # 1&":IF PEEK(59411)=61
     THEN642
643  FORK=1TO100:NEXTK:IF PEEK(59411)=61 THEN642
644  ?"?"CHR$(34)"&&&&"CHR$(34)":LOAD:$$"
645  ?"FORK=33456TO33647:A=PEEK(K-32630):POKEK,A:
     NEXTK:SYS(32791)&&&&&&&"
646  POKE525,2:POKE527,13:POKE528,13:END
```

These additions store the machine language program in Video RAM. Line 641 temporarily stores part of the machine language program in the second cassette buffer while your program is loaded from Tape Unit #1. Line 645 puts the program back in Video RAM and then renumbers your program. Be sure that your program (the one to be renumbered) is the first program PET will find after you press play in line 642.

Nestar Systems, 810 Garland Drive, Palo Alto, CA 94303 has the CLUSTER/ONE, a low cost distributed processing alternative to BASIC timesharing. The central unit (the QUEEN), via a high-speed data bus, connects up to 15 PETs as terminals (the DRONES). Programs and data files are shared among the users, stored on two IBM-compatible 8-inch floppies; each of which hold 315K bytes of data. Disk transfer rates are 250K bytes/second, managed via an LSI floppy disk controller ship. No internal modifications required. In fact, if a CLUSTER/ONE Queen fails, it can be replaced by a Drone in a matter of minutes. A full set of Utility programs for maintenance and backup, and separate documentation for the end users; disk drives, controller, bus electronics, additional memory, power supplies and cooling for $7500. Write to NESTAR SYSTEMS INC. for further details.

ELLIAM ASSOCIATES, 24000 Bessemer Street, Woodland Hills, CA 91367 announces cassette labels on *pinfeed* backing. They're white, fanfold, and $5.90/100. Write to William D. Roch for larger quantity prices, for pinfeed diskette and mailing labels, and delivery information.

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The PEM - CALCULATOR is a reverse Polish stack operated calculator written in BASIC for the PET®'s 6502 micro-processor and requires 12K of memory.

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SET®, which stands for Software Engineering Tool, allows the user to manipulate other programs in a very convenient fashion. MICRO-SET® I provides the following functions in a manner designed and tested for ease of use:

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DELETE — removes from your program all lines numbered between limits you specify.

PROGRAM INFO — reports the number of lines in your program, first and last line numbers, and the number of bytes free.

RENUMBER — change line numbers in a range you specify to new numbers starting with a number you designate, increasing at a step size of your choice. Provides information for manually changing targets of GOTO, GOSUB and IF - - - THEN statements.

8K of user memory required

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"Mortimer Snerd" writes that he's 15 years old and would like to share with us the following tidbits: SYS(64840) calls the screen test program — but you have to turn off the PET to recover. When you call USR without POKEing the address into locations 1 & 2, you get an ?ILLEGAL QUANTITY ERROR because the address in those locations on power-up is the address of the routine printing that message! And, to avoid abnormal RETURN key functions after closing a file, POKE 3,0, then a few garbage letters, then hit RETURN. But the program has to include a CLOSE statement — or the RETURN key doesn't work.

National Artificial Intelligence Laboratory (NAIL), P.O. Box F, Mobile, AL 36601 has two new machine language programs for the PET. SYS7171 is a machine language monitor which allows the user to program in machine language or in BASIC without destruction of the monitor once it's loaded. The user can jump from BASIC to SYS7171 and back again freely, to append one BASIC program to another, and spend only $29.71 doing it all. SYS8181 is a machine language renumbering program using only 1K of RAM and costing $18.71. The user can select a beginning line number and increment amount and SYS8181 correctly renumbers every GOTO and GOSUB in the program. Both programs come with manuals. Write to Evan Foreman for delivery information.

John Hirsch writes to let us know this:

Try this program:

```
10 FOR I=4.8 TO 6.3 STEP .3
10 PRINT I
30 NEXT I
```

You might expect the last I printed to be 6.3 — instead, it's 6.00000001! I assume this is due to the impossibility of representing .1 exactly in binary arithmetic. To see why, try solving:

$$2^X = .1$$

$$X\,LOG(2) = LOG(.1)$$

$$X = \frac{LOG(.1)}{LOG(2)} \approx -3.3219281$$

But if we try 2↑-3.3219281, we get .099999997 — the limit of PET's nine-digit display. This lack of correspondence between decimal and binary makes it risky to use "IF X= (some constant) THEN . . . . . ." when we are comparing floating point numbers. Every experienced programmer knows (and keeps forgetting) this.

I enjoyed Roy Busdiecker's article on date formats in #9. The only thing left out was the algorithm for converting floating point to PET 5-byte. Those interested can look up Mark Zimmerman's article in "PEOPLE'S COMPUTERS", Sept/Oct '78, V7 #2, p. 16.

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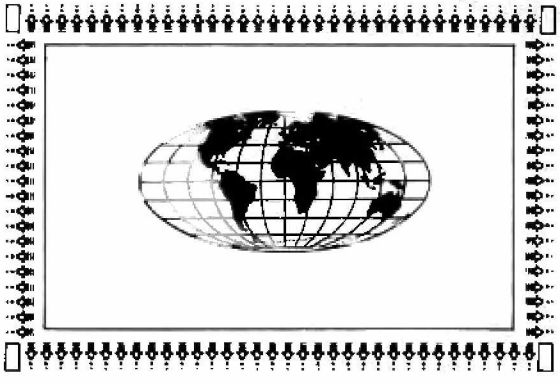
THE PET IN THE CLASSROOM — continued

and a grade-recording program is being developed for use with the printer.

Any correspondence with others interested in education is welcome. Some of the CAI programs are available for exchange, and the school computer club has many games that are available for exchange. Just write: John Fultz, Lincoln School, 750 E. Yosemite, Manteca, CA 95336



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