

Creative Computing

140-44

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October 1981
vol 7, no 10
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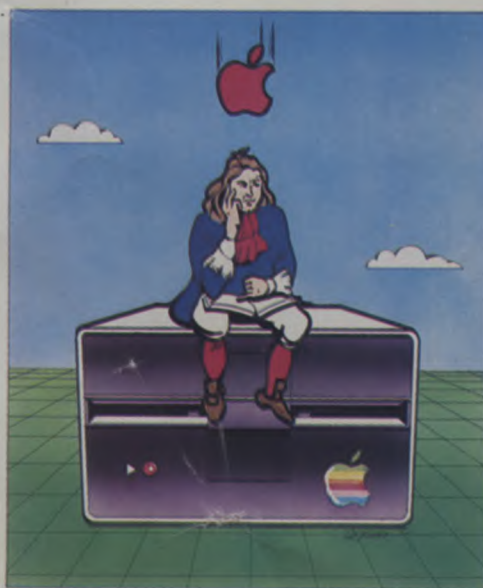
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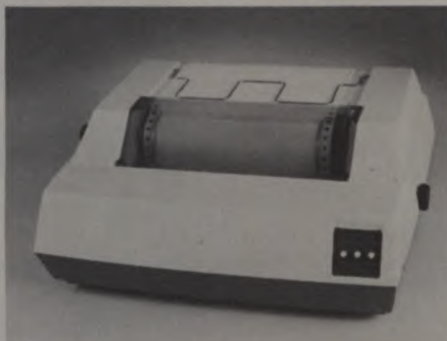
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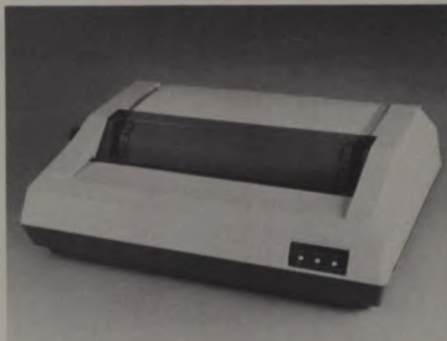
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the cover

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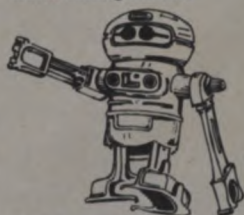
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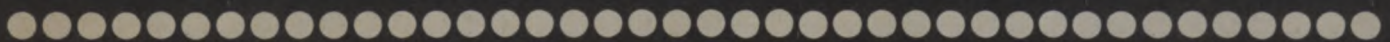
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In conjunction with our exhibits at the National Computer Conference and the summer Consumer Electronics Show in May and June, *Creative Computing*, *Microsystems* and *SYNC* held a drawing for a free Sinclair ZX80 computer.

About 400 people participated in the contest, of which Jeffrey M. Eby was the winner. Mr. Eby is a remote terminal specialist for United Airlines in Comstock Park, Montana.

We can't guarantee that you will win a computer, but we do encourage readers to look us up at one of the many computer shows we attend. We exhibit at about 200 shows each year, from the giant trade shows such as NCC to small one-day educational conferences, from Cedar Falls, Iowa to Birmingham, England.

We enjoy meeting our readers, and are eager to learn how our magazines can serve you better.

Fortran Anecdotes Wanted

Pioneer Day at the 1982 National Computer Conference will honor the 25th anniversary of Fortran. A special commemorative publication will be a collection of anecdotes about early uses of Fortran (before 1965). If readers can supply any such anecdotes or other humorous, interesting or horrifying incidents, please send them to J.A.N. Lee, IBM Corp., M43/D27, 555 Bailey Ave., San Jose, CA 95150.

And then there was the one about the Mariner probe to Venus going astray and an undeclared variable type.

Corrections

We made a goof in the July, 1981, "dateline: tomorrow" (page 6). Just over 7600 school districts, not schools, have computers which are used for instructional purposes. Over 13,000 secondary schools and over 9500 elementary schools used computers to teach during the 1980-81 school year.

In the program for "Caesar's Watch" (June 1981, page 169), line 2370 should read: GOSUB 3000.

The following lines were omitted from Evan Heit's "Tree" program (August 1981, page 126).

```
5040 GOSUB5506
5045 NEXTJ
5050 RETURN
5250 REM VERTICAL GROWTH
5255 NEEDED=8+24*RHEIGHT(J)
5260 RHEIGHT(J)=RHEIGHT(J)+TURN(J,4)/NEEDED
5263 IFRHEIGHT(J)<1THENRETURN
5265 IFRHEIGHT(J)>8THENRHEIGHT(J)=8
5270 FORK=1TORHEIGHT(J)
5275 BELOW(K)=LEFT$(BELOW$(K),1+6*J)+CHR$(48+J)+MID$(BELOW$(K),3+6*J)
5280 NEXTK
5285 RETURN
5500 REM HORIZONTAL GROWTH
5505 IFRHEIGHT(J)<1THENRETURN
5510 RH=RHEIGHT(J) NEEDED=6+2*RH
5515 WIDTH=TURN(J,5)/NEEDED+.5 IFWIDTH>5THENWIDTH=5
5518 IFWIDTH<1THENRETURN
5520 FORK=(2.5+6*J)-WIDTHTO(3+6*J)+WIDTH
5525 IFMID$(BELOW$(RH),K,1)<>" " THEN5535
5529 SIZE(J,2)=SIZE(J,2)+2
5530 BELOW$(RH)=LEFT$(BELOW$(RH),K-1)+CHR$(48+J)+MID$(BELOW$(RH),K+1)
5535 NEXT
```



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Two lines from "Stoneville Manor" (August 1981, page 163) were not printed properly. They should read:

8120 DATA "AT THE EDGE OF A GORGE", "ON MAIN STREET", "INSIDE THE GENERAL STORE", "INSIDE THE HOSPITAL", "IN THE FOYER", "IN THE PARLOR"

8140 DATA "AT THE TOP OF A STAIR WAY", "AT AN OUTLET IN THE DUCT", "AT A TURN IN THE DUCT", "AT A FORK IN THE DUCT", "AT AN OUTLET IN THE DUCT", "AT A TURN IN THE DUCT"



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Avid Reader

Dear Editor:

I have a complaint to register! Your magazine is threatening my job. I ceased my love for subscribing, and now I spend all my time reading and rereading *Creative Computing*. The final irony is that my main work is done on an IBM System/34 (a really nice machine) in RPGII (some nifties, but definitely hostile to structured, easy-to-read programs). We also have a Basic/4 model 610 with cash projection and games, so far.

I am also debating heavily with my wife and budget for a personal computer. I am impressed with the software available for the Apple (my tentative first choice), but are there really that many disk systems out there? I'm going to be scraping the bottom to get the computer, let alone the extra memory and disk drive. Is everyone rich but me? Oh well.

Even without a personal computer, I have avidly followed everything you have published on *Adventures*. I also loved the Smalltalk overview, especially in light of all the teasers you threw in. The thought also occurred to me that the various *Adventures* look like limited implementations of Smalltalk. Am I close?

Thanks for a great magazine. You seem to have the best mix of practical theory and novice/advanced. After six years in DP, I will learn something (usually several somethings) from each issue.

Dana Taylor

*And we thank you very much. Yes, get a disk for your Apple even if it means you have to mortgage the children. Is Smalltalk like *Adventures*? Well, let's say that if you program in Smalltalk you create your own *Adventures*. And getting mixed up with the language at all tends to be an *adventure* in itself—ED.*

High-Resolution Color Graphics for the Apple and Atari

Graphics Breakthrough



How many programs have you written that would benefit from animated high-resolution graphics? Probably several. It is this kind of dramatic graphics that distinguish outstanding programs from ordinary ones. But if you've ever agonized for hours or days just to get one image perfected, you're probably not anxious to do it again. Now there's a better way.

New Graphics Entry System

Today there is a new graphics system available that is not only amazingly user-oriented but surprisingly economical. Called VersaWriter, it starts with an ingeniously simple entry board consisting of a 14" X 12" high impact plastic bed with a tough clear plastic overlay sheet. The original drawing or diagram is fastened with masking tape to the plastic bed and then covered with the clear sheet. Instead of using a light pen or complicated electronic X-Y head, the VersaWriter uses a double-jointed arm attached to the top of the entry board at one end and a magnifying lens with crosshairs at the other end. The VersaWriter resembles a draftsman's pantograph on a smaller scale.

Attached joint in the arm of the VersaWriter is a potentiometer. A cable from these potentiometers connects to the paddle input of the computer. No special interface electronics or board is needed. Since the arm of the VersaWriter bends only in one direction, each point on the plotting head corresponds to a unique set of resistances on the potentiometers. All that's needed now is software to translate these resistances into usable screen coordinates.

Exceptionally powerful software

It is in the software where VersaWriter really stands out. VersaWriter comes with two full disks of user-oriented software. First it has sets of "low level" commands for entering, creating and copying drawings and diagrams. Secondly, it has extensive sets of application routines for moving, enlarging, rotating, coloring or animating drawings that the user has created.

Of course the basic commands let you enter a drawing freehand or by tracing it. You can enter brush strokes. Six colors are available. Drawings can be independently scaled in both the vertical and horizontal directions. An enclosed shape may be filled in with any of 256 colors. No, that is not a misprint—by the same technique that a printing press can create hundreds of colors from three primary ones, so can VersaWriter.



Here a shape (the letter A) is being animated. After putting it in a shape table it may be used in other programs.



From the shape table, a shape (the letter A) may be enlarged, shrunk, rotated, colored or moved about the screen.

Create Animation for Other Programs

The images you create with VersaWriter can be used and manipulated with ease in other programs. Up to 256 images can be entered into a shape table. These shapes may then be placed on the screen in any position or may be overlaid on a full or partial screen image. Animation is produced easily by moving about a portion of the image created by VersaWriter. For example, by alternating between two images of an airplane propeller it will appear to be spinning.

Other VersaWriter software includes text writer with which text can be added to graphics. Upper and lower case, choice of color, text size, direction and starting point all may be specified.

The Area/Distance program lets you calculate distances (in centimeters) by entering a table and tracing a shape or map route with the drawing arm. Areas of figures, open and irregular, can be similarly calculated.

The software also includes sets of electronic and computer logic shapes. In addition an entire disk of dramatic demonstration graphics is included. These twelve full-screen graphics run the gamut from a fully labeled cross section of a human skull to colored maps to animated cartoons to an electronics schematic.

Free Software Updates

You may have read a review of VersaWriter that indicated that the color kit option was slow. It was. But not anymore. Several new routines and improvements were added to the VersaWriter software since its introduction. All customers of Peripherals Plus received these changes free.

As new updates are developed, Peripherals Plus will furnish them free to all customers FOREVER. We make this unique guarantee because it is in our best interest to have you make the best use of your computer. We're convinced that if other people see your VersaWriter in use, they'll want one too.

Best Performance and Price

At Peripherals Plus, we evaluated every graphics entry device. We wanted to find the best one regardless of price. VersaWriter has the best performance bar none. Surprisingly it also has the lowest price, just \$299.00 for the Apple version.

VersaWriter requires an Apple II with AppleSoft in ROM or an Apple II Plus disk and 48K of memory. The Atari version requires an Atari 800 disk and at least 32K. It is priced at \$200.

VersaWriter comes complete with two disks of software, a comprehensive instruction manual, a 90-day limited warranty, and Peripherals Plus unique guarantee of software updates forever.

Try VersaWriter for 30 days. If you are not completely satisfied we'll give you a refund and courteous refund of the full price plus shipping both ways.

To order, specify Apple or Atari version and payment plus \$3.00 shipping and handling to Peripherals Plus, 39 East Haddon Ave., Morris Plains, NJ 07950. (New Jersey residents please add 5% Sales tax.) Credit card customers should include card number and expiration date of Visa, MasterCard or American Express card. Credit card customers may also call toll-free 800-631-8112 in NJ 201-540-0443.

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Summagraphics Digitizer	745.00
Houston Instruments Hi Pad	795.00
Apple Graphics Tablet	795.00



Apple Accolade

Dear Editor:

I just received the June *Creative Computing* and am delighted with the Apple coverage. Bob Sasler-Colesoff's over letters are a challenge to analyze and a joy to behold. Paul Raymer's "Caesar's Watch" is a lot of fun. (Might I suggest the following watch cleaning?)

```

Add 025 START=1:M=M+1:GOSUB 2260
      M=M+1:START=0
Add 2305 IF START THEN RETURN
Change 2310 R=37
Change 3040 FOR X=17 TO 17
  
```

The flow is a bit better with these changes.)

The highlight of the issue is David Lubar's "Picture Packer." I am now busily packing pictures and am most pleased with the speed on the routines. Loading and displaying a packed picture is, on the average, much faster than using the original. And with no noticeable loss of quality!

Stephen M. Lawton
The G.R.A.P.E.
P.O. Box 263
Port Orchard, WA 98366

Surface Mail

Dear Editor:

I have recently started my second subscription with *Creative Computing*. One of the main reasons for this renewal was an article by Rod Hallen in the December, 1979, issue titled "Battle of the Assemblers." Not everyone out here is a "Basic only" user. I really appreciated the article and found it most informative.

Larry W. Smith
E-Systems
PSC-1 Box 77347
APO San Francisco, CA 96230

Your Numbers Are Dazed

Dear Editor:

Perhaps others have written regarding this bug in Apple RememBer on the System Master Disk, but I haven't seen it as yet in *Creative Computing* or any other computing magazine.

If this line is used in the program to be renumbered:

```
100 A=INT(A*100+.5)/100
```

frequently, but not always, and with no apparent pattern, the line will be changed to read:

```
100 A=INT(A*136+.5)/100
```

The "136" within the parentheses seems to be random but sometimes will be the line number.

When the program (RememBer) decides to perform this little bug-a-bug, elsewhere in the renumbered program arithmetic lines may be changed from:

```
130 A=B+C*125 to 130 A=B+C*136
```

The "136" being the same number that was substituted in line 100 above.

I have never seen a number outside parentheses suffer this change—only those inside.

E.B. Bastman
c/o E.G. & G.
P.O. Box 5 Pailin Panjang P.O.
Singapore 9911

The problem seems to occur after an asterisk. There might be a fix, but I haven't been able to track it down. The best bet is to use variables for multiplication. Perhaps a reader knows the fix.—DL

Lefthanded Compliment

Dear Editor:

I greatly enjoyed the listing of Leo Christopherson's "Android Man" in the June 1981 issue of *Creative Computing*. However, I found one bug in the program. When one of the three androids on the left of the screen raised his arm to "greet" the other androids, his arm didn't go back down. Instead, one of the 15 regular androids lowered his arm. To correct this, I changed line 8405 from:

```
8405 GOSUB 8040: GOSUB 8005: X3=X: GOSUB 8070:
      X=X3: GOSUB 8045: GOSUB 8450: GOSUB 8501:
      GOSUB 8050: GOSUB 8010: GOTO 8325
```

to:

```
8405 GOSUB 8040: GOSUB 8005: X3=X: GOSUB 8070:
      X=X3: GOSUB 8045: GOSUB 8450: GOSUB 8501:
      X=X3: GOSUB 8050: GOSUB 8010: GOTO 8325
```

Another thing I noticed was that line 8400 was listed as:

```
8400 GOTO 8405: GOSUB 8040: X3=X: GOSUB 8070:
      X=X3: GOSUB 8005: X3=X: GOSUB 8070: GOSUB
      8070: X=X3: GOSUB 8045: GOSUB 8450: NEXT N:
      GOSUB 8500: GOSUB 8050: GOSUB 8010: GOTO
      8325
```

Since the first statement of this multi-statement line is a GOTO, control will never go beyond the first statement in this line. I therefore replaced this line with:

```
8400 GOTO 8405
```

with no apparent changes in program execution.

With these two changes, "Android Man" is a very enjoyable program for my TRS-80. I hope to see more such programs in future issues. Thank you.

Jerry Schremp
312 Mary St.
Antigo, WI 54409

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Standing Ovation

Dear Editor:

I'd like to compliment Laurie Spiegel for an interesting article on electronic music ("Macromusic from Micros," May 1981 *Creative Computing*). Her opinions on the facts and foibles of computer music are sensible and pertinent, and she explains them quite clearly.

There are many hobby-home riders in electronic music who will take offense at some of Miss Spiegel's statements. They must follow their own ideas, of course, but Miss Spiegel's article expresses what I, as a serious electronic-music composer, have long thought.

Allen Watson III
1261 Robbin Court
Sunnyvale, CA 94087

Smooth Estimate

Dear Editor:

I enjoyed the program by John W. Enig entitled "Home Construction Cost Estimate" which was published in the August edition of *Creative Computing*.

A deficiency of the original program is lack of a provision for quick revision of specifications, location and/or grade of construction without rerunning the entire program.

I would be happy to send the Atari Basic program to any of your readers who would be interested in having it.

Robert Gordon, M.D.
6191 South Forest Rd.
Littleton, CO 80121

Big Trouble

Dear Editor:

I am having a problem, and maybe some of your readers can help.

As the owner of an Apple IIe, I have compiled some of my very favorite programs and used good parts of each.

For example, I've taken Roger Wagner's Apple DGC and used the feature of locating and changing names of variables. I've used Sensible Software's Super Disk III to alphabetize my catalog, after using the Boggle Bros' DOS RDS to customize my catalog by putting their name on it, as indicated in their instruction book.

Then using Apple's Tool Kit I have been able to shorten the programs to load faster and with Synergistic Software's Higher Graphics by Robert Clardy, I've done some beautiful things.

All of this I have now combined onto one disk—all of these remarkable programs—and now my problem.

This disk is 18" wide, because of the stuff on it. How can I get it into my disk drive?

Can any of your readers help?

Paul Raymer
Paul's Electric Computer
P.O. Box 42831
Las Vegas, NV 89104

We checked with our hardware guy, Will Rubin, who provided the following insight for a mere \$200: "I had a similar problem

a few years back. The first thing I did was take a hacksaw (Stanley #307 with a 37cc905-002 blade works best here) and expand the front slot of the disk drive along both sides. Be careful not to damage the write-protect sensor. Next, the spindle and read head have to be extended. Read-head conversion is fairly simple, using Emerson brand multi-hole building shafts. The spindle is another matter. After several weeks of experimentation, I discovered that the transmission from a '77 Mustang is ideal. An external power supply completed the fix. When it didn't work, I bought a Corvus."

We Have Ways to Make Things Tock

Dear Editor:

Referring to the "Caesar's Watch" program on page 166 of the June 1981 issue of *Creative Computing*, I noticed this program lurking in the back somewhere and thought it looked pretty good, so I plugged it in to my school's 48K Apple II+.

Thirty minutes and two sore hands later it was ready to go. I tried it and found that it was great, unfortunately it seems that the author forgot one minor detail, sound. I mean what is a clock without the tick-tock, or should I say "drip-drip."

So I figured, why not add the sound for him, and here it is:

```
275 C += -16336
1045 Z = PEEK(C) + PEEK(C) + PEEK(C) - PEEK(C)
2085 Z = PEEK(C) + PEEK(C) + PEEK(C) - PEEK(C) +
      PEEK(C) + PEEK(C)
3255 Z = PEEK(C) + PEEK(C) - PEEK(C) + PEEK(C)
```

Aaron Spilling
The Computer Room
Gwinnett High School
Box 402
Gwin, MI 49841

Mutual Admiration

Dear Editor:

I was very surprised at the number of inquiries we received in response to our article "Investing in Mutual Funds" (*Creative Computing*, May 1981). The listings we provided did not copy, so they were manually retyped and several errors caught. We will be happy to provide copies of the original listings to readers who send an SASE.

The data we used when we wrote the article is now about two years old and is not of much use. But there is an alternative to going to the library and digging through 29 weeks of newspapers. A small computer firm in Albuquerque publishes an inexpensive booklet, updated weekly, containing one year's worth of market index values and net asset values of selected mutual fund groups. This booklet can save a lot of time. The address is:

Mesa Software Engineering
P.O. Box 18056
Albuquerque, NM 87115

One aspect of the system which we should have stressed in the article is that one must not ask the fund group managing the investment to switch too often. They may restrict the investor's privileges. I have called my fund group only eight times since January 1, 1979. If the system is used correctly, switching shouldn't be too frequent to upset any reasonable managers.

John S. Browning
2071 B. Mercury Dr. SE
Kirtland AFB, NM 87118

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An Alternate Approach to Input in the Classroom

Keith Schlarb

We just received notice that, based on feedback from field use of prototypes such as the one described below, Mountain will be releasing an improved card reader in early 1982. This comparably priced unit will feature automatic load and an improved read head. It will be able to read both mark-sense and punch cards.

Classroom use has the obvious advantage over home private terminals. They have been used successfully by such institutions as University of Colorado and Longwood University. But the advantages that computer use offers are problems of accessing such data consistently within the tight cost of purchasing small computers.

Two alternatives are emerging for the campus user. Mountain Computer card reader, but the Chatsworth Data Card Reader. I use both in my classroom.

In previous columns, some concerning the Chatsworth Data reader appeared in the April 1981 issue concerning card I/O reader in classrooms.

Equipment Description

The Chatsworth reader is a compact 10" x 10" x 10" unit housed in a metal

case reader housing with double reader, and AC/DC converter, and mounting rack. All are included in the purchase of the reader. The reader uses a standard electrical outlet.

The Mountain Computer reader is larger at 12" x 12" x 12" and the reader housing provides the drive motor, solenoid

The Chatsworth reader automatically loads on the drive wheel when a card is inserted. As the card passes through the reader, the marks on the programming card are sensed by three electronic read heads, one for each row. A small amount of current is applied through the reader for accurate sensing of the marks. The

	Chatsworth Data	Mountain Computer
Price	\$750	\$475
Card Price	\$25/1000	\$15/1000
Interface	Included	Extra
Cable	10	20
Reads	Chatsworth	Chatsworth, automatically
Read Method	Acoustic sensor	Optical

Table 1

and is used to read the programming cards. A light sensor beam interface not to MCR drive is required. This is not part of the package. The power supply uses a standard grounded outlet.

Reading and Loading

Both configurations are very simple to connect to the right computer. Simple means the hardware is one of the most of two types. Both companies suggest that the Chatsworth work in other than Chatsworth that power card type 1000, and a programming card of the reader and are covered are ready to go.

cards drive on the same surface after passing through the reader. The Chatsworth Data reader requires the use of a card #2 power, but most common readings can be obtained with an Chatsworth card power.

The Mountain Computer reader drive wheel is turned on from the rear panel. Cards are driven through by the drive motor and sensed by optical infrared sensor. All sensing is done on the reader in the same in which they were sensed at the rear of the reader in the card rack. The rack has a horizontal insertion of 20 cards and is given a three pins. Since light is not used, working for some

Keith Schlarb, 1000 University Ave., Mountain View, CA 94035

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Compare Key Features	VERSAcard	DPS Multifunction Card
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BSR Control Interface?	YES	NO
Compatible w/ Apple II/IIe?	YES	NO - Serial Port only
Compatible w/ CMM?	YES	NO - Serial Port only
Card Format?	YES - 57TRCM (Apple II/IIe only)	NO - 57TRCM (Apple II/IIe only)
Apple Multifunction?	NO	YES

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THE CAMPAIGN. On the campaign trail, you must allocate your money among key-state, regional, and national advertising. Campaign stops must be carefully planned to avoid fatigue. You must decide on the pros and cons of debate as well as grapple with national and international crises.

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PRESIDENT ELECT is a three-player game representing the Republican, Democratic, and possible third-party candidates. The computer can play any or all three positions.

All you need to play both games are an Apple II with AppleSoft ROM card, 48K memory, and a mini floppy disc drive. Each for \$39.95, both come with their respective program disc, a rule book, and various player-aid charts.

That's a small price to pay to be on your way to your first million. Or to enter the race for the highest office of the nation.

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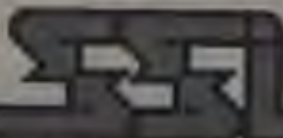
To order directly from SSI, credit card holders call toll free 800-237-1617, ext. 335 and charge your order to your VISA or MASTERCARD.

In California, call 800-775-3545, ext. 335.

To order by mail, send your check to Strategic Simulations Inc., Dept. CC5, 466 Fairchild Drive, Suite 108, Mountain View, CA 94043.

All our games carry a 14-day money back guarantee to assure your complete satisfaction.

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All prices are approximate and subject to change without notice.

STRATEGIC SIMULATIONS INC.

CIRCLE 245 ON READER SERVICE CARD

SYMBOL LOCATION	SYMBOLS	MARKING
Center of box	1 2 3 4 5 6 7 8 9 0	appropriate box
top left of box	A B C D E F G H I	appropriate box plus A
center left of box	J K L M N O P Q R	appropriate box plus -
bottom left of box	S T U V W X Y Z	appropriate box plus 0
bottom center of box	: ; @ ? = *	appropriate box plus B
top right of box	C < > (+)	appropriate box plus A plus B
center right of box	^ & ') : ;	appropriate box plus - plus B
bottom right of box	\ , 2 < > ?	appropriate box plus 0 plus B
carriage return (589) or automatic at end of card		
line feed (59)		

Figure 3. Outline of marking sequence used for Chatterworth Data cards.

The next area is the character field which is composed of 15 columns. The marking in this field is as follows: 1) If the symbol is within the box then mark that box. 2) If the symbol is between two boxes then mark the box above and below the symbol. 3) For a symbol to the left of a box, mark the box on the right plus the next two boxes below. See Figure 4, for an example of VLIN A.E. AT 32.

The final field is called the library field. Marking for the items of the left column in the library field is completed by marking either top boxes in the character field, (C) or (E), plus the box which lines up with the desired item. For example, marking the (C) and (E) in any character field column would generate the LEN() statement, while



Figure 4.



Figure 5.



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CIRCLE 17 ON READER SERVICE CARD

Statement Number Field

Command Field

Character Field

Library Field

Figure 5

THE NEW OMR 500 SEES THE LIGHT

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Data into Your
Microcomputer



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Connect your OMR 500 to your microcomputer with a cable. A few easy steps. Automatic printing is standard.

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The OMR 500 is available with:

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CREATIVE COMPUTING, INC.

10000 Wilshire Blvd., Suite 1000, Beverly Hills, CA 90210, (310) 341-1111

a ☐ ☐ and ☐ marking would generate the STRM statement. See Figure 5 for an example of marking library field items. From the example, it is seen that the ☐ plus two boxes are used if the statement of the library field occurs between the boxes. The items in the right column of the library field are marked in a similar way, except the ☐ or ☐ are used to indicate the right column of the library field, see Figure 5. Notice that all statements requiring parentheses have the open parenthesis included. For example, marking for COS results in COS(. The library field items which include the open parenthesis are: SGN(. INT(. SIN(. COS(. TAN(. ATN(. EXP(. LOG(. LEN(. STR(. VAL(. LEFT(. RIGHT(. POS(. SPC(. PEEK(. SCR(. PDL(. This is an indication of the thought involved in the card design.

Other possible uses of this well-designed system follow. First, commands from the command field may be used elsewhere in the character field by marking the top first and second boxes of the character field, ☐ and ☐ or ☐ and ☐ , and the appropriate box lining up with the desired command. The following commands DIM, READ, PROGRAM, GR, and END may not be used in this way. Figure 6, column 6 shows this method used to mark the NEXT statement.

Yet, another handy tool can be used for correcting mistakes. A line number column will be ignored by the reader if two marks appear in the same column. The reader will also ignore character field columns if the top and bottom boxes in one column are marked. Figure 6, line number column 3, and character field columns 1 and 6, show the method used to eliminate columns with marking errors.

Another handy feature is the ability to mark the cards for multiple statement lines. Marking the top four boxes of the very last column allows any line number statement to continue on the next card



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See the new world of programming from the perspective of your Apple dealer.

The best thing last: Multisync monitors are available for less than \$100 (see page 11).

CIRCLE 153 ON READER SERVICE CARD

Cardreaders, continued...

read. See Figure 6 for an example of the indicator marking for multiple statement lines which cancels the automatic return and allows the use of another card for the line number. This process may continue up to 255 characters. See Figure 7, for symbol location, symbols, and appropriate marking method for Mountain Computer cards.

The cards may also be used to input hexadecimal data. The hex data is converted to its binary equivalent, and then the ones are marked on the card with zeros remaining empty. Each column represents 12 bit locations. Mountain Computer states in the manual that this form of data input may be used with any computer and most any purpose when interpreted by a program prepared by you. I suggest if you are interested in this use you check a manual at the nearest dealer or contact Mountain Computer.

Data Entry

Entry of Basic programs is completed in a similar manner with both readers. The cards marked with Basic statements are entered, and the statements are printed on the monitor screen and entered into RAM as the cards are read. An automatic return is generated at the end of each card.

The Mountain Computer reader does require the initial card to be marked with either PROGRAM to inform the card-reader the program is in Applesoft, or INT PROGRAM for integer. The PROGRAM also generates an automatic NEW and TEXT, and creates line 0 REM PROGRAM to start your program.

Several methods are available for entering data into existing programs, all of which are similar to those used from the keyboard. One method is the use of a FOR-NEXT loop. Depending on how the loop is arranged, one data item or several per card can be entered through the reader. The number of cards used can be large if only one data item per card is used. See Figure 8 for sample FOR-NEXT loops for data input.

One advantage of the Mountain Computer cardreader for data entry is the ability to use the keyboard and reader at the same time. No IN#0 instruction is required to disconnect the reader before use of the keyboard is permitted. This permits the use of the keyboard to RUN, LIST and SAVE programs. These commands could be done through the reader, but this feature does provide additional flexibility to the overall system, and in the classroom allows students to use the keyboard for minor error correction. These uses require little time and give the students a chance for keyboard interaction.

The Chatsworth Data reader does not allow the keyboard use until an IN#0 instruction is placed through the reader.

SYMBOL LOCATION	SYMBOLS	MARKING
column field	PROGRAM-READ-23-COL-58 PLOT-4-23-57-58 CARD-423-57-58	one on left
	END-INPUT-423-57-58 PLOT-4-23-57-58 RETURN-423-57-58	one above and below on left
LINE NUMBER field	DEF-58-59	one on left
	END	lines above and below on left
character field	1 1 1 1 1 1 1 1 A B C D E F G H I J K L M N O P Q R S T U V W X Y Z	correct line
	A B C D E F G H I J K L M N O P Q R S T	one on right with each line below line
	1 2 3 4 5 6 7 8 9 0 A B C D E F G H I J K L M N O P Q R S T U V W X Y Z	lines above and below
library field left column	READ-58-59 END-58-59 LINE-423-57-58 CARD-58-59	either one line of character field (A-Z) or (0-9) one line is used with the line
	END-58-59 END-58-59 END-58-59	either one line of character field (A-Z) or (0-9) one line is used with the line
right column	END-58-59 END-58-59 END-58-59	either of the second column from the top (A-Z) or (0-9) lines in line with the line
	END-58-59 END-58-59 END-58-59	either of the second column from the top (A-Z) or (0-9) lines above and below the line

Figure 3. Outline of marking sequences for the Mountain Computer cards.

```
200 FOR I=1 TO 10
```

```
210 INPUT A(I)
```

```
220 NEXT I
```

Input of one data variable per card using a FOR-NEXT loop.

```
200 FOR I=1 TO 27 STEP 3
```

```
210 INPUT A(I),A(I+1),A(I+2)
```

```
220 NEXT I
```

Figure 4

The A2-GE1 Graphics Editor for the Apple II

You thought your Apple II for its graphics capabilities. Now with the **A2-GE1**, you can use these capabilities to the fullest.

With **Object Editor** you can create whatever objects you want in the screen of your choice. You can also create whatever 3D text you want and in different sizes. And saving an object is as easy as naming it.

Then give this object names to **Motion Programmer** and see how the beautifully designed keyboard controls will let you create scenes, turn them off, animate them, or add uppers or lower case 3D text moving around. It's simplicity.

You can also record your entire presentation and playback it for later use with **Motion Playback**, or just take your picture in motion, changing with **Slide Show Playback**.

The **A2-GE1 Graphics Editor** is composed of 3D-GE1 or 3D-GE2 and includes **Object Editor**, **Motion Programmer**, **Motion Playback**, and **Slide Show Playback**. It also includes a unique A2-3D2 interface for BASIC programming.

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A2-3D1 Graphics Package
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a 3D wireframe program
\$24.95 on disk (48K, A2-3D1,
and Accusoft required)

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CIRCLE 77 ON READER SERVICE CARD

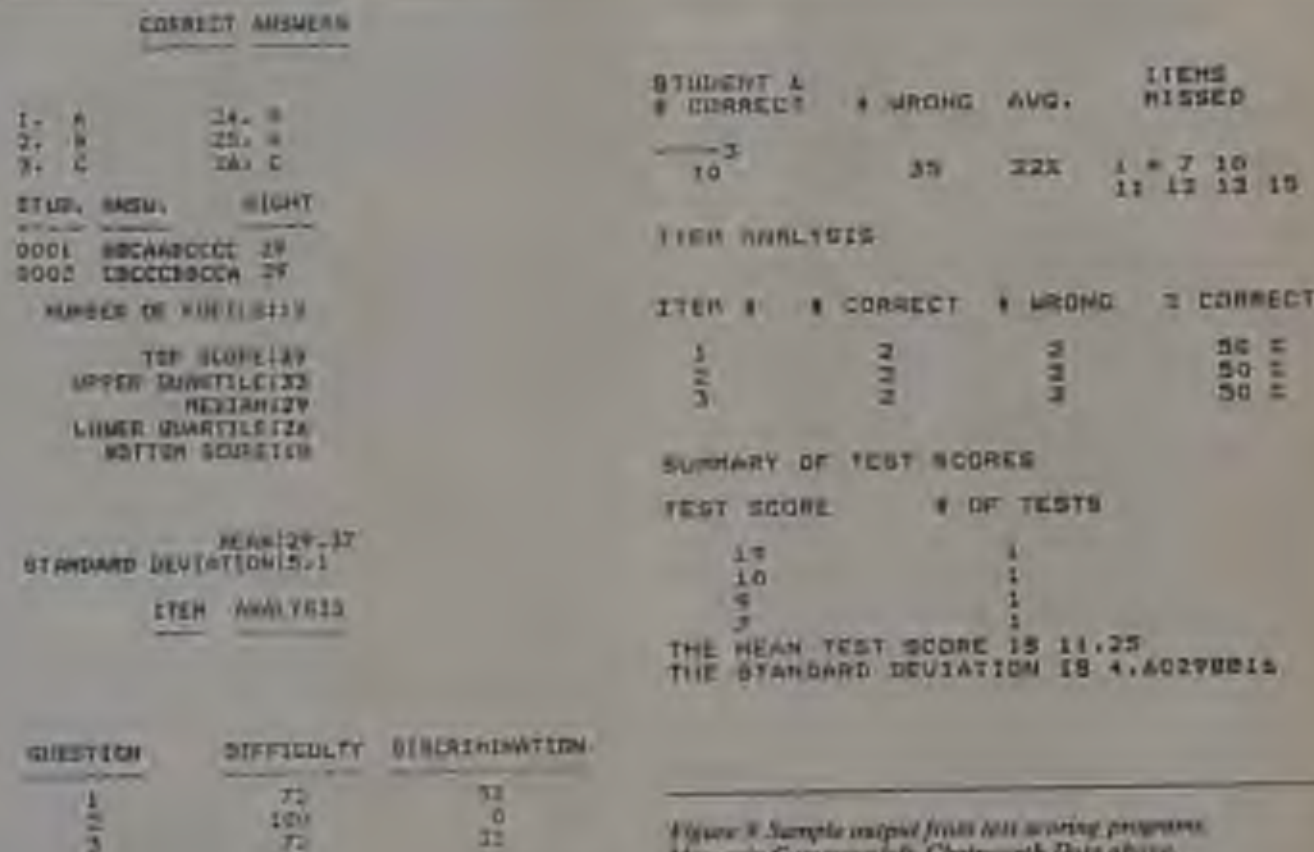


Figure 3. Sample output from test scoring programs. Mountain Computer left; Chatworth Data above.

Test Scoring

Both companies supply a test scoring program which is very helpful to the educator. Special test cards allow for a multiple choice test with five possible choices (A-E) for each question. Both packages have similar statistics to summarize results. See Figure 3, for a sample of the test scoring results.

The Mountain Computer scoring program will run the student identification numbers before printing them, thus providing a list to follow the grade book. This program, as written provides only hardcopy from a printer.

The Chatworth program gives a listing of scores by student identification number in the order of entry. This program provides only for CRT display, but has the added feature of allowing a teacher-generated response for each missed question. This option would be very useful for a computer managed instruction unit, if hardcopy were possible. The differences are minor and the programs can be changed to suit your needs if you have a little AppleSoft programming experience.

Compatibility

The Mountain Computer reader is designed to operate with an Apple Computer and the Apple version of Basic,

however, it should be remembered that the use of the hex data entry mode allows for use with other computers. The Chatworth reader is available with interfaces for Apple, PET, and TRS-80.

Overall Performance

I have used the Chatworth reader for two years in my classroom to teach a unit on computer programming. The instrument has been reliable, but has presented problems. One is the consistency of reading marks, which I believe to be directly involved with the method of scoring. The small needles actually rub across the card and thus remove some of the graphic. This results in the card being correct on one reading and possibly wrong on the next. The second drawback is the marking of cards of the Chatworth. For example, the statement PRINT "HI" requires the student to make appropriate marks for each letter and symbol of the statement. This can result in the student concentrating more on the marking of cards than on programming.

Mountain Computer has solved both of these problems. The optical sensing method seems to be better since it allows the use of marking media other than pencils, and eliminates problems arising from rubbing off the mark, especially if markers are

used. As a test, I entered a short program of three cards marked with a black magic marker. The cards were still being read correctly on the 20th trial.

The method used to mark the cards for the Mountain Computer seems to be easier for student to use. The statement of PRINT "HI" requires only one mark for the word PRINT. This greatly simplifies the card marking process for students. Also, the stacking of cards in the rack plus the ability to use the keyboard and Mountain Computer reader interchangeably without any I/O commands provides great flexibility for error correction and entry of direct commands.

Cost

Chatworth Data is presently advertising their card reader, AC/DC converter, and interface at \$750. Programming card cost on my last order was \$25/1000. The Mountain Computer reader is \$1195 and requires a serial interface. The Mountain Computer programming and testing cards are \$16/1000.

Chatworth Data Corporation, 20710 Laurel St., Chatsworth, CA 91311 (213) 341-9200.

Mountain Computer, Inc., 200 E. Pueblo, Scotts Valley, CA 95066, (408) 836-6631.

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Word Processing Printer

The Xymec HY-Q 1000

C. A. Johnson

Some years ago, I was a full-time, professional writer. In the late 1940's and early 1950's the pulp paper magazines were the way of the dinosaurs, and just as mysteriously, but in my case, I gained a wife and moved into military service to help in the Korean police action. My career was thus interrupted, and I failed to make the transition into non-fiction. I found myself in a new career which consumed most of my creative energies, and it was over twenty years before I picked up my typewriter seriously again.

After thirty years away from the typewriter I found my few typing skills were lost, and a touch of arthritis was making it nearly impossible to develop any real proficiency again.

Then I heard about word processing systems and investigated them with enthusiasm. My enthusiasm dimmed quickly when I examined the price tags. It appeared that word processing was not of my reach.

Then I discovered personal computers, and soon bought my 16K Level II TRS-80 and a word processing program. Although I did not have upper and lower case, or a printer, I found it worthwhile to write my first draft and polish it on the computer. Rewriting, reorganizing, inserting, moving or deleting text was both simple and fast. I began to wonder how I had managed to get along without word processing as long as I had. It was still necessary to type the final copy from the text on the computer monitor. It was not as desirable as printing out my copy directly, but it did allow me to increase my output significantly.

Soon, I started the painful process of trying to select the proper printer for my application.

My big break came when one of my friends bought a Xymec Daisy Wheel printer (computer interfaced Olivetti ET-201 Memory Typewriter). I made the necessary arrangements with him and

bought a Radio Shack upper/lower case modification and Script. Our arrangement was both beneficial to me and profitable to him. I would prepare my article on my TRS-80 and take him a diskette copy for printing. My volume increased again.

Outwardly, the Xymec looks like a sophisticated business typewriter with 18 additional switches and keys. Even without a computer, the Xymec is an intelligent typewriter, and that can be a life-saver if your CPU is in the shop. With a computer, nearly all the special features are accessible using relatively simple "escape sequences." (In Basic, for example, ES=CHR(27)+ "AA"; LPRINT ES will turn on the reverse image print—white on black).

The Xymec looks like a sophisticated business typewriter with 18 additional switches and keys.

It prints at the rate of 25 characters per second, and has a switch-selectable choice of ten, twelve, or fifteen pitch, or proportional spacing. The daisy wheel is easily replaced for changing type sizes or styles.

There are several automatic functions, such as right justification, automatic carriage return, line counting to end of page, and printing in either normal, bold face, underlined, bold-underlined, or reverse image. Script provides for right justification and line counting, so I found little use for these features in the printer.

I encountered no problem in hooking it up to my system. I just plugged it into the parallel port and it worked. I was

pleased to find that it came with four print wheels (one for each pitch) and a carbon ribbon (yellow, correctable, and high yield carbon ribbons are readily available). It is necessary, however, to buy the Centronics Tri-compatible printer cable from Radio Shack. The TRS-80 uses the parallel connection, but the Xymec can be bought with either an IEEE or RS-232 interface, as required.

There are 27 different type styles available as standard accessories. It is curious, but none of them with a standard alphabet has the symbols for "greater than" or "less than," which are required for program listings and mathematical formulas. Since they are used so frequently in computer applications, these symbols should be provided as standard on a printer designed for computer use. I called this to the attention of the Xymec representative, but was told that Olivetti had no plans to market a daisy wheel with these symbols. A print wheel with these characters can be custom ordered at a premium of \$30 over the regular print wheel price (final \$62).

The Xymec has given us good, reliable service. My friend's part-time word processing business keeps it running the better part of 20 hours each week, and it has been in use at that rate for over ten months without trouble of any kind.

Using the printer in conjunction with CompuServe, I have had occasional loss of characters which showed on the screen, but did not get printed out. I am not sure whether that is actually a fault of the printer, since in the many months of using the printer with Script, there have been only two instances in which a character failed to print.

Overall, I have been pleased with its performance. I recommend it highly for conventional word processing applications, and consider it well worth the \$2600 price tag.

Xymec, Inc., 17901 Sky Park Circle, Suite 2, Irvine, CA 92718. □

C. A. Johnson, 3919 Sunset Dr., Oak Ridge, TN 37824.



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creative computing SOFTWARE PROFILE

Platform: Hi-Res, II, IIx, IIc

Type: Soccer

System: IBM Apple II or II Plus
and one disk drive, DOS 3.2,
48K 3.1

Features: Graphics

Language: Macrom

Summary: A fun soccer game and
great graphics

Price: \$29.95

Manufacturer:

On-Line Systems
2675 Midway House Rd.
Fremont, CA 94555

I never expected to see a computer game this good—at least not so soon. Designed by Jay Sullivan (who also designed Hi-Res Football for On-Line), this game is a scunner. Rather, it's a canner, especially when one of the strikers sends the ball floating toward your net and you send the goalie in the wrong direction.

Sullivan has designed it so that each player controls the movements of eight soccer players with the game paddles. The angle of an arrow drawn on the paddle determines the direction in which a figure runs. So your figures are constantly

scribbling across the screen. I should have such boundless energy.

The player in the green jersey dribbled the ball down the field, deftly evading the rushes and lunges of his purple-clad opponents. At the last second, faking a kick to draw the goalie toward him, he passed the ball to a teammate who drove it between the bars for a score.

The player who has the ball dribbles it with his feet. The paddle setting also controls the direction of the kick—in one of 28 directions. With a little practice, you learn how to pass the ball back and forth between players; how to fake the goalie out; how to carom a pass into the goal off the sidelines in the beginner's game; where to have your goalie put a goal kick; and how to keep from being demolished by the Apple team in solitaire games.

To simulate balls being kicked into the air, some kicks can't be caught immediately; a rebound off the solitaire goalie delays one second, as does a throw-in when the ball is kicked out of bounds to the top or bottom (advanced game only). A corner kick occurs when a team kicks the ball out of bounds on the side of the field on which its goal is located; the opposing team gets to kick it in from the corner, with a two-second delay. Finally, a goalie can kick with a two-and-a-half second delay if the opposing team kicks the ball out of bounds on his side.

There are three levels of play when two people play, one for solitaire play. At the beginner level, the ball bounces off all four sides of the field. For intermediates

it bounces off the top and bottom but goes out of bounds to left and right, and in advanced play the ball can go out of bounds anywhere.

On color sets, the players are green and purple. On black and white, they're gray vs. black and white stripes.



It's hilarious to see the players run headlong across the field, steal the ball away from each other and intercept passes. The goalie even glides to catch the ball between his legs on attempted scores.

Don't expect to get the hang of it right away, either. I've been beaten by scores of 42 to 14, 24 to 6, etc. It took me several days of practice before I finally beat the game 5 to 3.

The game is divided into two halves of any length up to 45 minutes. The one bad thing about it is that there is no way to get a time-out to answer the telephone or any other call.

Dale Archibald, 1817 Third Ave. N., Minneapolis, MN 55405

SPORTS CORNER



Clockwise from left: Frank Linder, John White, Bob Callan, Peter Fay, Owen Linderholm, and unidentified friend.

Owen Linderholm and John White

We recently received the Indoor Soccer invite from Texas Instruments and being diligent, as we are, we immediately dropped the fun things we do around here, such as converting from the TRS-80 to the Atari, and put the game through its paces. Before you much time had passed, an Indoor Soccer Tournament had been scheduled. As they say, it's no picnic.

As word of this prestigious tournament spread, a number of All Stars signed up. The participants were Bouncing Bob Callan, Peter "Pete" Fay, the grizzled English veteran Owen "Lags" Linderholm, Jumping John White, Dave "Rock'em" Rogers, Giorgio Sternberger, and Dynamic Dave Lashar, who is odd-on favorite to win at any computer game we play.

Just the fact that we held a tournament with this game says something. It is, in fact, a heck of a lot of fun. The best way to describe it, however, is to let the winner of the tournament speak his mind. This interview took place in the locker room of T.I. Stadium, located within the spacious confines of our Software Development Center, and was conducted by that notable sports reporter, Warner W. Conell.

W.C.: Hello again, everyone, this is Warner W. Conell, speaking of sports. I'm here in beautiful downtown Morris Plains, where I have just witnessed a battle of monumental proportions. After scouring the world and even looking in the back room of our warehouse, the organizers of this tournament invited a few top athletes to compete in the first annual T.I. Indoor

creative computing SOFTWARE PROFILE

Name: Indoor Soccer
Type: Sports Game
Version: 1.0
Format: Plug-in from Indivision
Language: Machine code (V800)
Summary: Fantastic
Price: \$29.95
Manufacturer:
Texas Instruments Inc.
P.O. Box 9012
Dallas, TX 75222

Soccer Tournament. The athletes all declined, so they dug up some of the characters who work at Creative Computing. After many grueling matches, jumping John White emerged as the winner.

First of all, congratulations on a hard won victory. To what do you attribute your success?

J.W.: I was better than the rest.

W.C.: Seriously, though, how would you summarize this tournament?

J.W.: Well, almost all of the matches were close. Aside from Bouncing Bob, "Rock'em" Rogers and the great "Pete", everyone was pretty equal.

W.C.: Would you care to explain some of the details of the game?

J.W.: Yes.

W.C.: Would you elaborate on that?

J.W.: Since we didn't have the remote wire controllers, we had to use the keyboard controls, but they were surprisingly good apart from being a bit too close together for comfortable play. The controls manipulate a "Control Player," while the rest of the team operates independently under computer control. By attempting a tackle, one can switch Control Players.

W.C.: How about passing?

J.W.: Once the Control Player passes the ball, the receiver becomes the Control Player. This can set up some interesting passes off the walls and some tricky back shots can be made.

W.C.: What I really wanted to know is whether you had any difficulty controlling the ball in passing and shooting. Could you tell our viewers about that?

J.W.: With a bit of practice you can be accurate on the great majority of kicks unless you are like "Pete" Fay, who is a bit of a slow learner.

W.C.: Judging from the tournament results this is a high scoring, offensive game and you're one of the most offensive players I've seen.

J.W.: I'm not quite sure how to take that remark, but actually I pride myself on my defense. I get as much of a thrill out of a nice interception or a good tackle as I get out of a goal. Interceptions are made by moving one of your players into the path of the ball. Except for the occasional fumble, he then gains control of the ball. Tackles are harder and involve



Alone in your spacecraft, you are exploring an uncharted area when your Tactical Display Screen suddenly blossoms with gigantic moving objects. It would be bad enough if they were ordinary asteroids, but their size and behavior tell you they are much worse—huge chunks of deadly antimatter, capable of destroying your ship on contact!

You fire your starblasters, hoping to escape the menacing onslaught, but here come more of the sinister shapes. You are surrounded, and the only way to avoid destruction is to fire your laser cannon. Aim... Fire... A direct hit! But instead of destroying the rock, your blast has exploded it into several smaller—but equally lethal—pieces. Now each must be separately eliminated.

The thought occurs to you that the multiple appearance of these rocks might be more than coincidental, and your suspicions are confirmed as time bombs enter the Tactical Display's field, their time displays counting down toward your destruction! And finally the enemies themselves, in space ships firing antiproton torpedoes, join the fray.

Can you destroy or avoid the rocks and the enemy, and at the same time still the incessant ticking of the time bombs? With SPACE ROCKS, you can try. It's a realtime arcade game with sound effects to enhance the action. One or two players can compete, and there are five levels of difficulty to meet up the challenge to your skills (which).

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TENPINS

By John Allen

A realtime action game with 3-D graphics and sound, TENPINS brings the thrill of championship bowling to your TRS-80*.

From one to four players participate, and the program senses the skill of each player. Beginners can simply "roll" the ball while more skilled players can vary the ball's force, direction, and spin.

TENPINS even has factors to simulate imperfections in the lanes, adding even more realism. Available for only \$14.95 for 16K tape version, \$20.95 for 32K disk.



PINBALL

By John Allen

Get your flipper fingers ready for action in this realtime, machine language game.

Lots of sound and flashing graphics make this fast action game so much like the real thing that you'll have to remind yourself not to shake your TRS-80. Choose from five playing speeds to match your skill. Can you beat your friends' scores? Will you avoid the infamous "Bermuda Square"? Get PINBALL today and find out.

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INVADERS FROM SPACE

By Carl Miller

A fast machine language approach to this classic (and addictive) space game. The aliens drop bombs, move around, and try to overrun your bases.

You choose the speed, enemy bomb frequency and accuracy, and how many shots and bases you have. Unlike other games of this type, you can move your base and simultaneously fire at the invaders. Fun for all ages and skill levels, it has full sound effects for even more excitement.

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Sports Corner, continued...

good positioning as you attempt to kick the ball while it is in the other player's possession. You can succeed, fail or cause both players to lose control of the ball, depending on how skilled you are. The danger of playing tough defense is the potential for fouling. Giving away a penalty kick is an almost certain goal for the opposition. A good player can hammer home a shot in either corner of the net.



W.C.: Let's go to the videotape. A nice feature of the game is that you can do an instant replay of a goal. SWISH!!

L.W.: Nice goal!!

W.C.: Now that I've conducted the interesting part of the interview, let's go to my colleague, Ernest Gifford, to hear about the more mundane aspects of the game, Ernest?

E.G.: Thank you, Warner. I was immediately impressed at the beginning of the game with the graphics and sound effects. It is also multi-lingual, has time-outs, and all the excitement of the real thing. The game costs \$29.95 from Texas Instruments.

The main features are: keyboard or joystick control; passing; tackling; interceptions; replays; timeouts; multi-lingual capability (English, French, German, Italian and Dutch); 3-D high-res graphics; goal-kicks; penalty-kicks; free-kicks; blocking; interceptions; and sound effects (scored goals, referee's whistle, musical encouragement).

Before signing off, let us have a moment of silence for Giorgio Bernacker, who was kidnapped just prior to the start of the tournament. He is now rumored to be on the trading block, with California a good bet, (a very short punter) and Steve...

Thank you very much, John, nice having you here with us at Channel 2001 Studios. Now a break for a word from our sponsors, Creative Computing. □

"Does thou love ME? Then do not squander time, for that is the stuff life is made of."
Benjamin Franklin



What say we go out and stomp a few ???

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CIRCLE 293 ON READER SERVICE CARD

APF
Mathemagician

David H. Ahl

APV's Mathematician is a teaching calculator designed to help sharpen basic or intermediate arithmetic skills. In addition to being a calculator with all the basic math functions, it plays games. The electronic games include: Number Machine, Countin' On, Walk the Plank, Goody Gumdrops, Football and Lunar Lander. Most of the games can be played by one or two players and some are timed to test skill levels. Of course, the Mathematician will let the player know if his answer is

right or wrong. *Mathemagician* features an LED display, large keyboard, and plastic overlays for each game.

The Number Machine game helps younger players develop number recognition skills. The object of the game is to key in the same number that is displayed at the beginning of the round. Countin' On is a counting game. The Mathematicians will count by 1's or skip count by 2's, 3's, 4's, etc. You count along and then key in the number when the counting stops. You get a point each time you are right.

Walk the Plank is a guessing game. You get three tries to guess the secret number before you go "Bye." Goopy Gundrop is a game where the player must locate a Gundrop hidden in a 9 block by 9 block area of Gotham City before it blows up. (Goopy Gundrop is a head-belt) version of Hurtle.) Football is a game of mathematics practice. When you call a play the Mathematician will give you a problem. Answer correctly, and the ball moves closer to the goal line. If your answer is wrong, no gain. Good play will eventually score a touchdown. The rules are similar to regular football.

In Lunar Lander the player attempts to land a rocketship on the moon safely. The player starts out at an altitude of 300 feet in a LEM which is dropping toward the surface of the moon at a speed of 30 feet per second. The player has 99 units of fuel. The object is to select the right amount of fuel on each burn (one per second) to land safely.

Mathemagician, made by APP, has a suggested retail price of \$29.95. (For an in-depth review, see *Creative Computing*, March 1978.)



THE INSPECTION

These settings enable the user to maximize data safety in the Apple's memory and on disks. Periodically, users should examine through RAM and ROM memory, as well as backup frequency and changing data on disk.

Now and forever for some of Randolph's neighbors. Bicentennial & Home VTOC: Went out unannounced carded & shovelled in CATALYT through LINDSEY's shared name program. Report for that time tomorrow. Get. Ad with no being under created & covered, and more.

You may wonder about burning slides. This allows you to transfer DOC from one slide to another (helpful during a HistoLink where all this is known as DOB). It is not known if a positive HistoLink result is a positive result.

By using `WWW3` and `crane` you can create a 3D topographical representation of the data by using the following code. It automatically creates a `crane` plot. Note that in 3D you have to fit `crane`. Get an S3 object, so it becomes a function the `crane` object is a list consisting of a built-in `crane` object, a built-in `fact` object, because a `crane` was defined. This will allow you to fit it to an object without having any other objects in memory.

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If you want to add new (old) basic line numbers into your program, it's time to add the new line numbers in a program like the professional programmers do! In basic, you can't normally use DIM to change lines 11 to 100, you can't mark any DIM statement! Here's the reason, in the next bit.

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PROGRAM2 FOR PRE2CHOOER2: 2TARTING OUT YOUNG

Stephen Kimmel



In my early days with the personal computer, I took the company's computer home (note: this is the cheap way to get started with home computers—get somebody else to buy one) and slaughtered Klingons by the thousand. But none of their maneuvers terrified me as much as hearing the pitter patter of little feet and feeling the tug on my shirt sleeve. Reluctantly I would look down to see my 18-month-old son, Robert, smiling beatifically. Has anyone heard words more certain to freeze your blood than "Daddy, I wanna play computer?"

"No, you silly little brat! This is my toy and you can't have it!" I screamed in my mind, and almost instantly felt remorse: I could give the kid a complex of some kind. He would be traumatized, fail in school and life, become an axe murderer and kill me one night as I vanquished Klingons for the eight billionth time. Not a pretty picture.

"No. This is too easy to break," I thought. That, too, sounded terribly lame.

"Sure. Why not? After all I didn't buy it," I thought. That was the clincher so I smiled, reached down and lifted him onto my lap. Robert's response was immediate and exuberant. Pused. Pused. Pused with

both hands on the keyboard. "No. No. Push the keys. Don't pound on them."

Pused. Pused. Pused. Pused. Pused.

Three hours later, after I had finished cleaning the jelly from my computer keys, I paused to consider the situation. Kids, it seems, are interested in whatever interests you. If I was going to have the computer at home, I was either going to have to lock it and me in a room or play with it only at night. Or I was going to have to find something Robert could do with it.

Kids, it seems, are interested in whatever interests you.

For a while Robert was satisfied with simply pushing the keys and watching the letters disappear off the top of the screen. After only a month or two that got old. Then I began my search for software suitable for a preschooler.

It is worthwhile to consider the qualities of preschoolers that make them unique in the computing population. This will provide us with some key information about why

one program is good while another isn't. Without this fundamental baseline we are floundering along with little adults; a concept that is simply wrong.

First and foremost, preschoolers can't read. This is almost the definition of a preschooler. So obviously the program can't have written prompts. Rewards and punishments can't be in plain English. This sort of communication occurs to us, as programmers, first because it requires the least thought on our part and we are comfortable with it. Preschoolers, however, make it impossible. All of the communication between the computer and the preschool operator has to be nonverbal. Fortunately, there are many other ways to communicate. To me, then, requires more planning and greater skill on the part of the programmer.

The most important means of nonverbal communication is visual. Almost all home computers are capable of reasonable graphics. Even the T85-80 can generate a face that the youngest of preschoolers can recognize. The infant learns to recognize faces and facial expressions as communication almost before it learns anything else. Using this in a program requires no great skill. You simply show a smiling face when the child has done the right thing or a frowning face when the answer is wrong. Some of the programs reviewed take that one step further and have the head nodding approval or shaking to signify no. Everyone understands that.

Sound can be a very important part of communication. Needless to say, most

Steve Kimmel, 4756 South Irwin Place, Tempe, OR, 94555.



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CIRCLE 50 ON READER SERVICE CARD



Robert at 18 months during the first Creative Computing Chess Tournament. A big help.

preschoolers understand the spoken word long before they can read. The sound of something—an explosion, a musical tune—communicates as effectively as printing. "Your ship has been destroyed by the Klingons."

The second key characteristic of preschoolers is that they don't have well-developed problem-solving skills. In most cases it is probably valid to define a game as competitive problem-solving. Most younger preschoolers don't understand the concept of "game." Let a group of two-year-olds play in a room and you have a room full of two-year-olds playing by themselves. There is no sense of cooperation or playing together.

One of the recommended "games" for young children is to have them stick baby food jar lids through a slot. It is, for the very young, a staggeringly difficult task. Thus we can eliminate the majority of the traditional games.

The preschooler can only understand simple cause and effect. If I do this, it does that. Push the bowl, it falls on the floor. And even that was a surprise not too long ago. The level of depth to which they think ahead is quite limited. The preschooler's game has to be very simple with immediate results for actions.

Third, the preschooler hasn't developed particularly good coordination yet. One finger at a time is about all he can handle. Certainly anything requiring the hands to be doing different things simultaneously is beyond preschoolers. It's a skill I developed when I was about 12.

The preschooler doesn't react quickly. Even older preschoolers seem to have rather slow reaction times. So games that

require moving quickly aren't very good either. The problem is that the child is easily frustrated at his own inabilities, and the experience can become an unhappy one quickly.

The class of games that comes to mind immediately is the arcade type game. To challenge an adult requires quick actions, frequently with both hands. The preschooler will be attracted to this sort of game, but won't be able to play.

It is necessary to address the issue raised by Sally Greenwood Larson in her book *Computers for Kids*. She states, "I can't emphasize this one enough. Don't ever let your children play commercial game tapes until they are accomplished pro-



Robert at 3 1/2 years is a seasoned veteran who knows what computers are for—fun!

grammers! By 'accomplished' I mean the end of the first year (of programming classes) for most children."

Her argument is that kids exposed to the fun of the slick commercial games will lose all interest in programming. She also states that the only games a child should be allowed to play are the ones he has programmed himself. The effect of this is that no preschooler should be allowed to play with the computer since the earliest he can be expected to be an "accomplished programmer" is about five years old.

The argument is specious. It is akin to saying children shouldn't be allowed to read the classics until they are accomplished writers. Most educators agree that the children who become the best readers, the best students, etc., live in homes filled with books. The parents show respect for books, read frequently and begin to read to their children regularly at an early age—sometimes before the end of the first year.

Reading begins as a close, comfortable sharing experience long before it has any significance as a conveyance of ideas. How different is sitting on your father's lap listening to a book from sitting on your father's lap playing a computer game?

There are differences, and the most obvious is that in one activity you are passive while in the other you are actively affecting the outcome. More important, however, are the similarities. You are warm, have a good feeling about yourself, your father, your book and your computer.

Interestingly enough, it is the good readers who become the good writers. All the professional writers I know are voracious readers. They have a love affair with words and it doesn't seem to matter whether the words are coming in or going out. Almost none of them were "accomplished" writers until their teens. Some didn't become competent writers until much later in life. The fact remains that all of these professional writers were good readers at an early age and all started their contact with books long before they learned to write.

I suspect that almost all of Mrs. Larson's students come from homes without computers. Her experience must be similar to teaching students who have never seen a book to read and write. Her students may eventually become competent programmers and be able to use the computer to good advantage as adults. Will they become great programmers? Will their programs become classics? Did Shakespeare's mother read to him as a child? I don't know. But I firmly believe that the preschooler who learns to love and respect the computer before he can program will ultimately be better for the experience.

I'll begin the review of some programs that might be suitable for preschoolers by

The Newest & Most Astounding Arcade Game
that TALKS has Just Reached Planet Earth

ROBOT ATTACK



BIG FIVE SOFTWARE

THE NEWEST & MOST ASTOUNDING ARCADE GAME

That TALKS has Just Reached Planet Earth

Robot Attack, Robot Attack, Robot Attack, Robot Attack, Robot Attack, Robot Attack, Robot Attack, Robot Attack

Robot Attack is a new arcade game from Big Five Software. It is a fast-paced action game that features a variety of robot enemies. The game is set in a dark, industrial environment. The player controls a robot that can fire a laser beam. The game is very challenging and requires a lot of skill to play.

Robot Attack is a new arcade game from Big Five Software. It is a fast-paced action game that features a variety of robot enemies. The game is set in a dark, industrial environment. The player controls a robot that can fire a laser beam. The game is very challenging and requires a lot of skill to play.

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10000 4600 MEGABYTE	100.00
10000 4800 MEGABYTE	100.00
10000 5000 MEGABYTE	100.00
10000 5200 MEGABYTE	100.00
10000 5400 MEGABYTE	100.00
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It is difficult, however, to see how it is possible to maintain a position that is both as strong as it is and as weak as it is. The only way to do this is to have a position that is both as strong as it is and as weak as it is.

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Preschoolers, continued...

reviewing the qualities we want. It should make extensive use of nonverbal communication. It should give immediate results to actions and require no great amount of strategic planning. It shouldn't require great speed or coordination. Like any program, it should be reasonably priced and free of bugs. Where do you find these programs?

Nine Games

Robert's favorite computer game and, in my opinion, the *creme de la creme* is George Blank's *Nine Games for Preschoolers*. I mention it first because it was about the first attempt at designing a computer program for the personal computer with the preschooler in mind. This is probably the first program you'll turn to when you start looking for software for your preschooler.

George got just about everything right. There are others who have done some of the things better than this early effort, but none have combined the qualities as well for a package of solid value.

As all you highly perceptive types have already deduced, there are nine games in the package. Letterfun allows the preschooler to type in a group of letters. He then presses enter and the letters do amusing things such as bounce around, explode, and march from side to side across the screen. While this may not seem like much, it will amuse a young preschooler for some time.

ABC has a little face that smiles when you type in the right letter of the alphabet and shakes its head when you type the wrong one. Sometimes getting the shaking head is funnier than the smile so there will be times when the preschooler will intentionally push the wrong key.

Letter Wars is a drill on small letters that pauses every ten letters for a brief square battle. The outcome is determined by whether you got the letters right or not. The graphics here are nothing to write home about, but they are adequate. By age three, Robert was going over 98% and playing 100 letters at a sitting.

Repeat is a game for much younger children. Here the key pushed is repeated 32 times across the screen forming patterns.

Names provides practice in recognizing names in the middle of text. You type in six names which are repeated in random order filling the screen. It pauses and you and your child pick out individual names.

Blackboard is just what it says. What you type appears on the screen. Troll's Gold is a game in which doors open and close. Your mission is to get the troll's gold and get out before he catches you and eats you up. If you escape, the screen is filled with dollar signs. If you get caught the troll's mouth slams shut on you. Each game takes about eight minutes, and Robert will play these in a row.

Mate Drill is a drill in addition and subtraction. Counting blocks are displayed, too. Calculator is a four-function calculator with the display in standard school format. Not a whole lot of fun.

One extremely nice thing about *Nine Games for Preschoolers* is that all of the games are in memory at the same time. The programs are called from a master menu that doesn't require reading. Pressing the clear key during a game will return the preschooler to the main menu. Part of the strength of the program lies in the fact that the games call for different abilities, and the child will grow out of some and into others.

The net effect is that this program won't be quickly discarded. Educational, well designed, good play. Yep. This program is probably the best. At \$9.95 from the TSE this program is an absolute must for anyone with a 16K TRS-80 and preschooler.

The Software Exchange, 8 South St., Milford, NH 03055.

Dancing Demon has the best graphics I've seen on a TRS-80.

Android Nin

Android Nin by Leo Christopherson, who I am secretly convinced has elementary school age kids, is an example of a planning game that is still good for preschoolers. Christopherson is the acknowledged master of low resolution graphics and Android Nin is an excellent combination of animation and sound.

The strength of the game is in its action. Instead of beans or sticks, the game is played with small robots. They fight nervously and chaotically, which holds the child's attention. After you've entered the number of androids you want to remove, a leader android "looks" to check if your move is legal.

It either "speaks" to affirm your choice or shakes its head to tell you that the move is illegal. Given a legal move, the leader pulls out a ray gun and disintegrates the appropriate number of androids. If the computer wins, it pronounces its victory in large letters. If it loses, the leader robots hang their heads.

Android Nin has action and effective use of nonverbal communication, and requires no great coordination. It does require careful preplanning, if you're going to play it right. However, it can be used as a counting game and as such has some educational value. Preschoolers will enjoy it—at least until they discover that "I

WIN" means that they lost and the computer won.

Android Nim is available from 804US, 38 South Warner, Tacoma, WA 98409.

Dancing Demon

Radio Shack has only two programs suitable for this age group. Dancing Demon may very well earn Ian Christopherian eternal glory. I am amazed at the man's ability. The name of this program is completely descriptive. You program in a song and the demon's dance steps, select a speed and play it all back. On the preschool level this is simply a matter of randomly pushing keys. It does have two prerecorded song and dance numbers and the ability to record your creations. As such it will amuse the preschooler somewhat longer than simply pushing keys and seeing what letters appear.

Dancing Demon has the best graphics I've seen on a TRS-80. The program makes no attempt at conversational communication and has no significant educational value. If you want lasting use with your preschooler you'll have to be ready to type in some familiar songs that you can sing together. This program is really for adults who want a cheap (\$9.95) introduction to music generation and something to show off their computer. As my local Radio Shack dealer told me, Dancing Demon is a short demo.

I haven't seen Radio Shack's Show and Spell so I'm not really qualified to comment on it. However the review in the March '83 *Consumer Computing* was enough to persuade me to cancel my order.

Kidventure

Kidventure 1, Little Red Riding Hood, was written, or at least sold, as a preschool version of the immensely popular Adventure series. Many things about it are very well thought out.

The program comes with two sets of keyboard masks on heavy cardboard that you cut out and color if you like, and use to relabel the keys. This is an interesting and very effective way of overcoming a preschooler's inability to read. When the preschooler wants to answer "Little Red Riding Hood," he simply pushes the key indicated by the picture of the little girl—which happens to be the up arrow. There is almost no possibility of mistaking Grandma for Little Red Riding Hood.

The program also comes with an audio cassette of, presumably, the author and his family reading the story of Little Red Riding Hood. The author raps a spoon against a glass of water and this is the preschooler's cue to press the space bar and advance the story. The screen changes to show the next group of words and a crude graphics picture. This is the program's story mode and what it amounts to is a bad and very expensive picture book.

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is available
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Preschoolers, continued...

In the quiz mode the program tells the story and periodically stops to ask a question. When the child answers correctly, the story proceeds. In the quiz mode the program plays appropriate (?) little tunes for each major character and event. Such as "Who's afraid of the Big Bad Wolf?" "Peepers, creepers. Where'd you get those (yuck)" and "I've been working on the railroad" for the woodcutter.

Also, the quiz is no challenge to anyone, including any preschooler who is familiar with Little Red Riding Hood. Robert only missed one question the first time through and I think he was joking ("But Grandmother, where did you get those great big (feds)?" Robert has only asked for Kidventure twice since the first day.

Frogs

Frogs is another game from Adventure International designed with kids in mind. Here you are a frog sitting on a log floating in a pond trying to catch flies with your tongue. The left arrow and the right arrow control your steps in either side. The frog will shake his head and croak at you if

There is almost no possibility of mistaking Grandma for Little Red Riding Hood.

you try to step off the log. Up arrow will shoot your tongue out to the left while the Q key shoots it to the right. When the frog catches a fly it goes through a state routine of chewing it up. (Robert learned that frogs eat flies from this program.)

After you catch all the flies, the frog thanks you and your score is displayed. The action is good, and demands no great speed or coordination despite requiring both hands. It is easy to play with two of you. Robert normally works the tongue while I control the steps. Although the instructions are quite long, they are simple and once through there is enough.

The program has one problem: each time you use your tongue, it grows shorter. That makes catching subsequent flies harder. The last fly floats around nervously and frustratingly out of reach. This period of frustration and inactivity almost ruins the game. However, it is really fixed by changing the "IF FL=0 THEN" to "IF FL=1 THEN." You catch all but the last fly and the game proceeds.

Adventure International, Box 2435, Longwood, FL 32750.



Educational Software and Books

David Lubar

Almost every software house in existence seems to be producing something for the educational market. Since it is impossible to cover every program, we have chosen a random sampling of software to review; some of the programs were requested from the manufacturers, others came in unsolicited.

On the Dotted Line

Sentence Diagramming gives a good presentation of a difficult subject. This Apple disk was developed using the ZIS authoring system which, along with several other authoring systems, will be reviewed in a future issue. The diagramming program offers the teacher a selection of options for each student, such as level of difficulty, percent correct before moving to the next level, and whether to present only the question part and skip actual diagramming. The program contains twenty sentences for each of three levels; each level has four segments, any one of which can be used by itself in the classroom.

In the first section, the student must determine the part of speech for each word in a sentence. If a mistake is made, the correct answer is shown. Once all the words have been classified, the student is given a chance to pick the usage for words and phrases. Since this is more complex than picking parts of speech, the student has the option to select only those with which he is familiar, and to move to the next section at any time. In the third segment, the student must identify the

sentence type. Finally, he gets to the diagramming portion. This segment puts an unfilled diagram form on the test screen. The student must fill it in with the correct words from the sentence.

If the teacher selects the record-keeping option, he can see a student's entire record, or the latest record for each student. The record contains the level and the per-

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SOFTWARE PROFILE

Name: Sentence Diagramming
Type: CAI English
System: 48K Apple, ROM Applesoft, Disk Drive
Format: Disk
Language: Basic
Summary: Can be used in whole or in parts to teach grammar concepts.
Price: \$19.95
Manufacturer:
Avant-Garde Creations
P.O. Box 30160
Eugene, OR 97403

centage score of the student. It should be mentioned that this particular program is for drill only; it doesn't provide tutorial material. But for what it does, *Sentence Diagramming* is a good presentation of a tough subject.

For the Very Young

Sammy the Sea Serpent is a computerized story book for children ages 4 and up. The program combines graphics on the Atari with an audio track on the cassette to tell the odyssey of Sammy. The child interacts by means of a joystick, guiding Sammy through waves, helping him catch flies, and moving him from one story segment to the next. While the program helps develop eye-hand coordination, its main function is to act as a storyteller. It succeeds in this task. The flip side of the cassette contains two games that can be

creative computing

SOFTWARE PROFILE

Name: Sammy the Sea Serpent
Type: Entertainment
System: 16K Atari, Joystick
Format: Cassette
Language: Basic
Summary: Interactive picture story.
Price: \$16.95
Manufacturer:
Program Design, Inc.
11 Hill Ct.
Greenwich, CT 06830

played with Sammy. The games (one where the player leads the serpent through a wave and the other where the player helps Sammy catch flies) appear in the story, but can be played repeatedly by themselves. Though no replacement for a human storyteller, *Sammy the Sea Serpent* is definitely a step above Saturday morning cartoons. Parents who are concerned whether the program will be used more

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Educational Software, continued...

than once should remember how often children will sit through a rereading of a favorite storybook.

Rewarding Figures

The *Math Machine* takes drill and practice a step above the usual drudge level. This Apple disk contains a full system including record-keeping capabilities. At the start, the user is asked for a password. If a student is using the program, his password starts the drill. The teacher's password gives him access to the options menu. Here, he can add or delete a student from the files, review records, obtain a list of students, or change a student record. To make an assignment, the teacher first selects from one of seven categories, which range from pre-math for kindergartners to multiplication for 7th grade and above. The program then lists and describes the levels within the category. Pre-math has the fewest with nineteen levels; addition has the most with 29 levels. After selecting the desired level, the teacher selects the number of correct answers the student is required to make before receiving reinforcement. This reinforcement is in the form of games. Whenever the student has achieved the required number of correct answers, he gets to select from a menu of six games. The games, while not of arcade quality, are adequate for reinforcement purposes.

The math problems are presented with large font numbers. If any problem is missed twice, the correct answer is displayed. The program does not provide any help or branch to different difficulty

Good Grammar

Instead of drill and practice, the format of *English Usage Exercises* seems to be explain and drill. These programs for the TRS-80 contain approximately one hundred short sessions per disk. Each session begins with an explanation and examples of a concept, followed by questions. The entire set consists of four volumes. Volumes I and II were available for review. Each session sticks to a specific topic, such as verbs ending with "ing," or sentences with double subjects. The scope and variety of the lessons provides teachers with a tool that can be used either as a whole or in portions. The only problem is that the computer, aside from immediately telling whether the answer to a problem is correct

presents a quiz game for from one to four players. In turn, each player is given a question with four possible answers. If he chooses the correct answer, he receives a predetermined number of points. The twist to the game is that players can steal a question. A successful steal earns double the point value. If the thief answers incorrectly, he loses double. The educational aspect comes from the ability to create sets of quizzes. Up to six quizzes can be stored on a disk, and up to 100 questions can be entered into each quiz file. With this capability, the program can be molded to suit almost any classroom situation. As another plus, *The Wizard* is one of the few programs on the market that allows four people to use one computer at the same time. And the price is hard to beat.

Reading the Meter

Metric System Tutor is a comprehensive set of lessons and drills covering the metric system. This Apple program begins with a pretest that determines which topics the student needs to cover. Each section mixes instruction with questions, producing very good lessons. The computer is used to its fullest: lines, graphics and sound are an integral part of the program. The first section, Intro to Metric, covers the development of linear and volumetric units. The next section covers conversion of common units. Following this are two sections for converting to very small and very large units. Last, there is a final test that contains questions covering all the topics.

CREATIVE COMPUTING SOFTWARE PROFILE

Name: The Math Machine
Type: CBI Math
System: IBM, Apple with ROM Adapter, DOS Disk
Format: Disk
Language: Basic
Summary: Math Machine's record-keeping system
Price: \$19.95
Manufacturer:
SouthWare Software Services,
P.O. Box 1801
Phoenix, AZ

levels. The student can keep going as long as he desires, or until he or the teacher hits escape. The student record contains the category and level, along with the number of problems attempted, the number correct, and the number of reinforcements. While not perfect, *The Math Machine* seems to be a good presentation of drill and practice.

CREATIVE COMPUTING
SOFTWARE PROFILE
Name: English Usage Exercises
Type: CBI English
System: IBM TRS-80, Two Disk Drive
Format: Disk
Language: Basic
Summary: Extensive use of grammar programs
Price: \$19.95 per volume
Manufacturer:
of Software
P.O. Box 201
Phoenix, AZ 85001

or not, provides nothing that can't be obtained through a workbook. It does provide ready-made drills that are convenient to use, but seems to be an adaptation of the computer to traditional techniques rather than an adaptation of techniques to the capabilities of the computer.

Online

Though nominally a game, *The Wizard* has the potential to turn the TRS-80 into a fun teaching device. The program

CREATIVE COMPUTING
SOFTWARE PROFILE
Name: The Wizard
Type: Game
System: IBM TRS-80, Disk Drive
Format: Disk
Language: Basic
Summary: Fun and potentially a good educational tool
Price: \$19.95
Manufacturer:
Phoenix Unlimited
P.O. Box 200
Phoenix, AZ 85001

CREATIVE COMPUTING
SOFTWARE PROFILE
Name: Metric System Tutor
Type: CBI Math
System: IBM, Apple, ROM Adapter, Two Disk
Format: Disk
Language: Basic
Summary: Significant use of the computer's graphics
Price: \$19.95
Manufacturer:
Cypress Software
800 E. Camel
Mesa, AZ 85201

The program responds well to incorrect answers, providing additional help whenever the student has a problem. The input routines are surprisingly good. One question, requiring an answer the number 10, recognized "ten" as correct. It's nice when a programmer anticipates these things. *Metric System Tutor* is an excellent program.

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58

CREATIVE COMPUTING

Educational Software, continued...

By the Numbers

Educational Micro Systems, Inc. has a rather broad set of math programs for grades two through eight. The programs, on tape or disk for TRS-80 Models I and III, cover arithmetic, simple logic, and metric/English conversions. The basic appeal of the programs is their flexibility. Teachers can specify a variety of parameters for the programs. For instance, in addition, there are fourteen types of addends, including single random digits, four-digit multiples of ten, and four-digit numbers with zeroes in the hundreds place. The teacher specifies whether the student will receive assistance for each incorrect digit, or assistance only after the problem is answered. Also, the teacher has the option to allow a reward for correct answers. This reward is in the form of a rocket that crosses the screen. After the student answers correctly, he hits the space bar, sending a missile at the rocket. Finally, the program can run in either a practice mode, or in a test mode. The test mode, of course, doesn't include the reward or assistance options, but problems can be presented with a time limit.

creative computing SOFTWARE PROFILE

Name: EMSI-1
Type: CAI Math
System: 16K TRS-80/32K (if on disk)
Format: Disk or Cassette
Language: Basic
Summary: Comprehensive math series.
Price: \$19.95 for the entire set (several other programs also available).
Manufacturer:
Educational Micro Systems, Inc.
P.O. Box 471
Chester, NJ 07931

After the student has finished the specified number of problems a full report is given showing both the problems and the answers given, as well as marking those problems where help was requested or mistakes were made. The series also contains four programs that generate worksheets with math problems.

While the general concept of this package is good, it is unfortunate that the disk version is nothing but the cassette version transferred to a new medium. No record keeping has been added, thus missing one of the greatest potential advantages of the disk.

Backtalk

A classic program with a fair amount of educational potential has found its way into compiled Microsoft Basic for CP/M system. *Ellis*, the interactive psychomotor

is a program that converses with the user, providing a simulation of a non-directive therapist. This version, from the Artificial Intelligence Research Group, contains a few extra touches which existed in the original but were absent from previous Basic translations. Rather than just replying to the most recent statement, it will occasionally refer back to previous inputs. And, since the program is compiled, it runs fairly quickly. *Ellis* has potential use in various subjects. She could obviously be used in a course on psychology, but could also provide material for courses in communications, computer literacy, and other areas. It should be mentioned that *Ellis* has been available for several years on an 8" disk, along with 49 other games.

creative computing SOFTWARE PROFILE

Name: Ellis Version 3.0
Type: Interactive
System: CP/M System, Disk Drive
Format: Disk
Language: Compiled Microsoft Basic
Summary: Program includes features from the original Ellis.
Price: \$25
Manufacturer:
Artificial Intelligence
Research Group
925 North La Jolla Ave.
Los Angeles, CA 90045

as *Basic Games-1* from Creative Computing (Microsoft required), and that a listing of the program is included in the book *More Basic Computer Games*, also from Creative Computing.

A Worthy Project

The majority of educational software is aimed at the elementary and high-school level, with most of the overflow hitting the colleges. One fine exception is a series of programs covering basic living skills for special learners. The programs cover important areas such as home safety and money management. Each program is very well done and includes all the trappings of good CAI. There are three levels of instruction, covering reading abilities from second to fifth grade, and the program branches to the appropriate level indicated by the user's response to questions. When the topic permits, the programs use graphics, adding to their appeal.

There are presently six programs available. *Job Readiness* gives a quiz to determine work attitudes and attempts to develop and reinforce positive work attitudes. From there, it goes on to cover job applications, interviews, and job-placements resources. *How Safe Home* demonstrates potential hazards in the home, focusing on the identification and prevention of

electrical, fall, and poison hazards. The other programs are *Income Means Expenses*, *Money Management Assist-*

creative computing SOFTWARE PROFILE

Name: MCE (Microcomputer Educational Program)
Type: CAI Basic Living Skills
System: 48K Apple, ROM Applesoft, Disk Drive
Format: Disk (from 4 to 6 diskettes are supplied per program)
Language: Basic
Summary: Fills a crucial need.
Price: Ranges from \$165 to \$340
Manufacturer:
Interpretive Education
2306 Winters Drive
Kalamazoo, MI 49002

and, You Can Bank on It, and Poison Proof Your Home. Each program is supported by an extensive set of worksheets for the user. These programs represent a good start toward filling the needs of a frequently neglected segment of the population.

PET Drill

Addition - All Levels, and *Subtraction - All Levels* are two good drill and practice programs for the PET. The addition program has 24 skill levels, and subtraction has twelve, making the programs suitable for grades one through six. The teacher or student can also specify a time limit and other options. Correct solutions are greeted by a graphic creature that waddles onto the screen. The main appeal here is a versatile program at a low cost. As a further bonus, the programs will run on any flavor of PET, despite the abundance of incompatible ROMs out there.

creative computing SOFTWARE PROFILE

Name: Addition - All Levels, Subtraction - All Levels
Type: CAI Math
System: 48K Pet
Format: Cassette
Language: Basic
Summary: Good drill and practice application.
Price: \$20 each
Manufacturer:
Twining Tools
Microcomputer Services
P.O. Box 12879
Research Triangle Park, NC 27709

Problem

The world is full
of intriguing problems
that never got into
a textbook.

Problems for Computer Solution
by Stephen Rogowski

Ninety intriguing and fascinating problems, each thoroughly discussed and referenced, make an excellent source of material in research and preliminary investigation. Eleven types of problems are provided in the following areas: arithmetic, algebra, geometry, trigonometry, number theory, probability, statistics, calculus and science. Author Stephen Rogowski of SUNY-Albany has included several problems which have never been solved. He feels that some research and an attempt to solve these will sharpen students' insight and awareness.

Some of the problems are not new like the one asking how much the \$24 the Indians were paid for Manhattan would be worth today had it been deposited in a bank. However, this problem was revised to have a variable interest rate so it would be a challenge to program. Of course, many of the problems are new and have never been in print before.

The student version has 106 pages and includes all 90 problems with variations, 7 appendices and a complete bibliography. Cost is \$4.95.

The 182-page teacher edition contains solutions to the problems, each with a complete listing in Basic, simple rules, and in-depth analysis explaining the algorithms and theory involved. Cost is \$9.95.

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Educational Software, continued...

Published Works

Guidelines for Evaluating Computerized Instructional Materials, from the National Council of Teachers of Mathematics, 1906 Association Drive, Reston, VA 22091, is well worth the modest price of \$3.75. Prepared by William P. Hewk, Jerry Johnson, and Robert J. Kanisky, this 32-page booklet has a wealth of information for those who are involved with buying or evaluating educational software. This is highly recommended reading.

Personal Computers and Education: the Challenge to Schools, by James A. Levin and Yakov Karcev, is an excellent overview of the subject. The 63-page report begins by covering the history of computers in education, then moves on to cover many facets of computers in schools. The material is clear, well written, informative, and fascinating. The report is number 98 of the CHIP (Center for Human Information Processing) series, and is available through the Library Loan Service of UCSD, San Diego, CA 92093.

JEM (Joint Educational Management) Research has produced some extremely thorough reference manuals that could be invaluable to anyone concerned with computers in schools. Volume I of *The Complete Reference Manual for the Instructional Use of Microcomputers* focuses on the Apple and covers everything from setting up the system to evaluating and selecting courseware. The manual, with over 400 pages of information, is available for \$30. Volume II (\$25), is also slated toward the Apple, and covers Basic, Pascal, and authoring languages. The final section contains in-depth information on the TRS-80, PET, Intecolor, Atari, and Apple, including good coverage of available printers and other peripherals. As if this hasn't kept JEM busy enough, they also publish *Micro-Scope*, a monthly newsletter produced on behalf of the Ministry of Education of British Columbia. A one-year subscription outside B.C. costs \$12. For further information, contact JEM Research, Discovery Park, University of Victoria, P.O. Box 1700, Victoria, B.C., V8W 2Y2, Canada.

"An educated man stands, as if with, in the midst of a boundless arsenal and magazine, filled with all the weapons and engines which man's skill has been able to devise from the earliest time."

Thomas Carlyle

Other Media

Adventures of the Mind is a series of six 15-minute video tapes on personal computing. Designed to be used in the classroom, the package includes a 21-page teacher's guide and video tapes in 2" quad, VHS, Beta or 3/4" format.

Although we were not able to view the sample tape we received on our video tape player which is compatible only with Beta II and III formats, we were impressed with the program as outlined in the teacher's guide.

Topics covered include: Computers as Personal Tools; Computer Components and Functions; The Basic Language — A Beginner's Introduction; Data Processing, Control and Design; Advantages and Disadvantages of Personal Computers; and Impact of Personal Computers on the Individual.

The teacher's guide provides questions and activities to be used before and after the viewing of each tape, outlines objectives and concepts covered in each lesson, describes the program, and suggests projects and follow-up activities.

Adventures of the Mind was produced by Children's Television International and the Applied Physics Laboratory of Johns Hopkins University and was the recipient of a recent International Film and Television Festival of New York award.

For further information, contact Children's Television International, Inc., 3 Skyline Pl., Suite 1100, 5201 Leesburg Pike, Falls Church, VA 22041.

Updates

CourseWare Magazine, covered last March, is still going strong. The magazine contains educational programs, along with a cassette copy of the programs. Single issues are \$12.95. A five-issue subscription is \$50. The address is CourseWare Magazine, 4915 Milbrook #222, Fresno, CA 93726.

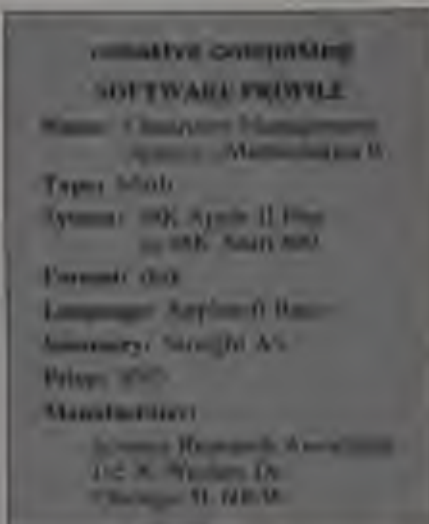
Also in March, Resource Software International was mentioned as a company publishing software in written form. They also provide programs on disk for the Apple and in Microsoft for CP/M systems. The sample they submitted contained a series of question-and-answer type programs covering math and language arts. The Apple version had evidence of the conversion syndrome: no special features of the Apple were used. Their address is RSI, 140 Sylvan Ave., Englewood Cliffs, NJ 07632.

Final Note

The programs covered here represent a tiny fragment of available CAE. If none of the above software suits your needs, don't be discouraged. There are thousands of programs on the market, and Creative Computing will cover new releases as soon as they become available. □

Classroom Management System

Russell Zausmer



At the beginning of every school year, classroom teachers are faced with an awesome task: individualize instruction for the students in their classes. The average teacher has about 30 students in his classroom, so creating an Individualized Lesson Plan (ILP) for each student in mathematics and reading is very time consuming. Every student must be tested, and each one placed in an appropriate group. A prescription must then be given to each student so that he may learn at his own pace. All this before the teacher has even begun to teach.

C.M.S. tests very specific skills defined by learning objectives.

While the educational concept is commendable, ILP has placed a tremendous burden on the teacher. In many cases, teachers have become clerks and record keepers rather than instructors. Is there, then, any help for the classroom teacher who sees the value of individualized instruction?

Help is here! Science Research Associates (SRA) has produced a fine educational tool which harnesses the full power of the microcomputer. The computer is called "Classroom Management System-Mathematics B." It is designed for students on a 4th through 8th grade level. The mathematics content includes: whole numbers—concepts; whole numbers—operations; fractions and mixed numbers—concepts; fractions and mixed numbers—operations; decimals—concepts; decimals—operations; ratio; proportion; percent; problem solving and estimation; geometry; measurement; and statistics and probability.

C.M.S. is a management system for classroom use that tests students, evaluates the tests, prescribes work to reinforce



Figure 1.

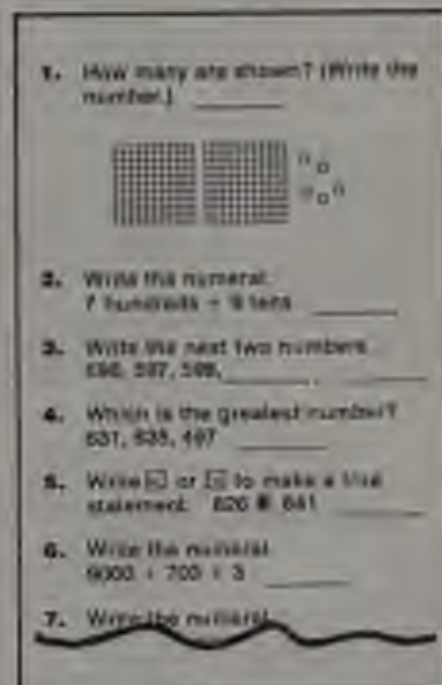


Figure 2.

specific areas where the student is weak, and records both individual and class progress. C.M.S. can actually free the classroom teacher from the tasks associated with developing, administering and scoring tests. It will also free him from searching for appropriate remedial or enrichment materials, and from keeping records, while allowing him to individualize instruction for students who need extra help and for advanced students.

C.M.S. tests very specific skills defined by learning objectives. It evaluates each student's mastery of the objectives and pinpoints weaknesses. This system instantly scores, evaluates, and records all test scores and then routes the student to the next test or prescribes remedial work geared exactly to the objectives he has failed to master. The prescriptions are correlated with six major basal math

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CIRCLE 151 ON READER SERVICE CARD

ROBOTWAR



David Lubar

creative computing SOFTWARE PROFILE

Name: Robotwar

Type: Game

System: MSX, Apple II, Applesoft,
Disk Drive

Format: Disk

Language: Microsoft BASIC

Summary: Graphics-oriented system for
developing graphics routines

Price: \$19.95

Manufacturer: Muse Software
100 N. Charles St.
Baltimore, MD 21201

His name is Bottom. His battle plan has carried him through scores of contests in the arena. Bottom always seeks the south wall of the arena, hugs it and moves back and forth while aiming his radar to the north. But Bottom is blind to his flanks. During the battle, Mover slips down, locks on his target, and fires. Bottom keeps coming. Mover shoots again. They collide and both are damaged. But the shots have taken their toll. Bottom succumbs. Mover senses his damage and goes to a new location. He spots another target. But this one moves before Mover fires. The shell flies past the target. Mover scans clockwise with his radar. He finds the target again.

This time he doesn't miss. He stands alone in the arena; the enemies are gone.

Bottom and Mover are two inhabitants of the universe of Robotwar. They have been programmed to find and destroy all who enter the arena. Were this all that occurred, Robotwar from Muse would be just another game. But there is more. Robotwar is a full system that allows the user to program and test his own robots. Among other things, this makes Robotwar an excellent educational tool.

Robot Talk

Bottom and his disk mates are programmed in a special robot assembly language. In essence, each robot acts as a small central processing unit. Actions are carried out by sending values to specific registers within the robot. For instance, the RADAR register activates the radar of the robot. A value from 0 to 355 can be placed in the register, causing the robot to send a beam at the appropriate angle. At this point the RADAR register will contain a new value indicating the result of the radar beam. The absolute value of this number tells the distance to the spotted object. The sign of the number tells the type of object. Walls return a positive value; other robots return a negative value. The robot also contains an AIM register which is used for pointing a gun, a SHOT register which fires a projectile, SPEEDX and SPEEDY registers to control movement, a DAMAGE register which indicates

the percent of injury sustained, a RANDOM register for generating random numbers, and X and Y registers to indicate position. There are twenty-four storage registers and an INDEX register. The storage registers are for holding values. The index allows the programmer to address registers indirectly. Each register has a number. Thus, if SPEEDX is number seven, you can place a seven in the INDEX register and any access to INDEX will actually access SPEEDX. This is a powerful capability. For instance, by putting a base number plus a random value into INDEX, you can randomly access either SPEEDX or SPEEDY.

O.K., there is a set of registers. What can you do with them? Well, the robot language also contains a set of commands. A value can be sent to a register with the TO command. A TO B takes the value in A and places it in B. Arithmetic operations are allowed, such as A+5 TO SPEEDX. The flexibility of the robots is increased with GOTO and GOSUB, and their "intelligence" amplified with IF statements. Putting it all together, a simple scan and shoot routine would be:

```

LOOP
AIM+5 TO AIM
AIM TO RADAR
IF RADAR<0 THEN GOSUB SHOOT
GOTO LOOP
SHOOT
U-RADAR TO SHOT
ENDSUB
    
```

In this example, LOOP is a label. The next line increases the aim of the gun. If the radar reading is less than aim, a robot has been spotted. In this case, the SHOOT subroutine is called. Placing the distance of the robot (RADAR) into SHOT causes a shell to go in the direction of AIM and explode at the instructed distance. END-SUB causes the program to return from the subroutine and continue execution at the line following the call.

The above, of course, is just one possible program segment. There are many ways to use radar, and many strategies. This is part of the value of Robotwar. Users of the disk are engaged into creating better, more effective robots. If two robots employ the same strategy, the one using more efficient code will probably triumph. The user begins to ask questions such as "What if radar oscillated instead of sweeping?" or "How large an increment can be used without too much risk of scanning past a target?" These "what ifs" can be put to the test. In the arena, program files

instead of a single battle, the user can schedule a tournament. Here, a running score is kept, allowing robots to be tested for long-term performance. It is possible for an inferior robot to win occasionally, but unlikely that such a robot will win a tournament. Even Target, whose strategy is to sit in place and do nothing, has been known to win once in a while.

The editor for writing robot code is a version of SuperText, and is easy to use. Since labels are allowed, the code doesn't require line numbers. The language is simple enough for beginners, but sophisticated enough to allow for a wide range of robots. Once the code is written, the source and object files can be saved to the master disk, or to a specially formatted backup. Disks can be initialized from the

program, which is good since the master disk has limited free space. A robot on a backup disk must be transferred to the master before entering a tournament. This is an easy process which is fully explained in the documentation.

The manual contains full instructions for programming robots, including many examples of different routines, and clear descriptions of registers and robot language. The only weakness in the system is the use of several different units of measurement. The arena is 400 meters across. The X and Y locations of the robot are given as values from 0 to 255, while the speed of the robots is given in decimeters. Aside from this, Robotwar is both an excellent game and an excellent learning tool. □

Even Target, whose strategy is to sit in place and do nothing, has been known to win once in a while.

become painfully obvious, but there is a less painful way to test robots. The disk contains a test bench which executes the code and displays register contents. Radar sightings and damage can be simulated. In essence, the test bench provides full debugging features, including single step and trace.

Let's step through some features of the disk. The menu begins with an option to put robots into the arena. If this is selected, the user sees a roster of available robots. From two to five can be selected. Once the choice is made, the battle begins. The robots appear as square, hexagonal, or octagonal shapes, each of which is distinctive. The side of the arena contains a display showing each shape, the name of the robot, percent of damage, and score. Every time a robot is destroyed, the survivors gain a point. Radar is shown by a white flash, the aim of the gun is indicated with a line inside the robot. Projectiles are small dots. Each robot in turn carries out an order. Since this is a sequential process, the program speeds up as robots are eliminated. With two robots, the action is quite fast.

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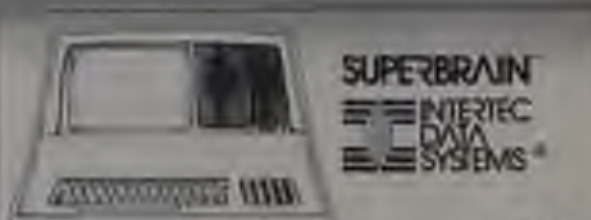
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Designing Good Educational Software

James C. Kingman

We have a good deal of things the more people of educational software and even a few teachers have to experience. The author of this article provides some concrete suggestions. Although some of the advice things he suggests may not be the best way they can be modified and the concepts applied to any computer. —JMK

"Mr. Jennifer. That's not right. Try again. Six plus three is how many?" I could feel my frustration rising. Worse, I could hear the frustration and anger in my voice as I spoke to my daughter.

Jennifer was nine years old and should have been capable of single integer addition long ago. But Jennifer is special—she is mildly retarded and goes to the elementary special education class at Ray Buck School in Helena, MT.

Because of her retardation, Jennifer needs a huge amount of overlearning in order to master a skill. A skill, such as single integer addition, might be mastered by a child of average intelligence in a couple of months while the same skill might take Jennifer and children like her a year, two years or more to master. It will take Jennifer many hours of drill and practice before she can master simple arithmetic.

Unfortunately, on that winter night as I was working with my daughter, the only thoughts on my mind were negative ones.



"We have the educational programmer I will agree to a set of standard format procedures."

They ranged from the "poor me" question of why couldn't Jennifer be normal to the realization of the enormous cost to taxpayers to educate special children. These thoughts plus the frustration of not being able to get Jennifer to understand and remember what, to me, were the simplest of concepts brought a premature end to our evening practice session. I ended it with some stupid remark like, "If you're not going to try, I'm not going to help you." Fortunately for special children everywhere, I am not a teacher.

About a week after the frustrating evening with my daughter, I was in the Radio Shack store to buy a new trinket while the salesman was demonstrating the TRS-80 to another customer. As an information management specialist, I was familiar with some computers since I had looked them over carefully out of professional curiosity when they first came on the market. However, as one who never balances his checkbook and dislikes book-keeping, I really didn't see how I could use a computer at home. Oh, it would be fun to tinker with, but that hardly justified the cost.

Then, as I was leaving the store, I heard the salesman say something to the other customer that turned on the proverbial light bulb. "Another use for the home is education. The computer is very good at presenting repetitive problems in math and language."

"Of course!" I thought.

"Drill and practice," I muttered.

"Repetitive presentation of practice problems with infinite patience is an emotionally neutral manner," I said aloud to the salesman and customer. Stunned, they only stared at me.

"I'll take one, please," I said to the salesman. He continued to stare at me.

"I would like a home computer. One of those. Today. Now, if you have one in stock."

"Slowly, still staring, he headed for the stockroom. When he returned with the large box containing my new computer, I already had my clock made out.

"Do you know how to program in Basic?" he asked as he wrote out the receipt.

"No, but I will figure it out," I said, not bothering to tell him I knew several other computer languages.

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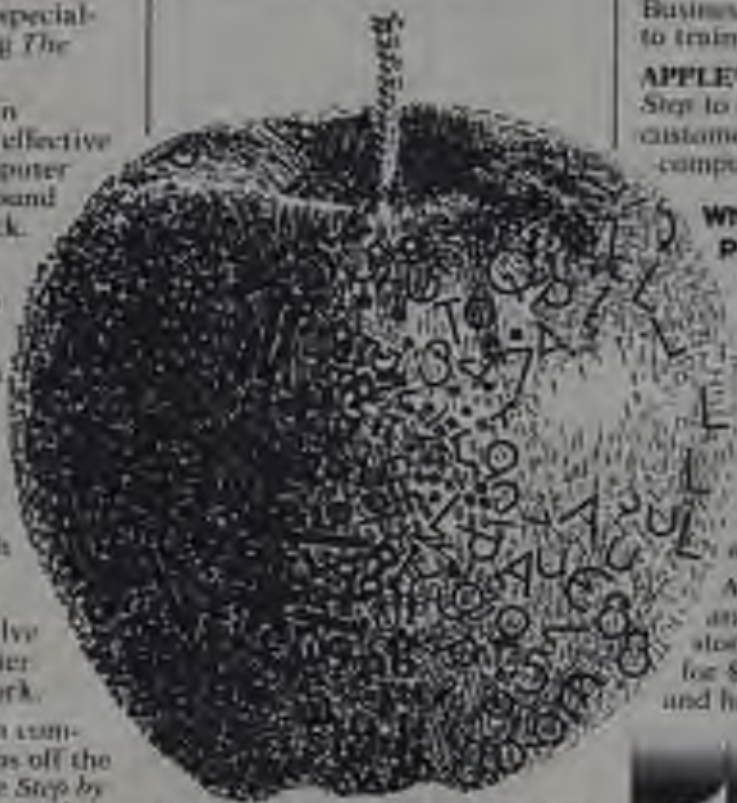
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Again, the state of incredulity. To this day the salesman, whom I have come to know well, suspects that I'm not altogether sane.

That was two years ago. Since that time I have quit a well-paying job and, with an educator and an experimental psychologist who specialize in human learning and motivation, formed a non-profit research and development corporation that specializes in microcomputer applications for developmentally and learning disabled individuals. I now spend most of my energies in the field of educational uses for microcomputers. This article is about what we have learned in the last two years. It is offered as a guide to others who want to write good Computer Assisted Instruction (CAI) and see it used in schools.

After acquiring a microcomputer for educational use one quickly discovers that there is not a great deal of software available. An added problem is that much of what software is available is not particularly good. We believe that good educational software must have eight characteristics. The eight characteristics are: 1) Educational Soundness, 2) Ease of Use, 3) "Bullet" Proofing, 4) Clear Instructions, 5) Appropriate Language, 6) Appropriate Frame Size, 7) Motivation and 8) Evaluation.

These eight characteristics are the same whether you are writing drill and practice

programs for elementary age mentally retarded children or tutorial programs for graduate students in physics. Applying these eight characteristics will not guarantee a good educational program, but ignoring them will guarantee a poor one.

Educational Soundness

The first and most important characteristic of CAI courseware is that it be educationally sound. By educationally sound we mean that the material to be presented, (1) is relevant to the student's needs, (2) is appropriate for the learning objective, and (3) does, in fact, contribute to the learning process. To be relevant to the student's needs, the material must be tailored to the current curriculum of the class. For example, if a junior high social studies class is studying economics, a tutorial program presenting the concept of "marginal propensity to consume" may not be relevant to the student's current needs. On the other hand, a simulation program that lets the student play king by allocating the resources of a fictitious country between "guns and butter" and then presents the results of the student's allocation, may be very relevant to the student's need to understand simple economic relationships.

The courseware developer must also know what the learning objectives are, or define them himself. Stated a different

way: what is it you want to teach? For example, if you want to teach a child the value of coins, a drill and practice program that displays a facsimile of a coin, then asks the student to identify its value may meet the learning objective much better than a simulation program that tries to get the child to make change for a hypothetical purchase.

The most difficult attribute of educational soundness to measure is whether, in fact, the program does contribute to the learning process. In two years, the only good technique we have found to determine this is field testing. The statistical techniques to measure this attribute are beyond the scope of this article, but the courseware developer should be aware of them in testing his programs.

Ease of Use

The second characteristic of good educational software is ease of use. Ease of use means that the program is designed

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to be loaded and executed by a user with minimum skills and knowledge. We believe that the best educational software assumes that the user has no knowledge of computers or programming, has no typing skill and will not read printed instructions, except as a last resort. Even then, if the instructions are read, they will not be understood. We recognize that this assumption is not true for most teachers, parents and students. However, if you develop your educational software assuming that it is true, you will probably go a long way in assuring that your programs are easy to use.

Bullet Proofing

Closely related to ease of use is bullet proofing. A bullet is a 10-year old hyperactive child who will press every key on the keyboard at every opportunity. Regardless of how well you think you have considered every contingency, the bullet is guaranteed to bring any new program to a premature halt within 30 seconds.

Some common bullet proofing techniques are:

- 1) Disabling the BREAK key at the beginning of the program.
- 2) Testing input responses for appropri-

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please range and type before they are accepted by the main routine of the program.

3) A null INKEYS command before an operational INKEYS to eliminate any response made prematurely by the student.

4) Error trapping routines that allow the program to recover if one buffer does find an unexpected way to terminate the program.

Depending on the audience your programs are aimed at, you may even wish to disconnect or physically move the RESET key. For example, the RESET key on the Radio Shack TRS-80, Model I, is inside the keyboard case and covered by a little door. This can be effectively taped shut to prevent unauthorized use of the RESET

printed instructions would for assembling a bicycle. Their advantage is ease of programming. The disadvantage is that they are somewhat overwhelming when presented single spaced on a video screen, and many times are not read. We recommend no more than one page of sequential instructions in any program.

The use of a menu can be very effective in allowing the user a choice of what he wants the program to do. A well designed menu can also provide much information about the operation of a program. For example, if you are writing the instructions for a drill and practice arithmetic program, you could write a page or more of sequential instructions that explained how the program worked and asked the student or teacher to enter the word "add."

Once that choice is made another menu might be displayed that allowed the user to choose the format of presentation. For example:

Which format?

1) $2 + 4$
—

$2 + 4 + 4 =$

Enter number of choice?

This process can continue until all program parameters have been defined.

A third method of giving instructions is through the use of a HELP routine. Generally the course developer must create the software routine that will accommodate this method, but it can be a very powerful method of only providing instruction when they are needed. In our previous example the teacher may want an explanation of "single integers without carry." To get this explanation he would enter HELP 1. The screen would then display:

HELP 1.

Single integer addition without carry will generate random addition problems whose terms will be single integers from 0 to 9. The addition of these terms however, will never result in a sum greater than 9.

Press ENTER to continue.

From the viewpoint of the user, the HELP routine is the most efficient since it presents only those instructions that are needed.

We believe that a combination of all three methods of instruction are useful in good educational programs. We prefer to use a brief overview of the program at the beginning then go to the menu-driven instructions to select program parameters. Should the user need further information about a particular menu item he can enter HELP and the number of the item. This would provide a detailed explanation of the menu item. One important rule in writing any type of user instructions, is to keep them clear, concise and simple.

Appropriate Language

The fifth characteristic of good educational programs is the use of appropriate language for the audience who will use the program. If you are writing programs for a senior high gifted and talented science class you may use language entirely different from that required for programs in a third grade arithmetic class. A classic violation of this principle is a number concepts program for kindergarten by a major manufacturer that displays:

Welcome to Kindergarten. Please wait a moment.

Presumably this was written to pacify the teacher while the computer is doing some internal housekeeping. It might have been better if the time was filled with some entertaining graphics or just a landing



"Your program is excellent except for the playing of the Triumphant March from Aida for each correct answer."

key. On the Radio Shack TRS-80 Model III the RESET key is on the keyboard. While it is recessed, even tape will not prevent inquisitive fingers from finding it. Thus, before the Model III is useful in an elementary special education class, we will need to move the key to the rear or the bottom of the cabinet.

Instructions

The fourth characteristic of good educational software is clear screen-oriented instructions on how to use the program. We believe all necessary instructions would be presented via the screen. These instructions must be clear and concise while giving the user sufficient information to feel comfortable in using the program. The three most common methods of presenting instructions are sequential, menu driven and the use of HELP. Sequential instructions generally present textual material in much the same fashion as

"subtract," "multiply," or "divide," to select which operation was to be practiced.

Alternatively, you could display a menu that said:

- 1) Addition
 - 2) Subtraction
 - 3) Multiplication
 - 4) Division
- Enter number of choice?

Those four numbers and eight words convey extensive information to the user about what the program may do. Multiple menus can then be used to define the desires and needs of the user further. For example, if the user inputs "1" in the above example another menu might be immediately displayed that said:

- Do you want to begin practice with:
- 1) Single integers without carry
 - 2) Single integers with carry
 - 3) Multiple integers without carry
 - 4) Multiple integers with carry
- Enter number of choice?

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picture to entertain non-reading kindergarten children while the housekeeping was performed. The key to appropriate language is knowing the general skill level of your targeted user.

Frame Size

The sixth characteristic is appropriate frame size. Frame size is defined as the amount of material which will be presented to the student in each segment of the program. To illustrate this, consider an arithmetic drill and practice program. If our program only practiced addition and subtraction we could design the algorithm with only two frames (i.e., addition and subtraction). Each term of each problem could be created with the statement $TERM = RND(n)$. Thus, in addition to our two frames being defined by the type of operation, they are further defined by the value of n . If $n = 100$ then the first frame of our program would create addition problems with terms ranging in value from 0 to 100. The second frame would create subtraction problems with terms ranging in value from 0 to 100.

Now, these are valid frames from the standpoint that they will execute. They may not be good frames from an educational standpoint, however. For instance, there is no control over whether addition

problems will generate a carry to the next place value or whether subtraction problems will require a borrow. Worse, the design allows generation of subtraction problems whose difference is a negative integer. To prevent this we must further define our subtraction frame to cause the minuend to always be larger than the subtrahend.

If our program is aimed at students with varying skill levels in arithmetic our frames still might not be very useful. We would want to subdivide the addition frame into a series of smaller and progressively more complex frames. One method might be that shown in Figure 1.

As you can see our frames can be defined as broadly or narrowly as necessary. The guideline for frame size is that the frame should be large enough to generate sufficiently diverse material that the student is challenged but not frustrated, and small enough to assure a high success ratio but not create boredom. Unfortunately, that is easier said than done. It may take a considerable amount of actual testing to determine optimum frame sizes.

Of course, all this can be avoided by just having one well-defined frame. The disadvantage then is that the program is so specialized that its usefulness is severely restricted. In general, the greater the

Frame #	ADDITION Description
1	Add two single integers whose sum will never be greater than 9 (no carry).
2	Add two single integers whose sum will be greater than 9 (carry).
3	Add one single integer and one double integer whose sum will not result in a carry.
4	Etc.

Figure 1.

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number of frames, the larger the student population for which the program may be useful.

Another consideration in the construction of frames is the rules that the program will follow in moving the student forward or backward through the frames. For example, if we have a time telling program that displays the face of a clock and asks the student to determine the correct time, we might have five frames (i.e., whole hours, half hours, quarter hours, five-minute intervals and one-minute intervals). Assuming that our program begins with whole hours, we will need to determine how many problems with whole hours we will generate and how many the student must get right before we start generating problems with half hours. Once in the half hour frame we must determine how many problems the student can miss before the program moves back to the whole hour frame. As in determining frame size, the determination of frame movement often requires considerable testing to arrive at the optimum rules.

Motivation

Motivation is the seventh characteristic of good educational software. Unfortunately, it is probably more difficult to measure than any other characteristic. The goals of motivation are to keep the student interested in the lesson being presented and performing at his maximum capability. Educators have been trying to accomplish these goals for thousands of years with varying degrees of success. Like our predecessors we have failed in finding the magic answer to motivation. Like them, we have achieved varying degrees of success depending on the child and the technique used. When we discuss motivation as it relates to CAI we are only addressing the feedback to the student that is generated by the computer itself. For example, a CAI motivational feedback would be a "smiley" face displayed on the screen in response to a correct answer. It would not be the teacher providing verbal praise to the student for inputting a correct answer to the computer.

For research purposes we classify CAI motivational feedback into three broad categories. The first category is called "passive." An example of passive feedback would be simply telling the student whether he got the problem right or wrong. With nevertheless it might be displaying a happy or sad face.

The second category of feedback is called "active." An example would be high speed graphics on the screen to reward a child visually for a correct response, or a Snoopy dog walking across the screen with a banner that says, "Great, John!"

The third category is called "interactive." An example of interactive feedback that we have found particularly effective with

elementary-aged learning disabled and mentally retarded students is rewarding them with a simple graphic computer game if they attend to the computer lesson and/or perform at a certain level of competence. This game allows the child to create his own computer art by pressing various keys on the keyboard. A variation of this is allowing junior high students to take 50 shots at flying saucers if they score 80% or better on a fractions and decimals program.

Evaluation

The final characteristic of a good educational drill and practice or simulation program is a student performance evaluation at the end. Tutorial programs may or may not require an evaluation of student performance.

A measurement of level of difficulty or complexity of the learning material presented should be given. The level of difficulty of the problems presented in drill and practice programs or the user

is encouraged to guess at an answer); the number of problems on which a prompt was given (where the program presents a "prompt" or "help" when the student does not respond or responds incorrectly); or an actual listing of problems with incorrect responses (where the teacher wishes to modify the curriculum based on performance). For simulation programs, an analysis of where the student lost points might prove beneficial for measuring performance.

Depending on how complex you wish to make your educational program and the physical limitation of the hardware, you can add routines to record the historical performance of the student so the teacher or parent can see the changes in performance over a period of time. You might also want performance criteria to modify the curriculum presented. For example, the arithmetic program discussed under the section on appropriate frame size, might be designed to actually change the frame size based on student performance.

If the student performs above a certain level, the program might combine frames to allow the student to move ahead in problem difficulty more rapidly. On the other hand, if the student performs below a certain level, the design might split the frame size into smaller segments. If the current frame size is the subtraction of single integers from 0 to 9 without borrowing, the program might split the frame in two parts (i.e., integer 0 to 4 and 5 to 9) for the student who is having difficulty with the larger frame. The program could then drill integers 0 to 4 until mastery, and then move to integers 5 to 9.

As stated at the beginning, applying these eight characteristics will not guarantee a good educational program, but ignoring them will guarantee a poor one. Designing these items into your programs is not always easy. Sometimes it requires very sophisticated programming, but using these techniques will result in two things. First, they will make you a better programmer. Second, they will increase the quality of educational software available to schools and parents.

Jennifer still has trouble with arithmetic, but she is learning. Through a grant from the Developmental Disabilities Planning and Advisory Council of the State of Montana, she and her classmates have had a microcomputer in their classroom for the last year. They have drill and practice programs in arithmetic, reading readiness, spelling, time telling and verb tense. Our research has conclusively shown that elementary-aged, educable mentally retarded and learning disabled children can effectively use standard microcomputers as learning tools. Much more needs to be done, and, because of the tremendous potential, much more will be done. □

The key to appropriate language is knowing the general skill level of your targeted user.

supplied or randomly selected variables that effect the difficulty of a simulation program are standard methods of measurement. To be useful, the level of difficulty must be easily understandable. For example, in the time telling drill and practice program, the level of difficulty might be expressed as the smallest unit of time at which the problems were presented (i.e., whole hours, half hours, etc.). In an arithmetic program the level of difficulty might be stated as "addition of two double integer terms whose summation does not result in a carry." While a statement in your documentation that "the program is designed for the second or third grader" or "the program can be used by pre-schoolers" may be good advertising copy, it is not particularly useful to a teacher or parent who is trying to determine how "Baller" just did on his spelling practice.

A measurement of the student's performance during the session should also be given. The number of problems presented and the number correctly answered in drill practice or a "point score" in a simulation program are two methods. Variations for drill and practice programs might be the number of seconds for a response (to measure on-task behavior); the average number of incorrect answers per problem presented (where a student

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Florida University Multimedia Data Bank

Glenn Kleiman Mary M. Humphrey Trudy Van Buskirk

EVALUATING EDUCATIONAL SOFTWARE

Advances are rapidly increasing speed of the potential of microcomputers. Currently available, relatively inexpensive, computer hardware is capable of providing powerful and flexible tools for teaching. Computers can be used to individualize instruction, motivate children's interest and present material in new ways through the use of graphics and simulations. Computers can be tutors that provide appropriate levels of instruction and questions for each individual. They can provide immediate feedback to students' answers, and they are infinitely patient. They can also keep detailed records of each student's performance.

Unfortunately, much of this potential remains unfulfilled. In itself, a computer is a machine, one of electronic components. In many ways, potentially powerful, the usefulness of a computer is determined by the software available for it.

The development of educational software lags far behind the development of hardware. Many of the available programs are poorly designed, do not take advantage of the potential of computers, and are difficult for students and teachers to use.

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We fear that the use of your software will discourage some teachers from using computers in all.

Some good educational software is available, and much more should be available in the near future. The aim of this article is to present guidelines for selecting good software. We will discuss the general principles that we, as educators, psychologists, and computer specialists, believe should serve as a basis for both software development and software evaluation.

Since we will discuss general principles rather than specifics, what we have to say is relevant to a wide variety of teaching programs, topics, students, and computer systems. The guidelines are presented as questions one should ask about the computer software designed for educational use.

First we will discuss three very general questions. Then we will turn to more specific questions that are based upon the three general ones.

The general question is: Does the software follow good educational principles? Much of the available educational software seems to have been written by computer programmers who did not know much about education or the abilities of the children who might use the program. Such software may be of high quality from a programming point of view, but it often comes across from a pedagogical point of view.



For example, educationally well-designed programs present material in small, well-sequenced units. We have seen many programs that present too much material at one time, and present it in ways that may be confusing to many children.

Another good educational practice is to provide immediate feedback when the student makes a response. Computers can be programmed to do so, but many programs do not take advantage of this capability.

Other programs make poor use of the graphics capabilities of computers. A common fault is using graphics in ways that distract the child from the material to be learned.

Another general question is: *Is the software suitable for the intended purposes and users?* Some educational software does not present a reasonable progression of material to be learned and therefore will not fit into any curriculum.

Other computer programs are not acceptable because they are difficult for students and teachers to use. Many lack adequate instructions, do not take into account the reading level of the intended users, require complicated procedures to enter answers, or stop operating if the user makes an inappropriate response.

The remaining general question is: *Does the software take advantage of the capabilities of the computer?* The major reason for using computers as educational tools is that you can do things with computers that cannot be done, or are much more difficult to do, without them. However, computer programs often do not take advantage of the capabilities of the computer.

For example, we consider programs that are basically written pages moved onto the computer screen, in which the computer simply acts to turn the pages, to be a waste of computer resources. Some lessons are better presented with other media. Since most schools do not have an abundance of computers, the available computers should be used for those types of lessons for which they offer strong advantages.

We now turn to the more specific questions, each of which reflects one or more of these general concerns.

Does the Program Fulfill Its Purpose?

Computers can be used in teaching a wide variety of topics, and one must decide whether a given program fits into the curriculum being used. Once a match between the curriculum and a software package has been found, there are several other considerations regarding the role of the computer.

One must decide whether the computer will be used in the initial teaching of the material, for review or practice, for testing, for record keeping, for facilitating general

skills, or for some combination of these functions.

Deciding which of these purposes one wants a given program to serve is an important step in evaluating the potential usefulness of the program.

Computers can be helpful in the initial teaching of material. For example, computer graphics and animation can provide useful visual aids. In some cases, computers can substitute for the teacher and textbook and actually teach the material.

Another possible role for the computer is to review lessons or present drill and practice. Since they are infinitely patient, computers can be especially useful for those students who need more repetition. Programs can be written to ask the student questions and give feedback when he answers.

Since computers can keep track of students' performance, they can also serve in testing and in record keeping. Well designed testing programs allow the teacher to enter questions and acceptable answers.

Does the program use sounds or graphics that might distract other children in the room?

Various criteria can then be set to individualize the test for each student. For example, programs can be designed to vary the difficulty of the questions presented depending on how many the student has answered correctly. With a printer, connected to the computer, written records can be produced automatically.

In addition to helping children learn and master specific material, computers can be important in facilitating general skills. For example, many computer games provide good practice in eye-hand coordination, making rapid responses, and maintaining attention. Other computer games exercise general problem solving and creative skills.

Is the Software Appropriate for the Situation in Which It Will Be Used?

When evaluating software, one should keep in mind where and when it will be used. Will an adult be present to assist the student, or should the student be able to use the program without assistance? Will children work individually or in groups?

If they will work in groups, one should

consider whether the program is designed so that children can share the work or alternate entering responses.

How often will each child use the program, and for how long? If a program is very repetitious, it might be suitable if it will be used only occasionally and briefly.

If a program is fairly complicated and will take a while to learn to use, it will be suitable only if sufficient computer time is available. Finally, will it be used in the classroom and, if so, does it use sounds or graphics that might distract other children in the room?

Is the Software Suitable for the Intended Users?

As we mentioned above, much of the available educational software seems to have been produced by computer programmers who know little about the children who might use the program. One important area of concern is the instructions provided with the program.

Many educational programs do not provide adequate instructions. Often the instructions designed for the child are unsuitable because of the reading level required. For example, we have seen instructions requiring high school level reading in math programs designed for grade school children.

Many programs also fail to provide adequate instructions for the teacher on how best to use the program. In several programs, we have suggested upon useful features that were never mentioned in the instructions.

Another important concern is how the user makes responses. There are many ways in which information can be entered into a computer. The most common ones use typewriter or calculator style keyboards. Young children can usually use these to enter single letter or digit answers. However, entering entire words or sets of words may be too difficult for young children.

Other input devices can be attached to computers. Light pens enable responses to be made by pointing at a particular part of the screen. Using a light pen, a child can answer multiple choice questions without needing to find the appropriate keys on the keyboard.

Other devices, such as joysticks and game paddles, also provide easy ways of making responses.

The pacing of the material being presented should also be considered. In some programs it is completely controlled by the computer. In other programs the material is presented in small units and the user presses a key in advance to the next unit. Since different children work at different rates, we generally prefer programs where the pacing is controlled by the user. The main exceptions are programs used to increase speed, such as

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in rapid word recognition. Even in these programs, there should be a range of speeds available so they can be used with a variety of children.

Does the Software Adapt the Computer to the User or Must the User Adapt to the Computer?

A very important consideration, often neglected by programmers, is whether the students and teachers will be able to use the program easily and comfortably. Psychologists call this area human factors—considering the people, not the machines.

Most addition programs provide examples of programmers' failure to adapt the computer to the user. When children do addition problems with paper and pencil, the addends are usually written one below the other, with the columns in line. The children work the problem from right to left, and mark carrying from one column at the top of the next.

Many addition programs present the problems with the addends side by side, require the answers to be entered from left to right, and do not provide any way of marking carrying. In using these programs, children often copy the problem, work it on paper, and then enter their answer into the computer.

Programs that present problems this way force the user to adapt to the computer. With more effort on the part of the programmer, the computer could have been adapted to the user.

Other examples of failing to adapt the computer to the user include using "x" instead of "×" to indicate multiplication, not providing any way in which mistakes can be erased, and filling the screen with so much information that it is difficult to read.

Another thing that makes programs

difficult to use is lack of consistency. One should check whether the way information is entered is consistent within the program, and, if possible, is consistent with other programs the children might use. For example, on the PET computer a key marked DEL (for delete) is usually used to erase responses. A program that uses some other key, or does not allow erasing, or only allows erasing some of the time, may confuse children who are accustomed to using the DEL key.

We hope that educational programmers will agree to a set of standard input procedures in the near future. As things stand now, educators should look for sets of programs that operate in similar ways.

Another problem good programmers should consider is that users do not always make the expected response. For example, given a choice of pressing "Y" for yes or "N" for no, an uncertain child might press "M" for maybe. Children often press keys just to see what will happen, and we have observed children pressing an "Erase" key

Given a choice of pressing "Y" for yes or "N" for no, an uncertain child might press "M" for maybe.

to try to erase a difficult question. Good programs are prepared for inappropriate responses, so that these responses will either be ignored or result in a message such as "try again."

Poor programs are not child proof and may "crash" when inappropriate responses are made. When testing any program, one should make sure that inappropriate responses will not disrupt the program.

Does the Software Take Advantage of the Capabilities of the Computer in Presenting the Lessons?

Many lessons, creatively designed, can take good advantage of the graphics and sound capabilities of the computer. Any lesson where animation or interactive graphics can be useful is better presented on a computer than a book.

For example, many lessons in physics, such as those on wave forms or vectors, can benefit from animated representation of the phenomena being studied.

Other examples include programs that produce maps and point to them during

lessons, programs in which graphs are produced and revised to support the information presented, and programs which enable the user to, in some way, draw on the screen.

Other lessons, such as those in music, can take advantage of sound generation capabilities—the student can both see the note on the screen and hear it, different sequences can be played, and so on.

In addition to using the built-in capabilities, other designs can be interfaced to computers. Sound can be easily and inexpensively added to computers that do not have it built-in. Interfaces have been designed to enable computers to control tape recorders, slide projectors, and video recorders. We hope to see greater educational use of computers controlling these presentation devices.

Is the Program Adaptable to Different Children and Teaching Methods?

A good educational program can be easily adapted for different users. For example, a program that can only present 10 addition problems, with each problem having two addends and two digits per addend, is very poor. A program that allows you to specify the number of problems you want is a small bit better. A program that allows you to set different difficulty levels for the problems as well as the number of problems is much better. A program that also gives you the option of using subtraction, multiplication or division problems is better still. The lack of this type of flexibility is one of our most common criticisms of available programs.

Some software companies market a large package of programs where one flexible program would serve the same purpose and be much less expensive.

For example, one company sells sets of 14 spelling programs. Each program contains a small number of words, and the only differences among the programs is in the word lists. It would not be difficult to write a similar program in which the teacher could input his own spelling words. This program could sell for a fraction of the price of the large package.

When obtaining flexible programs, one must be careful that they are easy to modify. Some provide a simple "menu" from which the user selects the desired option by pressing one or two keys. Menus are very easy to use. Other programs require the user to change the program itself, usually by modifying DATA statements or changing the values assigned to certain variables.

Will the Program Hold the User's Attention?

Another important question is whether the program will capture and hold the



"I'd just much more if it could pause for a moment."

user's attention. Properly designed educational programs have been successful in keeping even the most distractible children engaged in a task for surprisingly long periods of time (see "Microcomputers and Hyperactive Children" by Klitzman, Humphrey and Lindsay in *Creative Computing*, March, 1981).

The graphics and sound capabilities of microcomputers, properly used, can hold children's attention. Improperly used graphics and sound can quickly become annoying and discourage use of the program. When examining these aspects of a program you should determine not just whether they are initially captivating, but whether they will remain so with repetition.

For example, a program that displays a rocket ship slowly rising on the screen, or plays a melody after each correct answer, might be initially motivating. However, after one has seen or heard this ten times it will probably become tiresome. We find that graphic and sound reinforcement which is used repeatedly should be rapid (i.e., two to three seconds) and varied. Different pictures or tunes hold attention much better than the same one or two repeated frequently.

The pacing of the program and the frequency of user responses also affect how well it holds children's attention. A program in which the child has to wait long periods, or which moves more quickly than the child can read or give answers, will not hold the child's attention. Likewise, the more frequently the child must make a response, rather than simply watch the screen, the more likely he will stay engaged in the program. Receiving immediate feedback to their responses also helps hold children's attention.

In many cases, educational material can be presented in a game format. We do not believe that all educational programs need to be forced into games. However, the competitive nature of games often does hold children's attention. The competition can either be against one's own prior performance, against the computer, or against another person.

Game programs should be checked to make sure the children will be able to play reasonably well, but still find the game challenging. A game which is too simple or too difficult will not keep one's interest. The best game programs allow the user to set the level of play—e.g., present the older or more capable users with more difficult questions or less time to perform the task.

A good computer program—particularly one designed for use by children with concentration problems—can monitor the child's responses and provide special messages. For example, the program can measure the time between the user's

responses, and flash a special message or sound a buzzer if there is no response for a long time. We have not found many programs that do this, but we have found it useful in our research.

Does the Software Provide Useful Feedback to the User?

One of the major advantages of computer-based learning over other media is the capability of immediate feedback. As we mentioned above, immediate and frequent feedback helps keep children's attention on the task at hand, and this is especially important for children with attention problems. The right feedback at the right time is also important for facilitating learning.

Besides the motivating reinforcers for correct responses, an important aspect of a program is how it responds to incorrect responses. One poor but common type of response is simply to tell the child that he is wrong, and go on to the next part of the program. Some programs, written without

Messages from a computer such as "Wrong, Dummy" may be humorous to some adults, but can upset young children.

any thought about who might use them, even display insulting messages after a wrong response. Messages from a computer such as "Wrong, Dummy" may be humorous to some adults, but can upset young children.

One good practice is to provide the child with a second chance when an incorrect response is made. For some purposes, this is best combined with a prompt of some sort. For example, a spelling program might tell the child which letters are incorrect, and then have him try to spell the word again. In programs where the questions are based on an immediately preceding lesson, the appropriate section of the lesson might be repeated when the child does not answer a question correctly.

Another alternative is to give the child the correct answer. Depending on the content of the lesson, this may be best after a single incorrect response, or it may be better to give the child several tries before giving the correct response. In either case, a good practice is to provide some way for the child to compare his answer with the correct one, or to spend some time studying the correct one.

For example, in spelling programs the child should have to type the word correctly after being shown the correct spelling. Another good practice is for the program to store a record of the questions or problems the child answered incorrectly. These can be repeated later on, or given to the child at the end of the lesson for further study.

We have seen programs where the most interesting graphics and sound displays occurred in response to incorrect answers. These programs should be avoided, as they encourage children to make incorrect responses just to see what happens.

Other programs are designed to accept only the correct response. For example, some math programs will not let any but the correct number appear on the screen—if the child presses an incorrect number nothing happens. Faced with this type of program, some children just press all possible keys until they happen to hit the correct one, without paying any attention to the math problem. Clearly, this is not a recommended practice.

Conclusions

We have discussed several questions to be asked when evaluating educational software. All of them reflect three general requirements for quality educational software: 1) It must follow good educational practices; 2) It must be suitable for the intended purposes and users; and 3) It must take advantage of the unique capabilities of computers. Within these three general guidelines, which of the specific questions is most important depends upon the material being taught, the teaching method, the students' abilities, the available computer hardware, and other factors specific to each situation.

We hope this article will help teachers, educational administrators, and parents choose the best available educational software. We also hope it will encourage and facilitate the writing of good educational programs. □



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EXPLAINING COMPUTER RELATED CONCEPTS & TERMINOLOGY

Harold W. Lawson, Jr.

Have you ever tried to explain computer systems to someone who knows nothing or very little about them? Where do you start? Do you first explain the binary number system, Boolean algebra and/or computer logic? Perhaps you begin by showing the classic CPU, memory, I/O block diagram and explain each of these constituents, including stored programs, instruction sets, etc. Maybe you skip all of these low level details and explain flowcharting and/or some relatively simple high level programming language such as Basic.

Regardless of where you begin, you soon recognize that although you may be somewhat successful (after sufficient effort), the person being taught has no idea about computer systems and computing as a whole and many questions remain about the "miracle of the computer." On the other hand, it seems, on the surface, to be difficult to give a complete picture of computer systems right from the beginning.

After several years of experience with a "process oriented" approach we can remove the doubt and say that it is indeed possible (and desirable) to introduce computer systems concepts and terminology right from the beginning in an integrated manner. This approach has resulted in the book *Understanding Computer Systems** and the purpose of this article is to present the basic concepts used in this approach. As with all endeavors of this nature, the success depends upon proper structuring of the presentation. The approach used is highly pictorial, and terminology is introduced bit-by-bit in a logical fashion. Each chapter finishes with a summary, work list and problems. The entire vocabulary introduced is presented at the end in the form of a glossary.

But enough about the structure of the book—let us consider the approach.

Introducing Processes and Systems

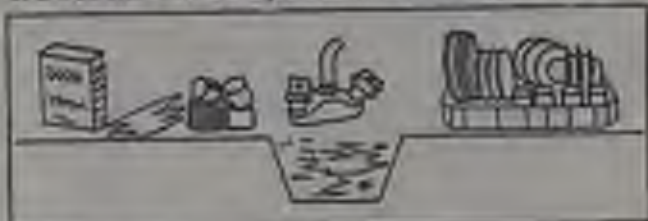
"People learn best when new concepts are presented in terms of what they already know."

The process is used as the LCD (lowest common denominator) for explaining the constituents of computer systems. At the beginning, it is necessary to select widely known model processes that can be used as the basis for association with computer system related processes. To show the example used, we take, as a verbatim quotation from the book, the introductory model process descriptions.

**Understanding Computer Systems, by Harold W. Lawson, Jr., Lawson Publishing Company, Linköping, Sweden, ISBN 91-7372-333-9. Similar versions of this paper have been previously published in *Computer Age*, issue 13, 1980 under the title "Understanding Computer Systems" and in *Mikrodatorn*, Nr. 2, 1981 under the title "Att Förklara Begreppet Inom Datorvetenskapen." Permission of these publishers has been granted for publication in *Creative Computing*.*

Harold W. Lawson, Jr., Linköping University, S-581 83 Linköping, Sweden

We begin this education process with a pictorial representation of a well-known real life process (task) faced by many of us.



A Process

Note that the concept of process and task are synonymous and thus in all further references to process related concepts, the word "task" may also be used.

Let us now consider this real life process of washing the dishes in the form of an abstraction which shows the major elements of this process as follows:



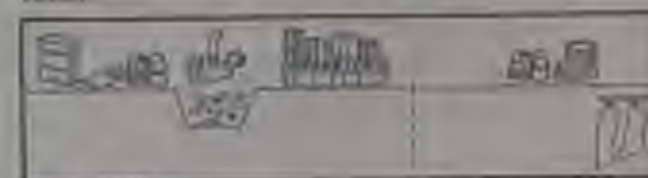
A Process Abstraction

Dirty dishes, detergent, water and dish cloth are process inputs and clean dishes are a process output. The process which we have shown here can only be carried out, executed, when we apply a processor.



A Processor

Let us complement this single process by introducing a second process, thus creating a system of cooperating processes.



A Second Process

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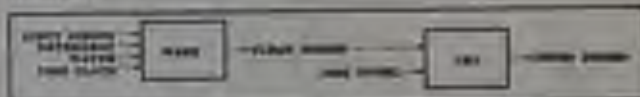
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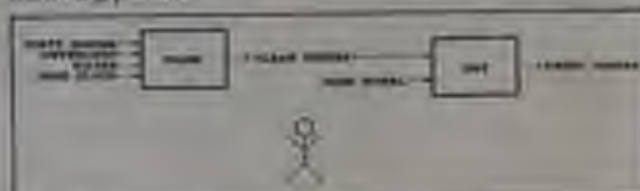
Note: Implicit in this description is the definition of a system as a collection of interrelated processes.

We can visualize the general abstraction of this system of cooperating processes by introducing an abstraction for the second process, namely the drying process, in the following manner.



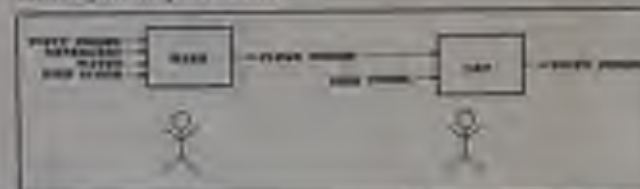
An Abstraction of a System of Cooperating Processes

If the processes are to be carried out by a single processor, and-processor, then this single processor must be assigned to both the WASH and the DRY process as indicated in the following picture.



A Uni-processor

Note that if the diatrack becomes full during WASH execution, then the single uni-processor must be alternated between the execution of the processes WASH and DRY. Alternatively, we could assign a processor to each process, that is, the processes are executed concurrently (at the same time) by multi-processors.



Multi-processors

During execution of a process by a processor, let us say the WASH process, the processor could be interrupted by a high priority process such as the following:



A High Priority Process

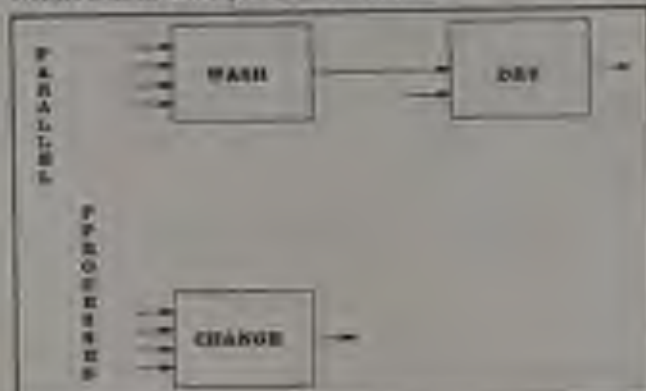
Consequently, a new process is created which we can represent abstractly as follows:



An Abstraction of the New Process

In the case of a single uni-processor, the processor temporarily suspends the process it is currently executing and initiates execution of the CHANGE process. After termination of the CHANGE process, the processor resumes its, resumed, execution of the process that was suspended.

Alternatively, in the case of multi-processors, the processor that acknowledges the interrupt (let us say the processor serving the WASH process) could assign another processor (the processor assigned to DRY or another available processor) to execute the CHANGE process parallel with the ongoing WASH and/or DRY processes as follows:

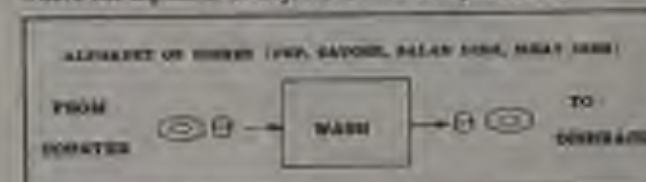


Cooperating Processes

At this point, we have introduced several important computer related concepts in terms that all can understand. The flavor of this example should now be remembered as we browse through, in a highlight fashion, the further presentation of concepts and terminology. While the remaining descriptions of the approach will be terse, you can certainly use your imagination to guess how the details of the approach are presented in the book.

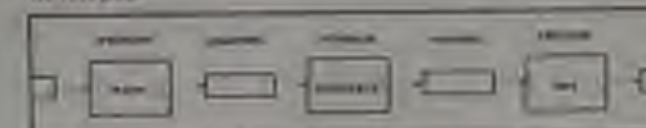
Data Flow and Control

Having introduced the basic process and system concepts, it is easy to build on the example to include data and control aspects. Data can be made analogous to objects processed by the processes of our example leading to the following view where the alphabet of objects is concretely declared.



Enumeration of Process Related Objects (Data)

The flow of objects within a process is explained in terms of classical data processing steps; namely, input (take object from counters, process (wash object) and output (place object in distrack). The transmission of objects between processes (over channels), including "storage processes" is indicated by the following, from which, for example, the explanations of terms such as simplex, half duplex and full duplex are easily developed.



Transmission of Objects (Data) Over Channels

80 COLUMN GRAPHICS



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

```
10 DIM M(100)
20 R=100: Q=100
30 Z=144: XN(1)=1/10000
40 YP=50: YN=1: ZP=0
50 SP=100: RP=YP*ZP/YN: ZP=XN/YP
60 FOR X1=0 TO 99
70 IF X1<20 OR X1>20 GOTO 150
80 ZP=X1*ZP/20: XN=X1
90 XL=XN(1)+XN*RP*SP-20*YP
100 FOR X2=X1 TO XL
110 YP=XN(X1+X2*20+20)+XN: XN=X1
120 YP=XN(X1+X2*20+20)+XN*YP
130 GOTO 170
140 NEXT X1
150 NEXT Z
160 NEXT Y
170 XL=XN+20*Y
180 YL=XN+20*Y
190 GOTO 21: MOVE XL,YL:IMP18
200 IF YL=0 GOTO 220
210 GOTO 21: LINE XL,YL-1,XL,0
220 RETURN
```

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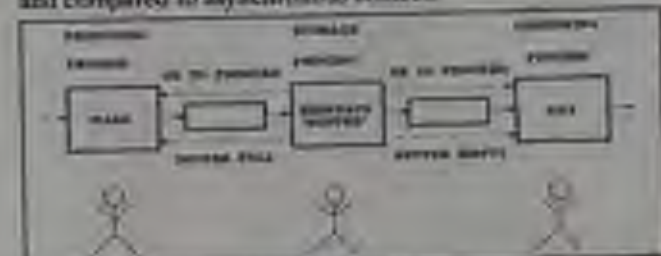
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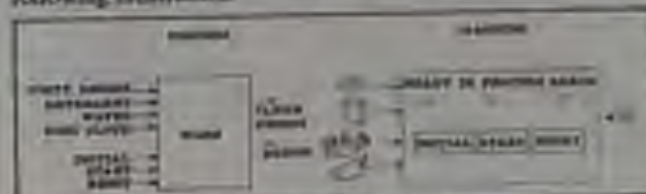
Concepts and Terminology, continued...

In explaining control, we consider signals to processes and related control mechanisms. For example, the following illustrates the producer-consumer relationship of asynchronous control where the feedback provides a perfect example of a buffer. The concept of asynchronous control is then explained and compared to asynchronous control.



Asynchronous Control of Multi-processes

In finalizing the control system, an important analogy is made by presenting the process as a machine with lights (corresponding to states) and pushbuttons as illustrated in the following illustration:



A Process as a Machine Controlled by Push-buttons

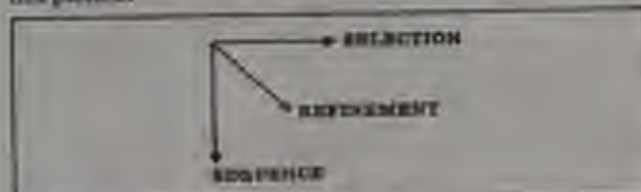
Programming Concepts

After considering the WASH process as a pushbutton machine, it is a simple matter to present the logic of a process as the following state transition diagram.



State Transition Diagram

To introduce the basics of programming, a modified form of "dimensional flowcharting" as described by Witty is utilized. This flowcharting format is accomplished by using three drawing directions for indicating sequences of actions, selection of alternative actions and refinement of larger actions into a sequence of actions. These rules are easily remembered from this picture.



Flowchart Conventions





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Concepts and Terminology, continued...

state transitions
finite state machine
state indicators
sequence
refinement
flowcharts (flow diagrams)
declarations

state transition diagram
local storage
state variables
selection
program (algorithm)
repetitive sequence
procedures

How many of us mastered so many concepts in so short a period of time when we began. In classical approaches to education (including self education) in this area, many of these concepts are learned only after many hours, days, weeks, months (and we say years) of struggling with details. It is not uncommon that the details that have been learned are then a detriment to gaining a clear picture of these more basic, general concepts.

Introducing the Real Thing

We now begin to consider, more concretely, the data processed by computer systems by introducing the terminal and the computer system in the following, now familiar, framework.



Terminal Connection to a Computer System

It is easy to convince the student that by pushing buttons, data is transmitted across the channel and placed in a memory where it is processed, and results are sent back for display on the terminal screen. At this point, we still treat the computer as a "black box." The terminal process is used to transmit data back and forth.

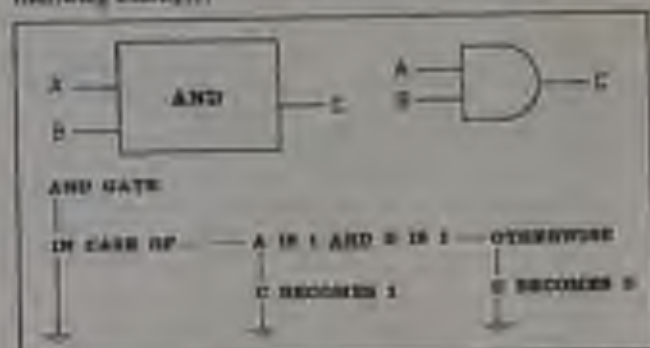
In making "data" a more concrete concept, the nature of numbers of base 2 and 10 is presented including an easy-to-comprehend algorithm for the process of converting a binary number to a decimal number as indicated in Figure 2.



Figure 2. Binary to Decimal Conversion Process

Digital Processes and Hardware Construction

Even the smallest of computer elements (gates) are presented as processes with related process logic as indicated in the following example.



The principles of computer arithmetic are considered, including the view of a binary adder in process form. The notions of combinational and sequential circuits are conveniently introduced along with a basic explanation of clock signals and timing.

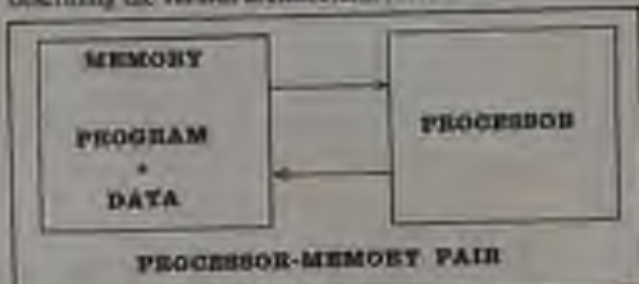
These digital building blocks and their eventual manipulation into integrated circuits, printed circuit boards and chips are easily described with this background.

Putting It All Together

The process concept has enabled us to present basic computer system concepts, the notion of programming and the composition of computer hardware. Putting this all together, we then create the notion of "architecture," starting with basic delineation between hardware and software architecture as follows.

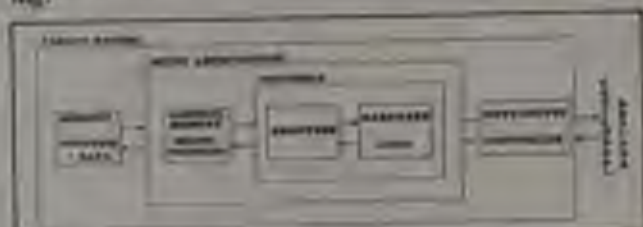


A further key concept, namely that of "processor-memory pairs" as illustrated in the following provides the keystone to describing the various architectural levels.



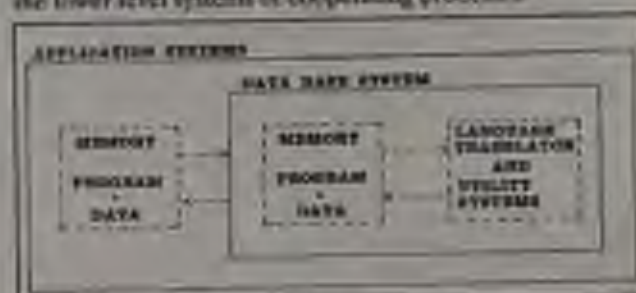
The Basis for Constructing Programmed Processes

The architecture of the target system (programmer's machine language machine) can then be described abstractly as nested pairs of processors and memories as indicated in the following.



Architecture of the Target System

This nesting is built upon to describe further the placement and role of operating and file systems, language translators, utility systems, and data bases, and culminates in the following view of the relationship between the application system and the lower level systems of cooperating processes.



Application System Architecture

Note: the dotted lines around the memory simply denote that it is not a separate physical memory but is a program and data representation in a common physical memory.

Further architectural concepts such as multi-port memories, DMA channels and common buses (highways) can be introduced in a natural manner as architectural alternatives. Finally, the concepts of network architectures and related terminology round off in brief (but comprehensive) introduction in the "core" concepts and terminology of computer systems.

Experience with the Approach

The approach described here has been sound and proved to be successful for a variety of audiences. For those seeking a starting point in learning about computer systems (amateurs and professionals to be) the approach permits an examination of the nature of the forest before examining the leaves of the trees. As an appreciative (computer literacy) vehicle the approach has worked successfully for journalists, politicians,

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Concepts and Terminology, continued...

and administrative and technical people. We have also been successful in retaining the best of secretaries who are learning to use word processing systems. Terminal operators of all varieties would certainly benefit from the understanding provided here. They get an idea of where they fit into the system that they are using and some idea of what is happening in the computer.

The simplification of the computer is a man if we hope to achieve any degree of harmony between technology and the citizenry of the world. This approach, which has been in it in the process of being translated into a variety of languages, provides a step in the right direction.

Some Final Comments

It is important to note that the approach is described in a completely product independent manner; therefore, the approach can be used to complement the real details of any product. Teaching assistance materials, including visual aids, are available and are quite useful for presenting the approach to small as well as large groups. The approach is well suited to being supported by animation and plans are being made to provide and animated video tape and animation via software for computers available on microcomputers.

Understanding Computer Systems can be ordered as single copies by sending a check in US dollars for \$15.25 (\$17.25 for airmail) to LAWSON, Gustav Adolfsgränd 9, S-20 20, Linköping, Sweden. Make checks payable to LAWSON. All other inquiries can be directed to the same address.



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MAXI-PROS has both graphical and line edit versions and the packet keyboard version contains a corrected keyboard routine that makes the OSI keyboard behave as a standard typewriter keyboard.

MAXI-PROS also has sophisticated file capabilities. It can access a file for names and addresses, stop for input, and print form letters. It has file merging capabilities so that it can save and combine paragraphs and pages in any order. Best of all, it is in BASIC (68000 51/4" or 8" disk) so that it can be easily adapted to any printer or printing job and so that it can be sold for a really price.

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It does have some limitations. It is memory hungry — 8K is the minimum word system that can run the Compiler. It also handles only a limited subset of Basic — about 20 keywords including FOR, NEXT, IF, THEN, GOSUB, GOTO, RETURN, END, STOP, USR, and PEEK. Characters: A-Z, 0-9, Variable names A-Z, and Integer Numbers (1-64K).

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COMPUTERS are for PEOPLE

Betsy Staples

"Computers are for kids," says a poster hanging on the wall outside our Software Development Center. After visiting the Marin Computer Center, just north of San Francisco, this spring, I wished I'd had another copy to send to David and Annie Fox, the dedicated young couple who run the Center.

We dropped in unannounced on a Tuesday morning and found a large, open

"flexible classroom" filled with Apples, PETs, Amibs, SCLs, and kids. The kids, who appeared to be in about fourth grade, were participating in the field trip program, which allows teachers to bring their classes to the Center for a morning or afternoon of exposure to computing.

In addition to field trips, the Marin Computer Center offers classes in programming for children and adults, and

"open time" when people can come in and buy time on the computer of their choice by the hour. There is also an area where a word processing system, complete with letter-quality printer, may be rented by the hour.

The Foces have found that many of the children who have their first exposure to computers on a field trip become regular customers, and often involve other



David Fox helps a student learn an Apple program.



Annie Fox explains the programs offered by the Marin Computer Center to a group of visitors. Jessica Fox distributes brochures.

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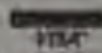
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members of their families is the program offered at the Center.

"Our first objective is to provide a place for people to meet computers," says David. He adds that "now when Annie asks a group of kids, 'who has played with computers before?' only about 20% haven't. When she asked the same question three years ago, only one or two in a group of 30 had ever touched a computer."

The Center is not just for kids, however. "Adults," says David "need a lot more introduction than kids. We started because three years ago we found that this was a definite need. People had to find some place where they could get some exposure and ease into computing without being afraid of it."

"I have a beginning class for adults that meets in the evening," says Annie, "and it's always packed. Some of them have already purchased machines and as we all thought they decide they had better learn how to use them, so they take our class. Others take the course to become more familiar with the jargon before going to talk to a computer salesman."

Computers are Fun

When asked about her feelings toward computers, Annie says, "I think they're a lot of fun. The kids I see working with them seem to be very turned on by the new way that computers allow them to express themselves. It seems to involve a different part of their minds."

What kind of child is turned on in this way? "I'm talking about kids that write programs. I teach programming to kids as young as fourth grade. They really get into the puzzling aspect of it. They're usually very bright kids who enjoy figuring things out, enjoy feeling the power the computer gives them."

"What kinds of programs do they write?" we asked.

"I have a five-week after school class where I teach Basic and some simple graphics. Usually the kids are writing interactive story-type programs or programs where a person is involved in a setting and has to make a choice. The children get very involved in the fantasy of it, but the thing they enjoy most is having the other students play their games."

Do they concentrate primarily on games? Annie responds, "we use the games to get people involved, but I find that everybody has a saturation point, and most of the people who return to the Computer Center like to get into programming on some level or another."

What about the game critics—those who feel computer games are a waste of time? How does Annie counter their criticism?

"I regularly demonstrate some of the



The enthusiasm of children using computers at the Center is contagious.

logic games to groups of teachers, and so far, there are only a few I haven't won over. They are aware that there is some learning going on when a child solves a problem such as the Towers of Hanoi or Leap Frog—problems where a strategy must be planned. The reactions, however, don't have conventional labels for that kind of learning process, so they have trouble with it.

Most of the people who return to the Computer Center like to get into programming on some level or another.

"Many teachers, on the other hand, have become more educated in what it means to educate someone. I don't know what is happening back East, but around here schools are closing and teachers are being laid off left and right. I find that many teachers are intrigued by computers. They anticipate being laid off and are looking for new careers, but they remain, first and foremost, educators. I think many of them will become involved in the development of good educational software."

Funding

The original funding for the Marin Computer Center was a bank loan co-signed by a friend of the Foxes. Recently, however, the non-profit organization has been the recipient of generous grants from a Marin County foundation which is bound by the terms of a bequest to spend all of its money in the county.

Among other things, the grants pay for two teachers to take computers into classrooms in the county. "We go on a need basis," David explains. "We look for schools that don't have computer programs, schools that are in low income areas."

"We also find schools that purchased computers without any thought as to what would happen when the machine arrived. They didn't train their personnel and didn't buy any software, and now the machines are sitting in the math teacher's closet gathering dust," adds Annie.

"We offer workshops to help these schools get involved. We make it easy for them; they don't have to pay anything for our services. We also work with schools that are still considering the purchase of computer equipment to give them an appreciation of what it will mean to incorporate a computer in their curriculum."

David adds that "the grant pays for approximately 1000 youngsters to attend a six-session course which provides nine hours of instruction."

The Center has also received support from the computer divisions of Atari Inc. and Commodore who have provided several computers on long-term loan.

"Of all the computer companies," David



A fourth grade class visits the Marin Computer Center on a field trip.

says, "Atari seems to be the most helpful. Everyone I have talked to at Atari has really been supportive; I am really impressed with the way they work with the customer."

Perhaps, in part, because of their good relationship with Atari, the Forest recently purchased 12 Atari 800s and six Atari 400s. Eight of them will be used for the school visitation program, and the rest will be housed in the "Atari Room" at the Center.

There are also quite a few Apples in use at the Center. These are connected to a hard disk system which eliminates

the need for repeated loading of individual floppy disks. The problem with this is that "most of the really good games are copy-protected so we can't put them on the hard disk."

David says he thought about finding a way around the various copy-protect schemes, but decided that the benefits did not justify endangering the reputation of the Center with software manufacturers. "We use floppy disk drives for those games and just have them up. It's not a major problem, it's just a hassle."

And speaking of software, what are the most popular games?

"Right now," says David, "the ones that are in the arcades are popular—Asteroids, Space Invaders, Star Raiders. The Adventure games such as Temple of Apshai, Morlock's Tower, and the Secret Adams Adventures are also among the favorites."

The Marin Computer Center, located at 50 El Camino Dr., Corte Madera, CA 94925, is open to everyone. Rates range from \$2.25 per hour for members using the regular computers to \$7.50 per hour for non-members using the word processing system. The phone number is 415-924-1935.

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Nursery Rhymes to Shakespeare: Using a Text Editor to Look at Literature



We're used to looking to computers for help in math and the sciences. Here's a very different application for use in the humanities.

Three little kittens
lost their mittens
and they began to cry.

Computers are ideal for pattern-searching, and if it is true that literature is highly patterned language then a computer should be very useful for studying configurations in literary works.

Take our nursery rhyme above, for example. It has all the basic features of most poems. There is rhyme (which many modern poems do not have, or use) and other kinds of repetition common to both rhymed and unrhymed verse. Most of us, when we think of poetry, think first of end-rhyme, the most traditional difference between poetic language and the language of everyday use. When we look a little more closely into a poem, we discover very quickly that rhyme is rarely more obvious than some of the other types of patterning. And we can distinguish a piece of language that is verse, whether or not that language has any end-rhyme in its makeup or even any obviously discernible regularity of phrase lengths or poetic lines. We manage this by responding, consciously or not, to the uniquely internalized patterning of its verbal materials on the one hand, and to its figurative or symbolic density on the other.

This is not the place to attempt to define poetry. However, a brief description may be useful. I think it is safe to say that poetry, in its most basic form, is both the development of a theme and the creation of a unique structure. The theme, usually of an intensely personal or emotional nature, is realized through metaphor and images of all sorts—elements that arouse the senses of sight, touch, taste, smell, hearing, motion and so on. These devices of comparison and description that stimulate our senses and enable us to participate in the experience being communicated to us, or being aroused in us by the poem represent a major characteristic of poetic writing.

Poetic Patterning

The other essence of the poem is found in its structure and the methods used to build the poem. The form the language takes, as it moves and changes in the expression and recreation of the experience, may be considered similar to the

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structuring of a musical composition. Poems and musical pieces are, of course, not the same thing, but they do have a very important common characteristic. Both develop within the media of sound and time. They are, in one way or another, performed sequentially, and the sequence reveals many different sorts of recurring elements and a great variety of repetition. The patterning that results is one of the major sources of a poem's effectiveness and of the pleasure we associate with reading verse.

It is only natural that a more acute perception of the repetitions and patterning of literature, and especially poetry, would or should provide us with not only a better understanding of how literature works and how it is made, but it should also tend to intensify and enhance our appreciation of literary language, the poet's skill, and the poetic experience itself.

***The computer now offers us
the possibility of examining
literary structuring with a precision
and incisiveness previously
unimagined.***

This is where the computer comes in. Listeners and readers of literature have, since the beginnings of history, been sensitive to such patterning. Some of the most perceptive have chosen to comment on that patterning in various ways. With few exceptions, however, those "critics" have had to rely on intuition and memory. The computer now offers us the possibility of examining literary structuring with a precision and incisiveness previously unimagined. It also enables us to look at the interplay and relationships among a variety of different elements, all woven together into a pattern of extraordinary complexity. Human memory and our scraps have simply been inadequate for the detailed and sustained sort of analysis or "unravelling" of configurations that the artistic sensibility manages to produce under the spell of literary inspiration.

The use of computers as an aid to the study of literature has been a relatively recent development. Deciphering the mysteries of language itself has stimulated a good deal more activity, and the early failures of linguists to resolve the problems that natural languages present to computer adaptation have led to a renaissance in the study of the nature of language itself. Out of the early disappointments have come new techniques and new knowledge that should help us greatly in the future.

In the spring of 1980, two very fine books devoted to literary and humanistic computing appeared: Robert Oakman's *Computer Methods in Literary Research*, U. of South Carolina Press, and Susan Hockey's *A Guide to Computer Applications in the Humanities*, Johns Hopkins. Anyone interested in the background of literary computing, its current activities and techniques, will enjoy both of these books. If you read either of them, however, you will quickly notice that literary computing on an interactive, individualized basis—where the person interested in literary structure can communicate spontaneously with a text—has been explored very little. And that fact opens up to the world of the small computer a wide horizon of possibilities.

Interactive Communication

My work has been consistently directed toward interactive communication with poetic works—although it has been carried out on a large computer, a UNIVAC 1106/1160. The concepts are very susceptible nonetheless to conversion to personal computers. Many of the programs (they are really macros written within the programming capability of the UNIVAC University of Maryland text editor) are of a very simple design, yet are surprisingly useful. Let's take a look at some of them.

The first one in Figure 1, I call WORDS, and its design is very straightforward. The user simply brings up a text, and by calling the program—along with the appropriate variables (words or phrases or word fragments)—causes all text except the selected strings to be converted to blanks. Figure 1 shows the results of this operation, and may call to your attention some aspects of structuring of pattern of which you might not have been aware in this very, very familiar nursery rhyme. To give you a more substantial sample of literature, I have added also a sonnet of Edna St. Vincent Millay, where the same WORDS program has been used. You can see at a glance the basic conceptual pattern of the piece. Traditional forms lend themselves especially well to this sort of demonstration because the internal configurations of classical meters are often unusually intensified. Selective displays such as these can be useful to a student as well as to the literary investigator.

Another example of a simple interactive macro within the text editor capabilities of the UNIVAC, and again one that could be adapted to a personal computer, is a program devised to provide an instant search, on a longer literary text, for specific words, expressions, or other phrase units (collocations). This program provides, in a fragmentary way, the kinds of information that are customarily handled by large and completely integrated concordance programs. The



Figure 1A. Highlight key words to show patterns.

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concordance, or a listing of all words of a text and where they occur—commonly including as well the context in which they appear—has existed for a long time. But up until recent years they have been prepared by hand. One of the most sophisticated areas of literary computing is currently the preparation of concordance for very large bodies of text, the works of Shakespeare, Biblical concordances, and such. The variety and subtlety of programs now available for large computers are discussed in detail in the Hockey and Oakman books mentioned above.

Often, however, the investigator may be interested in only certain very specific words or phrases. The example in Figure 2



shows how a simple macro will search out lines containing two elements separated by dissimilar or similar intervening material, indicate the line number, and then preceeding and the following lines to provide the investigator with a verbal environment sufficient to assess the way in which the elements under study are used. The text used for Figure 2 was T.S. Eliot's "Four Quartets." I have developed two other programs of similar nature, one to locate phrases of identical nature, and another to find words of related meaning, or words which represent members of a family of words (man, boy, youth, swain, etc.) in order to compare their roles in the text being examined.



Figure 9B. Listing key words in their positions.



Figure 9C. The entire concordance.

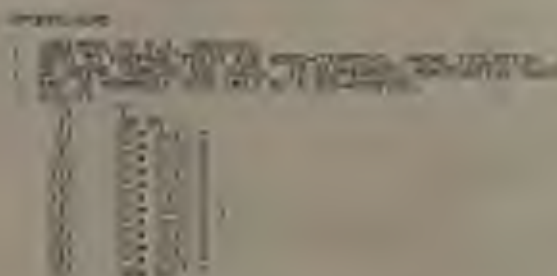


Figure 9D. The entire concordance.



Figure 9E. Listing identical elements separated by other words.

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Commonality of Theme

The final example I'd like to offer is a program designed to locate several elements related by a commonality of theme or meaning, much as the context searches just described, and convert the data into a graphic statement, a kind of thematic mapping of the text. The process is carried out by two separate operations. One program is used to locate the desired elements—up to eight are possible—and counts them. The output is captured in an output file which is then processed by a second macro which in turn produces a simulated graph of the profile of occurrences per ten-line interval. The entire process is a bit complex and relies on some hand editing to make the appropriate transformation of the material. The programs also draw upon other simple routines while carrying out their tasks. I suspect that these would have to be broken up into separate operations to be successfully transferred to a small computer.

The sample in Figure 3 shows a configuration of the narrative and thematic elements that establish the internal structure of a medieval tale—later used by Shakespeare for his "Taming of the Shrew." The beginning of the tale, the graph, and the macros are listed there. (In order to save space I chose a very short narrative for the example. The program is, of course, more useful on longer pieces.)

The graph enables the user to see at a glance where the thematic densities are greatest. The basic purpose of such graphing is merely to index areas of the text that might most profitably be explored further. They may suggest, for example, the temporal evolution of theme or other items.



Figure 2B. The structure.

THE BEGINNING OF THE TALE
 THE FIRST PART OF THE TALE
 THE SECOND PART OF THE TALE
 THE THIRD PART OF THE TALE
 THE FOURTH PART OF THE TALE
 THE FIFTH PART OF THE TALE
 THE SIXTH PART OF THE TALE
 THE SEVENTH PART OF THE TALE
 THE EIGHTH PART OF THE TALE
 THE NINTH PART OF THE TALE
 THE TENTH PART OF THE TALE

Figure 2A. The beginning of the tale.

THE BEGINNING OF THE TALE
 THE FIRST PART OF THE TALE
 THE SECOND PART OF THE TALE
 THE THIRD PART OF THE TALE
 THE FOURTH PART OF THE TALE
 THE FIFTH PART OF THE TALE
 THE SIXTH PART OF THE TALE
 THE SEVENTH PART OF THE TALE
 THE EIGHTH PART OF THE TALE
 THE NINTH PART OF THE TALE
 THE TENTH PART OF THE TALE

Figure 2C. The density graph of "Taming."



Figure 3C. The set of interconnecting procedures.

THE BEGINNING OF THE TALE
 THE FIRST PART OF THE TALE
 THE SECOND PART OF THE TALE
 THE THIRD PART OF THE TALE
 THE FOURTH PART OF THE TALE
 THE FIFTH PART OF THE TALE
 THE SIXTH PART OF THE TALE
 THE SEVENTH PART OF THE TALE
 THE EIGHTH PART OF THE TALE
 THE NINTH PART OF THE TALE
 THE TENTH PART OF THE TALE

Figure 3B.

Literature, continued...

The few operations I've shown here have been chosen from a library of some thirty editor programs—several of which are suitable for Spanish texts only—that permit a person interested in literary form to look at a number of other aspects as well: the isolation of end-rhymes, internal sound-patterning, frequencies of occurrence of given elements, metrical scanning, key-word searching of bibliographic materials, and so on. But what is of special interest are the implications of some of these programs in terms of software for small computers, and, more important, the suggestion that text editors lend themselves so naturally to the study of literature that their increased flexibility and versatility should be aggressively pursued.

Expansion of text editor capabilities could be very productive indeed if their ease of use could be enhanced. Although I am not trained in the sciences nor in programming, it would seem to me that it might not be an especially difficult task to make text editors easier to use for those of us unfamiliar with electronics and computing in general. I believe humanists will be more interested in computers when the languages have been adapted for unspecialized users, when they have been made less intimidating. Also, as small computers become more powerful and their programming simpler and more accessible to the uninitiated, the analytical uses can be made

more subtle and imaginative. The diversification of applications might increase rapidly as more and more individuals, whose interests are literature and language, are brought into the new technology. The entrance of new expertise should be very productive indeed.

It is important to emphasize also that such analytical programs can be easily adapted to teaching. They can be used to produce graphic material, printouts for distribution, and aids of all sorts that may serve in very traditional ways in the classroom. Or they might also be modified for tutorial programs, where the student, in a controlled environment, would be able to explore diction, versification, and other aspects of textual composition. The experimentation could be fruitful as a learning experience and would likely lead to new analytical concepts as well.

I think it is important that those with knowledge of computers and gifted in programming make every effort to implement the "simulacry" Ted Nelson speaks of in his plea for systems devised with the user, especially the uninitiated user, in mind ("Interactive Systems and Virtuality," *Creative Computing*, November and December 1980).

There is a remarkable array of creative talent and humanistic expertise in the world that could offer a great deal if the computer can be made a bit more accessible. □

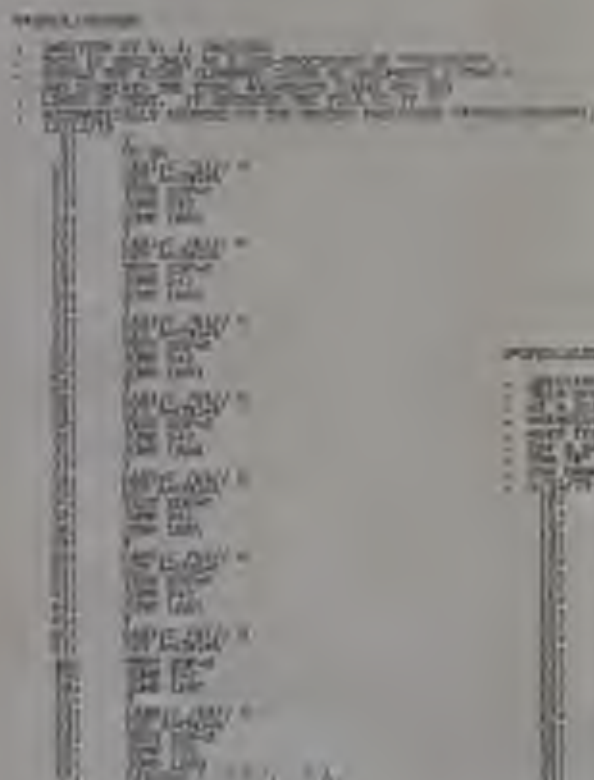


Figure 3C3



Figure 3C4



Figure 3C5

The Problem Solver

David Ald

Long time readers of *Creative Computing* will recall that in January 1976, I put together an all games and puzzles issue. In that same popular being one of the two issues that were ever mailed (the other was on artificial intelligence). In the issue was a 15-page section of over 100 puzzles many suitable for computer solution. (These puzzles may be found today in *The Best of Creative Computing: Volume 2* for \$8.95—advt.).

In one event, many of the puzzles were reprinted or adapted from *Games & Puzzles*, at the time a monthly British magazine. For as long as I can remember the puzzle column was compiled by the incredibly talented David Wells. However, as magazines are hard to do, *G & P* underwent some changes and the May 1977 issue was the last in which David Wells put together the puzzle column. P.R. Jackson took over his, also, until early into May 1978. About that time George Lewis told the magazine in Wales House Press when some months later, in turn, sold it to AHC Publications.

G & P has now split into two bi-monthly magazines, *The Gamer* and *The Puzzler*. For subscription rates, write AHC Publications, 214 George Street, Luton, Beds, England. American readers, however, might find *Gamer* more to their liking.

But what, you may ask, happened to David Wells? That's what I wondered too. In late 1979, I saw a small announcement from Dover of a new book. My memory is fuzzy, but D.G. Wells. I bought it immediately and had a delightful time with the 63 puzzles therein. At \$1.75 (plus \$7.50 shipping), the book is a steal from Dover Publications, 180 Varick St., New York, NY 10014. But it got me no closer to finding David.

Well, a note from David last week tells he is doing well with his new company, London Game Consultants, 191 Cuckfield Terrace, London SW6, England. Among other things he is publishing a magazine, 16-page booklet, *The Problem Solver* aimed at students and people interested in recreational puzzles. He doesn't mention the cost, but you can write the publisher, Hahn Publications, 6 Cormanthen Road, Weymouth-on-Tryon, Bristol, England for further details. Send something for a sample—this is a low-budget operation!

All this was a rather haphazard way of introducing some new puzzles by David Wells.

A Problem

1. There is only one number, apart from 1, which divides evenly into every one of these numbers. What is it?

16331

15207

135749

2. Many systems can be written as the difference of two perfect squares. For example:

$$5/14 \quad 25=36-11 \quad 210=284$$

Which numbers cannot be written as the difference of two perfect squares?

3. What is the sum of the following series? "Carried on forever."

$$1 \quad 1/2 \quad + \quad 1/4 \quad 1/8 \quad + \quad 1/16 \quad 1/32 \quad + \quad \dots$$

4. A quadrilateral has sides of length 5 cm, 5 cm, 1 cm and 7 cm, in that order. What is its maximum possible area?

The *Problem Solver* contains an additional 40 puzzles and, like the puzzles here, no solutions! Have fun! □



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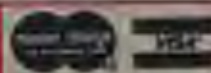


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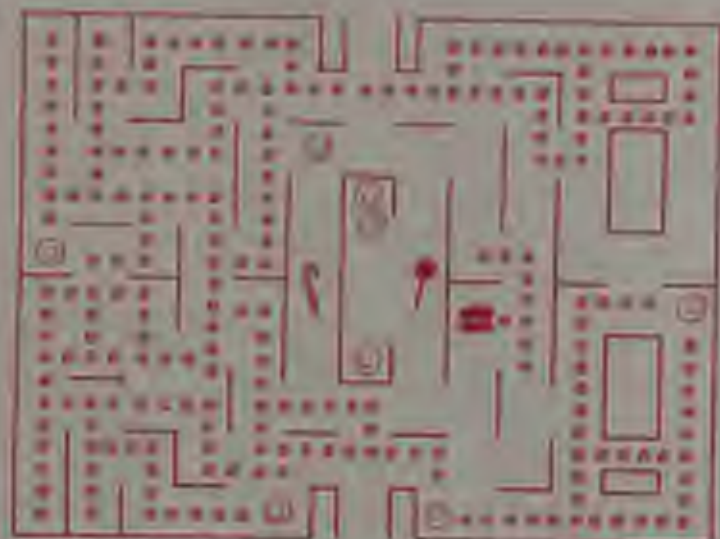


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a Beginning for Britain and computers— with the BBC

Owen Linderholm



The British Broadcasting Corporation is about to launch a major new project in the field of computer literacy. The aim of the project is to introduce interested adults to the world of computers and computing, and to provide the opportunity for viewers to learn through direct experience how to program and use a microcomputer.

The project is built around a ten-part television series, and includes a book, a linked microcomputer system complete with user guide, a range of applications programs, and an associated course in programming in Basic provided by the National Extension College.

It will follow on from *The Silicon Factor*, a series about the impact of microelectronics on society, which was first shown last year.

The project consists of three series about various aspects of the computer field. There will be a course aimed at teachers who are interested in computers and computing. Called *Technology for teachers*, it aims to answer any question a teacher might have and focuses in particular on the advantages and disadvantages to the student. Another course for people in business and industry will provide examples of how computers have been and can be

Approaches to Computer Literacy are Worlds Apart

As should be obvious from the article, England has embarked on a strong campaign for computer literacy. Whatever the results, the attempt deserves praise. The attempt also forces us to look at the American approach to computer literacy. How do we compare with England and the rest of the world?

Unfortunately, the American approach, like the uniform, seems to be something that doesn't exist. There is no unified effort to introduce people to computers. Individual examples come to mind, scattered bright spots where good work is being done. MECC is

doing excellent work in the field, and various other institutions are promoting the cause. The potential of television has been largely neglected in this country. The best show on computer topics, *Fast Forward*, is shown in the U.S., but was made in Canada. The lag time is so great that New York stations are currently showing episodes that are several years old. For example, we just saw an episode announcing that the latest breakthrough in the industry was the use of very-large-scale integration. And *Fast Forward* is not shown nationally. It is independently scheduled by individual public stations.

Computerworld, the only other regular TV show is produced by the weekly newspaper of the same name. The newspaper is oriented to the EDP side of the industry and most of the TV shows aimed to date reflect this bias. Nevertheless, it's a step in the right direction.

Thanks to computer courses in schools, the next generation stands a better chance of being computer literate. But this does nothing for those already out of school. A vast segment of the adult population still views computers as huge constructs of flashing lights and tape reels, capable of little more than generating loan letters and incorrect bills. England has begun their massive campaign. Why can't we?—DL

both used and misused in industry and the office. Both courses will examine the moral and social problems created by the use of microprocessors.

By far the most extensive course, however, will be *Hands on Africa*. This course will consist of ten television programs and is designed to introduce fundamental ideas and provide viewers with experience with computers and programming. In conjunction with the course, the BBC will provide a handbook and a very versatile, expandable and affordable computer. Other services provided will be a 30-hour self-teaching course on Basic programming offered through the National Extension College, and a service to provide tutorial help with any problems that may arise.

The series will start in January 1982 and will be repeated twice in the year. It is hoped that it will provide the layman with an insight into computers and computing at several levels: a basic level, just from watching the programs; an intermediate level, from reading the handbook and watching the series; and finally, an advanced level from buying and using the BBC microcomputer.

The computer is a potentially very advanced unit. In its simplest form, it will consist of a 6502 microprocessor, 16K of RAM and 32K of ROM consisting of a

16K Basic and a 16K operating system. Interfaces for cassette, disk, video, printer, Teletext and Prestel will either come as standard or be available as expansion options. The enhanced version of the

This is an extremely ambitious undertaking by the BBC and if it generates enough interest among the public, could make Britain the most computer literate nation in the world.

computer will be available with 32K of RAM, analog-digital interfaces, RS232 interface and an IEEE bus connector.

The computer has various graphics routines ranging from the 80 x 25 text

character mode, to 640 x 256 high resolution graphics in two colors. Lower resolutions can have up to eight colors. Many other expansion capabilities will become available, including networking and time sharing with other systems. The initial cost of the computer alone will be approximately \$480.

This is an extremely ambitious undertaking by the BBC and if it generates enough interest among the public, could make Britain the most computer literate nation in the world. For many people, it will be their first exposure to computing. At present, computing in Britain is limited to the professional programmer who works for ICL, IBM or other such companies, and to the hacker, who may be as sophisticated as his American counterpart, or could be using a long-outdated, mysterious set of circuit boards.

The personal computer revolution has arrived in Britain, but it has not proceeded as far as it has in America. The average Briton still thinks of a computer as a large box covered with whirling reels of tape. Some know better; some don't.

At worst, the BBC's venture will open the eyes of a few more people and lead them into the wonderful world of computing. At best it could revolutionize the attitudes of a nation. □



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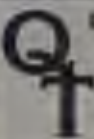


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bridging the gaps

**Karl L. Zinn
and
Bernard Banet**

Improving the links between national resources and local services, spanning gaps between development and applications, between product design and use, between educational marketing and learning effectiveness—these were the goals we set for ourselves.

The project we were to design using funds provided by the program for Development in Science Education of The National Science Foundation was intended to improve the effectiveness of microcomputers in education. Since we had spent some time working with schools and colleges on planning activities, intensive training, and problem solving, we were especially concerned with the contribution of local resource people in the use of technology in teaching. We had also been involved in various national resource networks, and appreciated the significant contributions of information centers, development projects, vendors, and publishers to the introduction of new ideas.

The result of our efforts is the Dataspan project, and is intended to help bridge the gaps between existing networks and groups.

*Funded in part by a grant from the National Science Foundation to High-School Educational Research Foundation. The ideas expressed are those of the authors and do not represent policy of NSF or the U.S. Government.

Bernard Banet, High-School Foundation, 600 N. Elm St., Ypsilanti, MI 48197

Karl L. Zinn, U-M CRLT, 500 E. Main St., Ann Arbor, MI 48106

If for anyone who cares about computers, "Dataspan" can be expanded into "decision aid for technological assistance with science programs aided by networks.")

A key function of national and regional centers is to demonstrate, document, and disseminate procedures and materials designed to reach individuals on a person-to-person basis. But the intended recipients

In this network the flow of information is rapid so that confirmation of facts and validation of new ideas follow quickly.

have not been plugged into the flow of information about microcomputer applications in education: some are first-time computer users; others are familiar with larger computer systems but don't know about microcomputers. We wanted to encourage distribution of the best available resource materials and examples of software from all sources. And we wanted to get it directly to the groups, individuals, and institutions that are being asked for advice and assistance on the selection and use of

computer systems in science education.

Furthermore, we discovered something that we now find is more important even than the availability of helpful materials: effective use of computers depends on local resource people, user communities, and, perhaps, service centers, through which new ideas are reviewed, shared, and put into practice.

Local Resources

People seeking to use advanced technology in education appear to prefer hands-on demonstrations of equipment and information centers. Such local, knowledgeable experts are being sought from among computer professionals, educators, media specialists, retailers, and the staffs of libraries and science museums.

Dataspan will encourage a variety of sources to provide objective and conveniently organized materials with which to provide such assistance efficiently. Local resource people and institutions will find advice on assisting people in decisions regarding educational computing—dealing with the rapid change and complex tradeoffs among cost, capability, reliability, maintenance and availability of applications.

Teachers, parents, administrators, and students face a perplexing and rapidly changing world of hardware and software. An unfamiliar jargon describes the features of various systems. Millions of people will be buying computers for the first time in the next five years; they will need help in selecting wisely if the potential of these systems for science education is to be realized. They will need to turn for advice

Datapan, continued...

to sources other than just the hardware manufacturers and product salesmen. They will need assistance in locating and using the software that is available, and in making practical plans to supplement this with local development efforts. Perhaps the largest obstacle to effective use of these systems for learning is no longer the cost, or even the lack of applications programs, but rather the lack of objective, expert guidance in first selecting and then making effective use of a given hardware system or program.

Meeting the Challenge

Our discussions with Datapan advisors and colleagues delivering similar services throughout the country led us to tentative solutions to the following seven problems or challenges:

1) Keeping up with the changing technology and market conditions. The project staff, consultants, and advisors are part of a network of people working with computers in science teaching. In this network the flow of information is rapid so that confirmation of facts and validation of new ideas follow quickly. Some of the local service people can be brought into this network, especially through activities of professional associations. The products provided will aid in establishing the links among users and with resource people. Furthermore, the products are designed to be readily updated, not only by staff of some national resource center working through successive revisions, but by local service centers making local adaptations and carrying on after the Datapan project no longer provides updates. From the start we are selecting information and drafting guidelines which apply to a range of technology and applications. For example, salient characteristics of equipment and essential considerations in selection of applications will survive several generations of microcomputers.

2) Identifying those functions of computers which are particularly useful in science education. Published comparisons of microcomputers tend to represent only superficial characteristics and those that can be easily measured in a casual review. Using expert judgment and analysis of published reviews of products, applications, and trends, Datapan will derive a set of essential functions which serve the purposes of science education. For example, it is not computational speed that responsiveness to users (in a learning exercise or problem situation) which is important. The size of a character set is not as important as the ability to define new characters, or select among predefined character sets that have been designed for use in the sciences.

3) Encouraging and facilitating review of hardware, software, and applications by experts and experienced users within each discipline. The Datapan project does

not propose to judge products for use in science teaching, but to increase the quality and availability of information. The information files carry published and unpublished information, presented in a way that encourages users to extend the files with additional information and opinions. From a variety of sources, advice and commentary on diverse applications, software, and hardware will be distributed to practitioners and decision makers in science education. Some of the unpublished information will be assessed by users, and its credibility further established through informal reviews. Indeed, some of the better material will probably be published. The informal network we encourage will continue to relate to the formal network of publications.

Datapan will help local centers share files of useful information, and explore ways in which continuing exchange among centers can be self-maintaining.

4) Adapting the materials to different audiences and situations. The workshop materials, indeed all of the products, will be annotated by staff and consultants. A subset of materials will provide a "starter set" for local staff lacking experience with microcomputers or ideas about sound applications. The full set of Datapan tools can be used with various audiences by the more experienced local staff. The services provided will use computer-based files which can be changed by local experts and by additions from other projects, professional associations, publishers, vendors, and other sources, so that the local staff is backed up by considerably more than the limited resources of the Datapan project. The cooperative effort which we encourage is likely to stimulate additional publishing, by professional associations as well as commercial sources, through which additional materials, reviews, guides and surveys will be distributed widely.

5) Exploiting electronic communications to increase benefits at low cost. The project will make available community bulletin board and conferencing systems which can help with local communications among resource people and users. Already some of these systems have proved helpful for peer consultation, usually within a computer club or similar setting. The cost

of such microcomputer-based systems is decreasing so that many resource centers will be able to dedicate a system with sufficient memory to the purpose. Datapan will help local centers share files of useful information, and explore ways in which continuing exchange among centers can be self-maintaining. Electronic communications are also proposed for moving information quickly among development projects, consultants, advisors, and test sites for rapid, efficient communication. In our experience much more consultation and planning can be accomplished in computer-based conferencing than in excessive telephone calls with each individual participant in a group activity.

6) Capturing an adequate number of application programs. Datapan is cooperating with several national projects in collecting examples of good software, and summarizing the larger catalogues of studies, distributors, clearinghouses, and projects which list what has been offered for sale or loan. Two years ago we collected public domain software written for a popular microcomputer which a local user had given away to many educators. A casual effort brought in over 100 items like the Commodore PET, about 70 of them for math and science education. Of course, many of these programs are useful only as a starting point for a better program that needs to be written or to generate new ideas about computer use and teaching. The important point is to start the information flowing and review possible applications.

We view Datapan as a catalyst for various processes by which materials are generated and shared. A modest quantity of quality materials readily available will help many science educators avoid mistakes which otherwise add up to a considerable cost in dollars spent, development time expended, and learning lost.

7) Relating to the ongoing system of science education. The impact of the outcomes of this project can be characterized by scenarios which illustrate ways in which the products and systems will have real results in science education.

A fifth grade teacher uses direction aims and exemplar materials found in the school district's instructional materials center to locate activities suitable for the students' first experiences with the school's new microcomputers.

A junior high school social studies teacher venturing beyond the textbook finds programs to illustrate a discussion of the statistical principles behind public opinion polling by using a resource file in the county library.

A district science coordinator gets information about local expertise in computer languages by using a "community bulletin board" system which the local computer club has selected and installed.

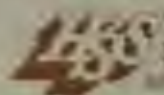
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CIRCLE 111 ON READER SERVICE CARD

A community college math instructor finds programs for plotting equations by using resource files at the college computing center.

Parents use an interactive decision aid in a science museum to help them decide whether to buy a microcomputer for their daughter to nurture an interest in science.

A district superintendent resolves a conflict between requests from the math and science coordinators by using an interactive decision aid program on hard-way selection.

A group of high school physics teachers requests information about the feasibility of extending standard text material with illustrations of optical principles (using their microcomputers) by using decision aids and resource files on authoring, and on hardware and software selection.

Survey of Information Resources

A telephone survey of information providers throughout the country was undertaken to sharpen the definition of Dataspan's mission as a facilitator of what others are doing, and to minimize redundant efforts. This survey convinced us we should give more attention to describing the major national efforts which now provide educators with information about computer applications.

From our survey we have identified four clusters of needs and opportunities: exchange among providers, additional resources, new means of communication to end users, and focus on local resource centers.

1) Information providers with activities that are national in scope can benefit from more exchange of information. In many cases one activity can build on another, and can publicize another. Already the Dataspan staff has served as an "electronic circuit rider" using phone and computer communications, passing word of resources and plans from one provider to another. The distribution of the materials to the information providers named there should bring additional people on the circuit.

2) The information providers we surveyed felt they lacked the resources to acquire, organize, and disseminate information and software products on the scale needed to keep up with the rapidly expanding volume of publications, computer software, and computer hardware components. One step toward a solution would be a more consistent Federal role in assigning tasks to laterally funded clearinghouses and dissemination projects, or perhaps an increase in the centralization of educational information and dissemination services. Another part of the solution seems to be emerging now in support given users by hardware vendors, software publishers, and distributors.

3) The technology and the literature describing it are changing so fast that

traditional publication mechanisms can't transmit information fast enough. New technologies offer part of the solution, but few educators will seek out information using electronic retrieval systems, unless these systems require very little effort. Those educators already using computers in some way are better able to access computer networks and databases than their colleagues who do not already use systems.

4) The local actions necessary to extend and improve the use of computers in science education depend on local resource people and facilities. However important it may be to increase coordination of information services nationally (through the leadership of projects like Dataspan, direct Federal initiatives, and efforts of the commercial sector) we also need to give careful attention to the linkage between these national resource networks and the local service centers. How is it that local people come to know about the various services? And how do the providers keep in touch with the needs of local centers throughout the country? We intend to make a difference in what is happening throughout the country for each local information provider in libraries, media centers, curriculum centers and offices, educational service agencies (such as Intermediate School Districts in Michigan and Boards of Cooperative Educational Services in New York), state departments of education, and so on.

Education at the precollege level in the United States encourages local information seeking and dissemination as part of the treasured autonomy of school districts, school buildings, and individual teachers. In this process the enormous amount of redundant effort appears inadequate or incomplete when compared to the magnitude of the task (for example, developing instructional software, reviewing the literature on computer applications, previewing instructional software, or acquiring optimal system configurations).

A Call for Help

We expect to have our first draft of a resource package into field test sites for the opening of school in the fall of 1981, and commentary on the role of national networks published in the educational newsletters and bulletins. By the summer of 1982 we will have helped put in place the mechanism which will keep the information flowing from national resource nets to local centers and back.

Obviously we need help. We are looking for information and advice about orientation, inter-service training, system selection, software and materials review, planning, development, funding, community bulletin board systems, small computer information management systems, and any other aids to improving the use of computers in schools. Join us! □

PLATO: Alive and Well?

David H. Ahl

At 15, within plus, it was the most expensive computer education project ever funded by the National Science Foundation. The NSF bowed out in 1975 with a flurry of enthusiastic reports and reports that promised the widespread use of the system by 1980.

Control Data Corp. was convinced and took over PLATO ten years later. Their subsequent investment makes the NSF look like others. But where is PLATO today? Certainly not in all the colleges and secondary schools envisioned by the NSF.

After much huffing and puffing about the system, attending educational conferences and meeting influential educators, CDC apparently learned the same lesson as every other company in the education market. The lesson: educators are not investors. Not only that, but educators expect the software to be free. Creative Computing Software recently received a petition from a group of educators protesting that the MECC software is on "protected format" disks. They wanted to buy one set of disks and copy them for all the schools in a county. Perhaps the notion that software should be free springs from the fact that books are filled with sentences, paragraphs and chapters (software) rather than being there, but I digress.

CDC wisely retreated from the institutional school market and focused on institutional programs for business and industry. One of their first major sales (\$3 million) in 1977 was to American Airlines. They use the Plato system to replace worn instruction previously done in a much more costly flight simulator.

Other systems have been sold to truck-trailer firms to train truck drivers. Since 1977, CDC has developed approximately 7000 course modules in scores of subject areas and expects their staff of 500 course designers to produce another 2000 programs in 1983.

CDC doesn't publish separate financial results for the Plato operation but estimates that sales of its software topped \$100 million in 1980. Nevertheless, it's not a lining resource from a profit standpoint. But not one likely to be dropped any time soon. In fact, Thomas W. Miller, CDC's vice president for education said, "Our plans clearly are to expand the base of activity in Plato, not to cut it back." And William Morris, CEO of CDC, expects that some day more than half of CDC's revenues and profits will be derived from Plato. Well, see.

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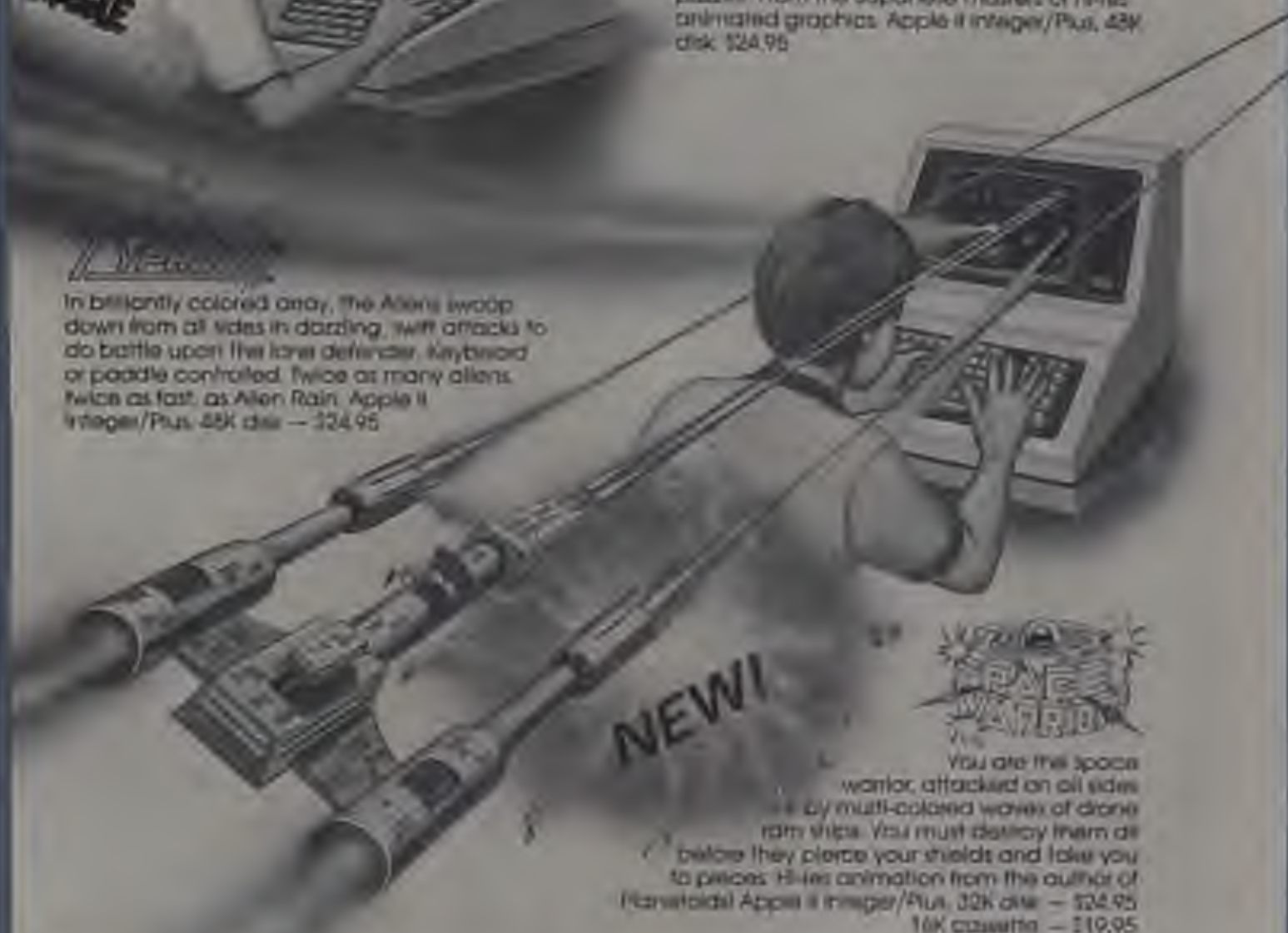


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CIRCLE 322 ON READER SERVICE CARD

Computer Simulations In the Classroom

Larry Noonan

A computer simulation is a system designed to reproduce essential aspects of reality for the purpose of finding ways to manage, control, solve, and/or ultimately agree upon the best solution for a problem.

In the classroom a simulation allows students to make judgments and, ultimately, decisions based on logic, observation and their knowledge of the real world. If the simulation is also a game, as is the computer simulation that I will discuss here, then it becomes an educational game. In the classroom, an educational game can change passive learning into an active experience that helps students understand more easily the concepts being taught.

Some Questions

Why use a computer simulation? This is a very important question. Computer simulations are not meant to replace hands-on activities and experiments, but to supplement them. Before using a computer simulation in the classroom you should ask these questions:

1. Can the simulation that you are considering be done better in a different way? If the answer to this question is "yes" then you should use that alternative and forget about computer simulation.

2. Does the computer simulation make good use of the capabilities of the computer? Does it use graphics, simplify record keeping, eliminate unnecessary calculations, etc.? Graphics help the student to visualize the experiment and simulate work with real equipment and materials. If the student or teacher must do all the calculations and keep all the results and records for the experiment or demonstration, then it might be better to do the whole simulation using paper and pencil only. Some record keeping may, however, be desirable for comparison purposes as we shall see later.

If, after you have answered these two questions, you feel that a computer simulation is what you want, consider the following four reasons that I often use to justify my use of this particular teaching tool.

1. The students are immediately turned on to this machine which has a certain amount of control over their future in the game.

2. The feedback or effects of their decisions are seen very quickly.

3. The simulation can be more complicated in its calculations (e.g. sales tax influences jobs which influence income tax, etc.) while keeping the outward appearance as simple as possible.

4. The random portion of the game or simulation is controlled by an unbiased machine.

Other reasons that computer simulations are enjoying increasing popularity are related to the fact that some things cannot be done in any other way. For example, some experiments and demonstrations happen too fast to observe. Others, like heredity experiments, may take too long. A computer simulation can slow down or speed up these experiments so that the results and the processes are easily observed. Some experiments such as those involving high voltage or radioactive materials are too dangerous to do in the classroom but can be safely simulated. Experiments involving expensive or difficult-to-obtain materials and apparatus can usually be simulated on a computer for a fraction of the cost of the actual experiment. Some experiments are too complicated. A computer can simplify these experiments so that only the important concepts and their interactions are seen.

Sources of Computer Simulations

Most software distributors advertise computer simulations. Some are educational but most are classified as entertainment. There are two ways in which many of these can be adapted for the classroom.

1. Make a commercial program fit into the classroom situation and develop activities and objectives that happen to fit that program.

2. Try to find a simulation that accomplishes the educational objectives which you wish to teach. This method is often more difficult but it is, in my opinion, better to fit the simulation to the needs of the class than vice versa. Therefore, I

have chosen to use this method in my classroom.

Educational Objectives

There are two kinds of educational objectives. The first, referring to the knowledge that should be attained by the end of the simulation, is called a "target objective." The second refers to those skills which are acquired during the course of simulation because they are necessary to meet the target objectives. These are called the "enabling objectives."

My target objective for the computer simulation was: to have the student, given a series of simulated real life situations, recognize and identify the cause and effect relationships involved by trying different solutions to the problems presented by the computer.

The program that I chose to achieve this objective is *Simon Peruvia and Fiamaccio* for the TRS-80 Level II from Instant Software. This program has very little documentation, none of which refers to educational uses. It allows teams or groups of students to participate simultaneously and keeps records for up to six groups.

The game creates a ruler whose objective is to accumulate land, grain and tax money and to construct buildings in his city while keeping his subjects alive and, presumably, happy.

The objectives in the program correspond with my target objective because the game requires the problem solving and intellectual skills of identifying cause and effect relationships. It also involves the cognitive strategy of originating solutions to such problems as what to do when bad weather strikes and how to balance revenues with grain production to keep the people healthy and happy. The students must try different methods to solve these and other problems, study the results and then apply what they have learned to create new and better solutions to the problems.

My enabling objective for this simulation was: to have the student, given a group situation simulating society, demonstrate a co-operative attitude within a group by helping to make the decisions that would lead to successful completion of the game.

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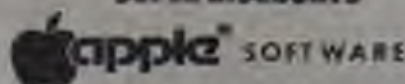
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Simulations, continued...

This objective requires students to work in a group for the common good of the group. Without co-operation within the group, failure to complete the game successfully is all but certain. It was hoped that each student in the group would see co-operation as an essential means to the desired end.

Intellectual skills required to calculate the best way to proceed and practice in decision making are also among the enabling objectives.

To use this simulation the students must have certain skills. They are:

- Computational skills of addition, subtraction, multiplication and division
- The ability to read with understanding
- The motor skills of drawing straight and curved lines
- The ability to write
- Mapping skills

Figure 1 shows a flow chart of the simulation.

Using a flow chart allows the teacher to examine and understand the program and devise worksheets for the students.

Worksheets

As a permanent record for the students and the teacher it is a wise idea to develop worksheets that will be filled in during the running of the program. As already mentioned, these worksheets should not require a large number of calculations. To draw up the worksheets, examine the simulation and find all the areas where the computer reports results or observations.

I developed worksheets in the following areas:

1. *Grain and Land* (See Figure 2.) The groups must decide to sell or buy grain on the basis of crop yield for that year, the price of grain and the amount needed to feed the people. Selling grain helps the treasury to buy markets and factories to make more money and create jobs. If too much is sold, however, there may not be enough to feed the people, and starvation will result. Fewer people means fewer tax payers which means less money for the treasury. Land can be purchased on which to grow more grain or it can be sold for cash.

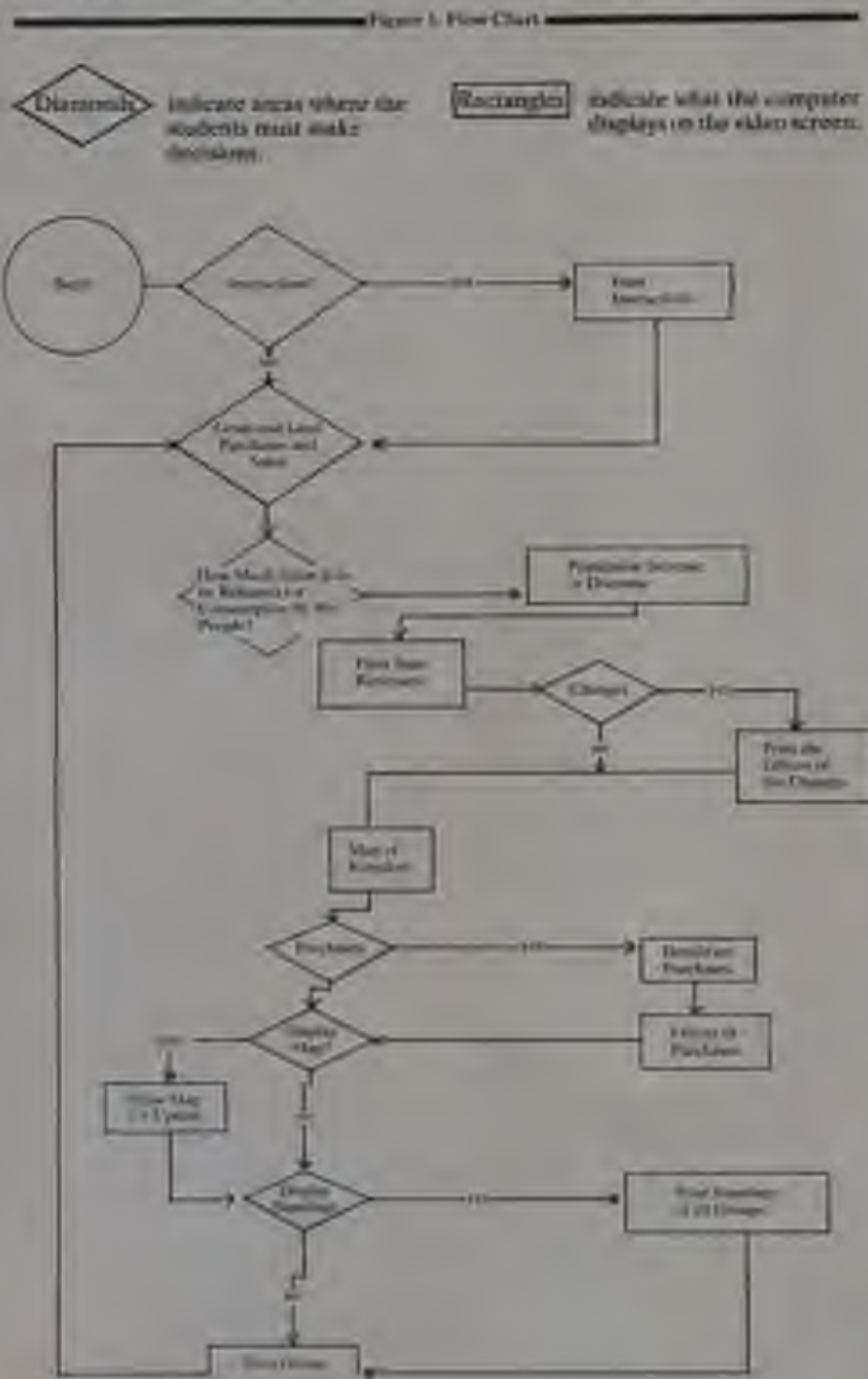
Figure 2: Grain and Land

Year	Grain Sold	Grain Bought	Land Sold	Land Bought	Grain Left	Land Left
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

2. *State Revenues* (See Figure 3.) The taxes and duties can be increased or lowered affecting the economy of the nation. For example, if the sales tax is raised, fewer products are purchased and fewer people are required to produce the products. As a result, the total income tax is decreased. (All of the complicated calculations are done by the computer.)

3. *Standings* (See Figure 4.) This sheet allows the groups to study the progress of other groups, compare their own performance and decide where they need to improve. It helps them to decide on strategy.

4. *Map* (See Figure 5.) This map is updated with every turn (every year in the game) and helps the groups to visualize their kingdom.



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Figure 3. Main Revenue

Year	1	2	3	4	5	6
Revenue						
Expenses						
Profit						
Land						
Grain						
Population						
Grain Reserves						
Grain Sold						
Grain Bought						
Grain Given						
Grain Used						
Grain Left						
Grain Sold						
Grain Bought						
Grain Given						
Grain Used						
Grain Left						

Figure 4. Expenses

Year	1	2	3	4	5	6
Revenue						
Expenses						
Profit						
Land						
Grain						
Population						
Grain Reserves						
Grain Sold						
Grain Bought						
Grain Given						
Grain Used						
Grain Left						
Grain Sold						
Grain Bought						
Grain Given						
Grain Used						
Grain Left						

Figure 5. Map

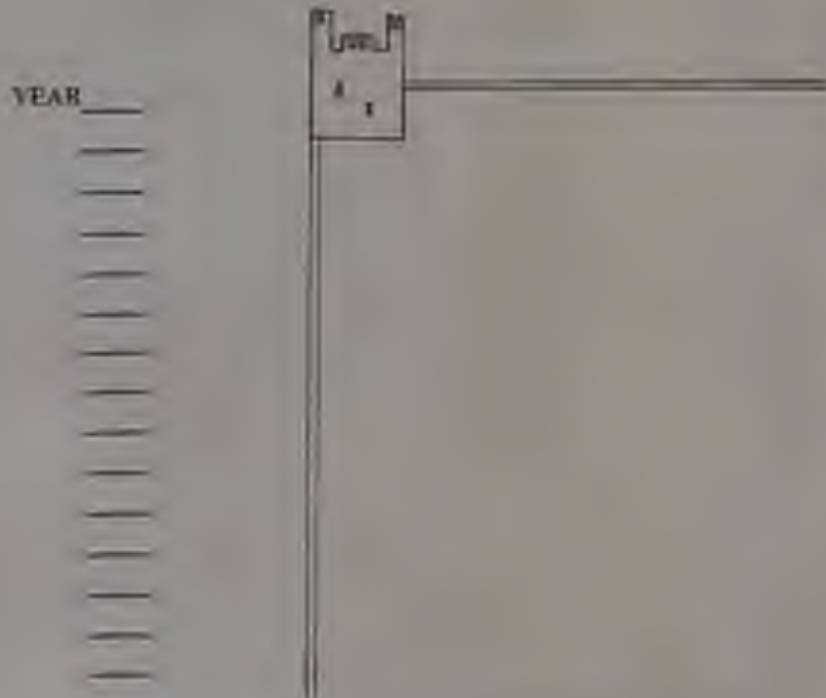
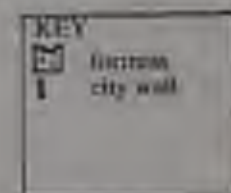


Figure 6. Learner Flow Chart

1. DECISION - buy or sell land
2. DECISION - buy or sell grain
3. DECISION - amount of grain to give to the people
4. DECISION - raise or lower or keep taxes the same
5. DECISION - build markets, etc. or not build them

Learner Flow Chart

In order to analyze the possible results of a decision a learner flow chart should be drawn and examined. These flow charts can be as simple as the one in Figure 6.

The five decisions that the students make during each turn, all have a cause and effect relationship that the student hopefully will soon recognize and then use in further decisions. Some of the effects are immediate (e.g., if the people receive too little food many of them starve. This, of course is to be avoided.) Other effects take longer to see (e.g., buying land results in the production of more grain during the next year).

Analysis of Learner Flow Chart

1. Decisions are made concerning purchases and sale of land. The students that used this simulation quickly realized that more land means more crops while less land means more immediate money. These facts are weighed one against the other and a decision is made. The effects of the decision is apparent during the next turn.

2. A decision must be made concerning the buying or selling of grain. If there is too much grain because of a good crop year then the students usually will sell some of it for money that can be used in other areas. If there has been a bad year, I found that the students had more difficulty making a choice to buy or to let some of their people starve. Since the object of the game is to make as many gains as possible, including population, the usual decision was to buy grain. I observed during this period that the majority of students were concerned about keeping as much money as possible in order to buy markets and make more money. There was however, in each group, at least one person who saw the results of giving less food to the people (i.e., starvation). It was this one person or small group within the group that always prevailed. These people, although usually not the dominant players in their teams, used good arguments to convince the rest of the group. I found that good judgment consistently won out over apparent greed. I was surprised to find this.

3. Calculating skills were required to make the decision of how much grain to give to the people. Some grain was needed for the next year. Too little grain given to the people means immediate death for many, while too much means that babies would be born and immigration would increase. Too much grain was the usual choice at the beginning of the game until a year of bad weather occurred. The supply of grain was exhausted, and many people died. From then on the students took considerably more time in calculating their grain reserves.

Cause and effect relationships were seen

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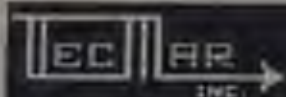


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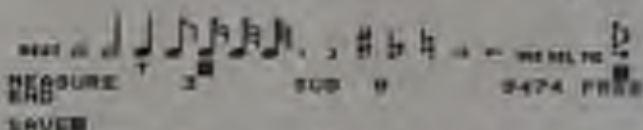
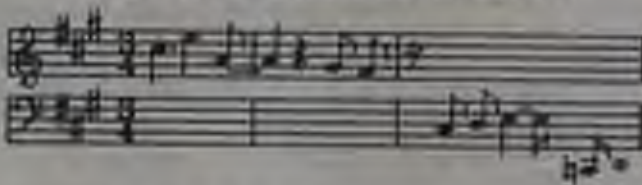
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—Oak Hills, Tennessee

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have for my Apple, I enjoy them the most. It has to be the most enjoyable
thing that has ever been invented. I hope you continue to develop products as
clever and enjoyable as this one. The entry programs to be one of the most
amplified programs I have ever seen. It proves that a hardware manufac-
turer (DLS) have the ability to also produce quality software. It is priced
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—Mudbank, California

About ease of use:

I have had my Music Card MC1 for a little more than a week now and I have
almost completely mastered it. The Music Card MC1 is so easy to use, it is so
simple that I thought and so I am very, very pleased. My family can't believe
I let up to all of the right playing with the pieces thing.

—Cypress, Texas

A L F has opened up my head and ears and excited me to do things musically
which I would like to be able to play on conventional instruments. So much so,
I love the instruments I try to play. I just don't have the talent and technique to
play what is in my head. By using the A L F board, about 1000 of my
fantasies, though, I can play half of that thing, playing notes and chords
which previously have existed only in my head. Many thanks from a frustrated
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About documentation:

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already (Oh yes, you wouldn't happen to know of anyone that wants to buy a
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I am absolutely delighted with it. In addition, I purchased the time boards
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Simulations, continued...

most easily here as people starved for lack of food or births and immigration increased because of an abundance of food.

Here as in the other decisions, the students evaluated previous decisions and their effects and tried to improve upon them during subsequent turns.

4. Decisions must be made about raising or lowering taxes. Results are, again, immediate, however there are long term effects which are less evident. An example would be that a decrease in sales tax produces immediate loss of revenue but stimulates production and increases jobs so that income tax revenues increase. This second result is not evident until subsequent turns. I found that most students had difficulty recognizing this point.

5. The fifth decision involves the building of markets and mills. To build costs money but creates more jobs and taxes. If the following year has good weather then everything will be fine for those groups that spend all their money on building projects. If bad weather and poor crops come, then money is needed to buy grain or many will starve. It is here where the element of chance comes in.

The students usually took one of the following routes:

1. Gamble on good weather and deplete the treasury to build markets. These groups often made quick gains but rarely ended up in the lead when the game was over.

2. Build fewer markets and mills and keep some money in reserve. The groups that chose this course made slower progress but usually ended up higher than the gambling groups at the conclusion of the game.

Conflicts often arose within the groups as to which way to go. The attitude toward working in a group for the common good of the group is developed during situations like this. If no decision could be agreed on then the leader of the group had the final say. The most important thing for me, as the teacher, to insure was that the decision (cause) was made and its results (effects) were seen and studied.

Testing Results

When using a computer simulation in the classroom, it is difficult if not impossible to test formally the results of the learning. Instead, the final outcome and observations of the groups form the basis of the testing that must be done. By observing the groups and how they work it becomes clear which groups and which individuals are developing the necessary co-operative attitude which is so essential in the game. Periodic examination of worksheets will also help to determine if the students are learning from their experiences with cause and effect relationships.

If, when the game is over, the group has more money, population, markets,

etc. than when it started, it is deemed successful. The degree of success is measured in the final difference between that with which it started and that with which it ended. If, for instance, two groups start out with 1000 people and one ends up with 10,000 while the other ends up with 2000 then the first group understands the cause and effect relationships in the game better than does the second group which could have increased its population by pure luck.

By examining all the areas where gains can be made and realizing that the greater the gains the more likely the group understood the purpose of the game and the more likely that they could recognize and work with cause and effect relationships, you can evaluate each group.

If a group ends up with less than they started with or with only a small gain, then it is likely that cause and effect relationships have not been fully understood.

Introducing the Computer Simulation to the Class

Now that you have chosen the simulation, thought about your educational objectives, developed worksheets and become thoroughly familiar with the computer program itself, how do you introduce it to your students?

The term simulation is heard on TV and in the movies enough so that it can be briefly explained to the students as a game that allows a person to make judgments and decisions based on past experience and their knowledge of the real world. A discussion should follow this definition so that the students really understand what they will be doing.

The students should be divided into groups of up to six and the class arranged so that the groups can sit together from the start. This will hopefully promote the co-operative attitude that is so important to the game.

Each of the worksheets that the groups will be using can be made into overhead projections and these can be used to explain the basic rules of the game.

Using each of the worksheets in turn the teacher can work through the techniques of entering data and making decisions. The possible effects of certain actions could be discussed. Examples:

1. What might happen if you sold almost all of your grain?
2. What might happen if you raised the sales tax to 100% to make an object cost twice its worth?

When the basic rules are understood, each group should select a leader. The leader is then asked to select a person or persons for each of the following positions.

•Department of Agriculture: This person uses the Grain and Land Worksheet.

•Treasurer: This person uses the State Revenue Worksheet.

•Department of Commerce: This person uses the State Revenue Worksheet.

•Department of Lands: This person uses the Grain and Land Worksheet.

Results

When I used this computer simulation in my classes (grades 5 to 7) I observed several things. Here are just a few.

Around the fifth turn I noticed that some groups came to the computer prepared to enter values they had already calculated at their desks. This was a good indication that they were looking at the results of their past decisions and making new choices based on the observed effects.

Each time I ran the simulation, some groups hastily made decisions for their first four or five turns, a practice which caused them to fall behind the other groups. As the game went on I noticed that all of these groups started to make better decisions and better thought-out choices. They were learning from their mistakes.

In every game that was played, at the end of eleven turns not one group was worse off than when it started. All groups were successful. Some, however, were more successful than others. These were the groups that carefully thought out the different possibilities and used their past mistakes and correct decisions to their advantage. □

To find more to read or to simulate, contact the author, the following for complete material, computer, screen pictures and simulation materials:

Creative Computing
P.O. Box 1044
Menlo Park, CA 94025

"Software on how to create simulations on the Apple and TRS-80 and Atari software for the Apple."

Complete
P.O. Box 104
Menlo Park, CA 94025

"Software on how to create simulations, screen pictures and graphics on the Apple, TRS-80, and Apple II."

The Video Software, Inc.
777 Broadway, Wm. S. 102
Carmichael, CA 95232

"Macintosh and II manual simulation for the Apple."

Apple
1000 Broadway Ave.
Menlo Park, CA 94025

"All the software of simulation materials on the Apple II and the Apple II Plus."

How to Solve It — With the Computer

Donald T. Piele

Last Winter an invitation was extended to schools and organizations throughout the United States and the world to participate in our computer problem solving contest. Soon after the announcement appeared in the February 1981 issue of *Creative Computing*, entries began arriving from all parts of the United States, Canada, and a few foreign countries—Great Britain, Australia, Germany, and Ecuador. Within a month, over 500 requests for information were received from groups of all sizes. Some were requests from teachers who had only one team of enthusiastic programmers who wouldn't let them rest until they had entered the contest. Others came from local directors who anticipated having 10 to 20 teams in each division. As the applications began to fill my mail box, I realized for the first time why authors, who encourage their readers to write to them, often request a stamped self-addressed envelope!

Tim Foxman, a colleague at the University of Wisconsin-Parkside, and I had spent two weeks preparing the problems for this year's contest and had checked them out on our individual home systems. On April 4, members of the Parkside Computer Club finished addressing the envelopes and stuffing them with copies of the rules, the contest problems, and the results sheet. Two cardboard boxes filled with 377 overstuffed envelopes were carried down to the campus post office and mailed. The contest was scheduled for Saturday, May 2, 1981.

The Contest

From its inception four years ago, our contest has been entirely interactive. In the two-hour time period, teams of up to three students put their computer problem solving skills against five problems. Each team has only one computer terminal. Time is the major limiting factor, and, of course, there is never enough of it to do justice to all five problems. It's not that the problems require lengthy programs; in fact, they can each be solved in under 40 lines of Basic code. But to figure them out quickly requires a considerable amount of skill. If our contest were a track event, it would be comparable to the 440 yard run—you've got to go all out from the very beginning, but you must still use some strategy to win.

The Problems

The problems in our contest have become more difficult each year. There is a good reason for this: every year the teams have gotten better. In the local contest last year (our fourth), the winning team in the senior division completed all five problems perfectly! If that could happen locally, imagine what would have happened internationally. Obviously, we would have to dig a little deeper for harder problems this year. We wanted to avoid having to choose a winner based on the number of remark statements used. Unfortunately, more



The principal of Rockport H.S. presents the Senior Division Trophy to Charles Nienisch, the local contest director. The three students are the members of the winning team. From left to right: Brian Tuck, Jonathan Wise, Chuck Nicholas (director). Dan Lencioni (Captain), Stuart Schuur (Principal).

difficult problems make it tough on the rookie teams. (We are looking at alternatives to ease this problem next year.) In any event, here is what we came up with this year—our rookie year for an international event. Figure 1 shows the problems as they were presented to the students. (See pages 146-148.)

The Results

Within a few days after the contest was over, the results began to trickle in. After two weeks, we had the results from 64 junior division contests and 92 senior division contests. The number of teams that entered each local contest varied from one to 14 in the junior division (total 226) and from one to 26 in the senior division (total 365). We asked each contest

Number of Correct Programs	Junior Division	Senior Division
0	25%	44%
1	32%	27%
2	20%	16%
3	16%	9%
4	5%	6%
5	2%	0%

Table 1.

director to give us a breakdown of how many teams solved zero, one, two, three, four or all five problems. The results, shown in Table 1, gave us a measure of difficulty of the contest as a whole in each division.

Donald T. Piele, Department of Mathematics, University of Wisconsin-Parkside, Kenosha, WI 53141.

It appeared that the senior division contest was more difficult than the junior division contest. Another question of interest was: which problems were solved most frequently? The answer is shown in Table 2.

Problem #	Junior Division	Senior Division
1	30%	35%
2	10%	27%
3	31%	23%
4	11%	12%
5	9%	3%

Table 2

This provides a clear indication of the level of difficulty of each problem. The 3% who solved the hardest problem in the senior division represents a total of nine teams. Twenty-seven solved problem five in the junior contest.

Finally, we compiled the data on how many problems were solved by the winning teams in the local contests.

Number of Problems Solved

by the best local team	Junior Division	Senior Division
0	3%	3%
1	15%	24%
2	31%	32%
3	28%	28%
4	11%	15%
5	10%	0%

Table 3

This breakdown, shown in Table 3, can be used to measure the results of individual teams against the best in all the local contests. It can be used by those who want to see how they rank internationally. The average number of problems solved by the winning team in a local contest was 2.56 in the junior division and 2.25 in the senior division.

Included in our letter to each contest director was a temporary rating system. This was constructed before the contest was run and, thus, before we had any feedback about the difficulty of the problems.

Number of Correct Programs	Rating
1	Fair
2	Good
3	Very Good
4	Excellent
5	Super Colossal

Table 4

This rating system, shown in Table 4, turned out to be very accurate for the junior division. For the senior division, it should be moved back one step so that one correct solution is "Good." This would make four correct "Super Colossal" and five correct "Unbelievable."

The Winners

In the Junior Division (grades 7-9), the top three finishers came from teams with only one student each. Of the top ten teams, seven were made up of only one student. As one might expect (although we hadn't), in the early years fewer kids got

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CIRCLE 149 ON READER SERVICE CARD

How to Solve it, continued...

Junior Division		
Team Name	Team Members	School
1. —	John Rempel	Piedmont Middle S., Piedmont, CA
2. Bug Exterminator	Ken Sherriff	Prince Charles School Portage La Prairie, Manitoba, Canada
3. Wizard	Craig Cohen	Merrick Ave. J.H.S., Merrick, NY
4. SSMCIS I	Nicholas Cravoita Calvin Chen	Alfred Nobel J.H.S., Northridge, CA
5. Two Bits	Glen Tisdley Erik Olson	Walter Reed J.H.S., North Hollywood, CA
6. —	Paul Kenrick	Walter Reed J.H.S., North Hollywood, CA
7. Freshman #1	Eric Brand Dwight Lee Andy Williams	Rolling Meadows H.S., Rolling Meadows, IL
8. Disk Wizard	Steve Barkins	Merrick Ave. J.H.S., Merrick, NY
9. Basic Trigonometry	Danny Lukas Raymond Waldrop	Bartlesville, OK
10. Listeners	Chip Drenn	Bartlesville School Normal, IL

Figure 2

their hands on computers and the few who do quickly acquire skills beyond their years. Figure 2 lists the top ten teams.

The winner, John Rempel, is a ninth grader who became interested in computers through a neighbor's TRS-80. He wrote the programs for the contest on his school's computer system and was able to complete all five problems perfectly, supply excellent documentation, and help keep the computer system running for the other students—all within the three time period!

Mathematics and computers are John's long suit. Last year he finished near the top in the California Mathematics League Algebra Contest. Mrs. Ann Reynolds, a teacher at Piedmont Middle School who directed the local contest, remarked, "John is extraordinary in the field of computers. He has had to be continually encouraged to study other subjects, because he has such a marketable skill in math and computers already!"

We hope that John continues to fill the books as well as the keyboard in high school, college, and beyond. He has shown us that he has the potential for making truly original contributions in the field of computer science.

In the senior division, the top three teams were made up of three students each. For tougher problems, it obviously helps to be able to divide the problems among three competent people—taking advantage, perhaps, of different strengths. Figure 3 lists the winners in the Senior Division.

Dan Lanciani, the captain of the winning team, is a junior at Rockport H.S.—a small school of 300 located 35 miles north of Boston. Dan's main interest is solid state physics—he designed and built his own home computer system. Chuck Nicolini, his advisor, recalls the time when the school's PDP-8 went down and the estimate to fix it was \$300. "We didn't

Senior Division		
Team Name	Team Members	School
1. Franticsakes	Dan Lanciani Brian Tuck Jonathan Wise	Rockport H.S., Rockport, MA
2. The Happy Programmers	Karen Ellen Peter Frazer Bruce Edwards	Tarang H.S., Tarang, Victoria Australia
3. Electronic Intrigues	Washington Taylor Jonathan Mark Ian Taylor	Cambridge Ridge & Latin H.S., Cambridge, MA
4. The INOCES INC.	Chap Wappes Warren Jacobson Dwight Ettel	Crosier Seminary Omaria, MN
5. Mark	Mark Riley	El Camino H.S., Woodland Hills, CA
6. Scopus Thru	Gerant Noll Denny Davis Ken Ross	Mount Scopus Memorial College, Burwood, Victoria, Australia
7. Bad Apples	Brad Shipp Andy Gottlieb Dave Wilman	Mount Brown School Providence, RI
8. Incandescent Penguins	Fareed Stevenson Steve Robbins	Gumper Secondary Ct., San Diego, CA
9. The Blind Programmer	Steve Friedman	Fair Lawn, H.S., Fair Lawn, NJ
10. —	Gadi Friedman Adam Bralove Anis Fuhman	Highland Park H.S., Highland Park, NJ

Figure 3

have \$300 in the budget to spend on it. Dan asked if he could work on it over the weekend. Monday morning, it was up and running and the cost of the repair was 15 cents." Besides maintaining and building computers, Dan also enjoys writing computer programs. In fact, he wrote the scheduling program that is used at Rockport H.S.

Brian Tuck, a graduating senior, is also an outstanding programmer. Nicolini recalls, "Brian was the first on his block to own a TRS-80. He wrote an excellent program for the French teacher—sort of a French version of hangman/concentration."

Jonathan Wise, the third member of the team, is an excellent mathematics student. "All three have participated in the mathematics competitions sponsored by the Massachusetts Mathematics League," Nicolini added.

The "Franticsakes," as they call themselves, used an Apple II and completely solved the first four problems. The programs were straightforward, easy-to-read and well documented. The team was almost finished with the last problem when time ran out—an Excellent and near Super Colonial performance.

The Awards

The Parkside Computer Club awarded a silver trophy to the winning team in each division. This is a traveling trophy and the names of the individual team members were engraved on it. Creative Computing awarded individual prizes to the top three teams in each division. The cash value of all the

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How to Solve It, continued...

prizes was kept to a minimum, since we feel that recognition alone is the biggest reward. Certificates of rank were awarded to the top 10 teams.

The Feedback

Throughout the contest, we received letters from people all over the U.S., Canada, and a few other foreign countries. Each day brought another batch of returns which were often accompanied by helpful remarks. We were made aware of difficulties that some local contests had and received several suggestions for improvement in the future. Here is a sample of the feedback:

"Some of the teams with printers felt they were at a disadvantage because of the extra time given those without printers to print out their results after the two hours."

"We look forward to next year's competition. A couple of the problems seemed a bit tough for a two-hour competition."

"It was difficult to interpret 'Runs Properly' on some of the problems."

"Please clarify whether partially correct solutions can be given partial credit for creativity, readability, etc." (The rule is: If it does not run correctly, it gets a zero and no partial credit in the other categories.)

"Problem two (Senior Division) can't accept a 70-digit number unless it is a string. However the intermediate digital product becomes too large to compute." [Not if you construct your own string multiplication routine.]

"Too much for three students, one terminal, two hours. But good problems."

"We had problems with one, the easiest, because the students programmed it using PRINT @ which is O.K. for the screen but not O.K. for a hard copy."

We appreciated receiving the feedback, and will use many of the ideas we received to improve the contest for next year. Other comments included:

"Problems were very interesting, but tough! A Challenge! I'm already planning to participate next year."

"This was a great experience for these students. We would like to participate again next year."

"Super problem—great format—kids had a lot of fun."

"An excellent competition and learning experience. Although one of our two teams was completely shut out, all students involved (and many of their friends) are still working on and discussing the problems. This rarely happens (to such a degree) in pure mathematics competitions."

"The 12 students thoroughly enjoyed the challenge, and put in a lot of extra work over the last month. If nothing else they certainly learned a lot about programming."

"Good contest for us. Very hard problems. This was our first time at something like this, but it certainly won't be our last. We all had fun. Thanks for the problems."

The Conclusion

The solutions to this year's problems have deliberately not been included here. Many readers may want to use these problems as exercises for themselves or for a class and we don't want to spoil it. The solutions will appear next month. We will, however, send a copy of the solutions to anyone who requests it as long as we receive a self-addressed, stamped envelope (two stamps please). For requests from outside the United States, we will supply the stamps. Please do not send money. The University of Wisconsin—Parkside Computer Club raises enough money each year at our annual computer fair to pay for conducting the international competition. Our biggest time waster is addressing envelopes, and next year it may be even worse. If that job can be eliminated for us, then we can concentrate on keeping the contest alive and interesting.

We enjoy reading all your cards and letters—especially if you don't agree with how we solve the problems. So keep those cards and letters coming, but please include a SASE.

In subsequent columns this year of "How To Solve It—With The Computer," I plan to elaborate on the problem solving skills that were helpful in solving the problems in our First International Problem Solving Contest. Many of the key ideas and techniques that were used by the best teams will be demonstrated. In the course of this series, all of the problems in this year's contest will be solved, and many similar ones will be posed to challenge the reader. An effort will be made to explain the fundamental skills at elementary, intermediate, and advanced levels. This material will be especially useful to those individuals who plan to enter the Second Annual Contest.

The announcement for next year's contest will be made early in 1982. At that time the date will be announced for the 1982 contest, and the newly revised rules will be published. The basic format of the contest will remain the same, but we will try to fine tune it, taking into account the suggestions that we have received from those who competed in the 1981 contest. Here are a few changes that we are considering:

1. Move the date of the contest to a Saturday in April.
2. Add an Elementary Division (grades 4-6)—probably without international ranking.
3. Give everyone two hours to write the programs and 15 minutes to list the programs and sample runs—with no changes permitted during this time.
4. Prohibit the use of any previously prepared submissions either in written, electronic, or magnetic form. (This hasn't been a problem yet as far as we know.)
5. Require that all code for the language must be standard machine code inherent to the processor of the computer.
6. Provide samples of the correct output for each problem for the local graders use.
7. Clear up any ambiguities in the grading procedure.
8. Set a two-week deadline for the return of the results sheet after the contest.

If you would like to add your input to these suggestions or make new ones, let's hear from you. Your suggestions are always welcome.

Acknowledgement

I would like to thank the many people who helped make this event possible. Tim Fossum, chairman of the Engineering Science Division at the University of Wisconsin—Parkside, helped create the problems and grade the results. Loren Bachman, president of the Parkside Computer Club, along with members Patty Craig, Kathy Ziemer, Brian Kapitan, MaryJane Tropin, Scott McDowell, and Don Sornman, helped administer the contest and grade the results. Patty Fields-Troha typed the problems on the Science Division's word processing system. The time and effort contributed by these people was greatly appreciated.

I would also like to thank the many contest directors who contributed their time in directing the local contests and who, in many cases, sent detailed remarks—sometimes several pages long—about how it went.

Finally, I would like to congratulate each individual who participated in this contest. Our contest director wrote, "I was amazed at the tenacity of the students. I'm sure glad I didn't have to solve those problems in two hours." Only one team, of course, can "win" this contest in the sense of being ranked first. But from our vantage point, we can see that there are many winners all over the world. These kids have demonstrated their ability to take on a difficult challenge and give it their best shot. And the pleasure that we read over and over again in the remarks sent to us which typifies this spirit was: "Wait till next year!" □



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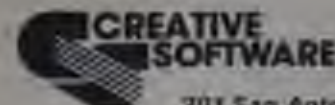
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INTERNATIONAL COMPUTER PROBLEM SOLVING CONTEST
FOR

JUNIOR AND SENIOR HIGH SCHOOL STUDENTS

B U L L E T I N

1. Divisions Senior 801 Grades 10-12 (age 18+)
Junior 201 Grades 7-9 (age 13-17)

All students should be classified first by grade and second by age. Thus a 15 year old 10th grader belongs in the senior division. Any junior person may be a member of a senior team but not vice versa.

2. Team Size A team consists of one to three members.

3. Computer System Any interactive computer or microcomputer system may be used; however, each team may only use one input device (keyboard or terminal). Hard copy must be available for listing the programs and displaying the sample runs.

4. Time Limits Each team will be given five problems to solve within a two hour time limit. In cases where a problem must be shared between two or more teams, time may be taken after the two hour time limit to make listings and sample runs of the programs. This must be done with an official present. Nothing can be changed in the program except statements that make it possible to get a hard copy.

5. Grading Procedure It is the responsibility of each local contest to grade the results. This should be done with the following considerations:

- If a program runs properly using the test data provided in the problems, it gets 12 points. 50 points are given for a program that does not run correctly.
- If the program is well designed and easy to read, then it gets another 5 points. Partial credit is possible here.
- If the program is imaginative or creative, then it gets an additional 3 points. Partial credit is possible here.

Each program that is handed in should have a score sheet stapled to it. This is the responsibility of the team captain.

6. Contest Dates To qualify for the national ranking, the contest must be held on Saturday, May 2, 1981. Exceptions require special permission. More than one session may be used on that day to accommodate all the teams in a limited amount of hardware.

7. General No outside help is allowed during the contest, including books, programs, or people not on the team. However, questions concerning the operation of the computer, terminal, or printers may be answered by those conducting the contest. Any language reference book or pocket guide of commands and statements is also allowed. This may be taken before the contest to familiarize the contestants with the computer system.

Figure 1.

INTERNATIONAL COMPUTER PROBLEM SOLVING CONTEST

Junior Division

1. Parkside's Triangle.

Parkside's Triangle is generated from two numbers - one for the lines and another for the size. For example, here are two of Parkside's Triangles

Size 5, Seed 1	Size 6, Seed 3
1	1
2 3	2 5
4 5 4	6 7 6
2 8 9 1	5 1 2 3
2 3 4 5 4	4 5 6 7 8
1 2 3 4 5 4 3	

Your problem is to write a program that will generate Parkside's Triangle given any size N (5-25) and any seed S (1-5555). Test your program by generating Parkside's Triangle for 5-6, 5-1 and 6-7, 5-6.

2. Round Numbers.

A positive integer N is said to be a round number if the binary representation of N has at least as many ones as zeros. For example, 9 is a round number (since its binary representation is 1001) while 26 is not a round number (since its binary representation is 11010).

Write a program which will accept input of a positive integer N , and which will print the number of round numbers less than or equal to N in the format

THESE ARE THE ROUND NUMBERS LESS THAN OR EQUAL TO N

There are 5 round numbers less than or equal to 10. Run your program twice, with inputs of 10 and 100.

3. WFL Helms.

There are 28 football teams in the WFL. Many superstars and discount stores have vending machines that dispense miniature team helmets for one quarter (25 cents) each. Assume that all helmets are equally likely to be dispensed by the machines.

You are to write a program to simulate putting quarters in vending machines until all 28 helmets have been obtained. Your output should have the form:

TOTAL SPENT TO GET ALL 28 HELMETS = \$ XXX.XX

Run your simulation 3 times.

4. Letter Count.

Consider a paragraph containing several lines of text submissions. You are to write a program to print a letter frequency table which will list the frequency and percentage of occurrence of each letter (A through Z) of the text in order of highest frequency first.

Your list should be headed with the line:

LETTER	FREQUENCY	PERCENT
--------	-----------	---------

and should have a final line:

TOTAL	END
-------	-----

where *sum* is the total number of letters in the paragraph. The list and letters which do not occur in the paragraph. In BASIC, you can use DATA statements to enter your test text as:

1000 DATA "CONSIDER A PARAGRAPH ..."

See how to convert all lower-case letters to capitals. Test your program with the first paragraph of this problem.

5. Missions, Missions, and Communications.

On a small island in the South Pacific, there are missionaries and there are missionaries with only a small boat with which to move from one island to the mainland. In planning for the transfer of everyone to the mainland, the missionaries know that they cannot trust the cannibals. Thus to be able they establish the rule that missionaries must never be outnumbered by cannibals on either the island or the mainland during the transfer process.

If we use M to represent a missionary and C to represent a cannibal, then MMCCC represents three missionaries and three cannibals together. With this representation, it is possible to list all possible arrangements of missionaries and cannibals on the island and the mainland in a list:

ISLAND	MAINLAND	STATUS
1. MMCCC		SAFE
2. MMCC	C	SAFE
3. MMCC	CC	SAFE
4. MM	CCC	SAFE
5. MCC	M	etc.
6. etc.		etc.

The safe positions are those which obey the rule set up by the missionaries. Your problem is to write a program which will find out the entire set of possible arrangements of missionaries and cannibals on the island and the mainland and to print "SAFE" after every arrangement that is safe. The program must do all the work. It is not acceptable to refuse to be tested and simply print out the results.

THE UNIVERSITY OF WISCONSIN-MADISON

MAY 2, 1981

INTERNATIONAL COMPUTER PROBLEM SOLVING CONTEST

Senior Division

1. Parkside's Other Triangle.

Parkside's Other Triangle is generated from its members - one for the size and one for the seed. For example, here are two of Parkside's Other Triangles:

Size N, Seed 1	Size N, Seed 3
1 2 4 7 2 7	3 8 6 9 8
3 5 8 3 8	5 7 3 5
6 8 4 6	8 2 8
1 1 1	3 7
6 2	8
3	

Your problem is to write a program that will generate Parkside's Other Triangle given any size *N* (1-250) and any seed *S* (1-549). This must be done without the use of arrays - which would make the task easy. Test your program by generating Parkside's Other Triangle for (10, 20) and (10, 7, 5-9).

2. The Digital Product.

The digital product of a positive integer *N* is defined to be the product of its nonzero decimal digits. For example, the digital product of 99 is 81. The digital product of a positive integer *N* is obtained by repeatedly taking digital products until a single digit is obtained. Write a program which will accept input of a positive integer up to 70 decimal digits in length, and which will print the intermediate steps in computing its digital product from:

For example, for an input of 9999999999, the output should look like:

```
9999999999
9876543210
9876543210
1428
12
2
```

The digital product must be 2.

Run your program with inputs of 9, 10, 123456789, and 9999999999.

3. Bag Walk.

A bag begins at home and goes for a random walk on a strip of 20 squares.

19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14	-15	-16	-17	-18	-19	-20
----	----	----	----	----	----	----	----	----	----	---	---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

HOME

If moves to the right or left are squares at a time but in a random fashion. It moves to the right with probability $1/2$ (0.5) and to the left with probability $1/2$ (0.5). When the bag reaches either end of the strip, its next move is always towards home and then it continues the random walk.

After the bag has returned home for the 10th time it stops.

Write a program that simulates the bag's random walk for any input of N and P and prints out a list of all the squares the bag has visited, and the number of times it has been there. Print out the list in order of frequency, giving the most frequently visited squares first. Run the program for $N=5$, $P=1/2$ and $N=10$, $P=2/3$.

.....

4. Word Count.

Consider a paragraph containing several lines of text information. You are to write a program to print a word length frequency table. This table should list the word length, frequency of occurrence, and percentage, in three columns, in order of highest frequency first.

Your list should be headed with the line

LENGTH FREQUENCY PERCENTAGE

and should have a final line

TOTAL 444

where 444 is the total number of words in the paragraph. For purposes of definition, a word consists only of alphabetic characters (A through Z). Words also that different words such as "FOR" and "THEY" having the same length are to be counted together in determining the word length frequency. Do not list word lengths that do not occur in the paragraph.

In BASIC, you can use DATA statements to enter your text such as:

1000 DATA "CONSIDER A PARAGRAPH CONTAINING SEVERAL..."

Test your program with the first paragraph of this problem.

5. Shuffle Puzzle.

The Shuffle Puzzle of size 3 consists of three white marbles, three black marbles, and a strip of wood with 7 holes. The marbles of the same color are placed in the holes at the opposite ends of the strip leaving the center hole empty (E is empty space).

O O O O X X X X

Initial State

The object of the puzzle is to completely reverse the marbles on the strip and end up with the goal state

X X X X O O O O

Goal State

There are only two types of moves you can use. You may move 3 marble 1 space into an empty hole or jump 1 marble over 1 marble of the opposite color into an empty hole. You may not back up and you may not jump over 2 marbles.

A Shuffle Puzzle of size N consists of N white marbles and N black marbles and $2N+1$ holes.

Write a program that will solve the Shuffle Puzzle for any size N (100 and display the board after each move. Use 'W' to represent white marbles and 'B' to represent black marbles and 'X' to represent the empty hole. Then 100XXXX is the initial state and 111XXXX is the goal state in a Shuffle Puzzle of size 3.

Test your program for $N=3$ and $N=4$.

HINT: First figure out how to solve the puzzle. Next, observe the movement of the empty space. Finally find the rules that govern the movement of the hole to the left and right and program the computer to carry them out.



The Computer Tutor

Harley M. Templeton

"The Computer Tutor" is written for the *Templeton Instruments*™ & has been designed to be a different kind of tutor. The *Using Another Computer*™ is one of the best possible examples for comparison to other tutors.

"Child, that's an awful report card! You need a tutor!"

"Aw, just let me have it!"

Sound familiar? How about a computer tutor? Many teaching programs are available for computers. Typically, they teach a particular subject at a general level. They are great—if you need to learn what they teach. But to help your child with current assignments you need something customized for the areas with which he is having difficulty. Or maybe you are a teacher who would like to write lessons, drills, and quizzes that your students can do on an available computer. This article describes two programs for the TI 99/4 which can be used for computer aided instruction. One writes a set of frames (or screens) and the other displays the frames. The result is a teaching tool custom designed for a special purpose.

Lessons, Drills, and Quizzes

The frame builder program writes a set of frames to be displayed by the display driver program. Each frame may contain either a question or information. When the question is a multiple-choice question, the answer can select the frame to be displayed next. True-false questions and questions that have exact, brief answers can also be used. Questions of this type

cannot readily select the next frame for display as the next question in the set is displayed. The question can, however, be repeated, giving the student a second chance to get the correct answer.

By a lesson, I mean a series of frames designed primarily for teaching. Each answer selects a frame to be displayed next. The frame following a correct answer should say that the answer is correct, and may include additional information. After each incorrect answer the next frame should tell why the answer is incorrect, and give the correct answer. A display driver can keep score, if you tell it to. The score helps the student to see how he is doing.

In a drill, the questions are displayed in sequence, regardless of the answer. You can specify a repeat to give the student another chance to answer the question. If the second answer is wrong, the display driver displays the correct answer before displaying the next frame. A drill can be scored, too. If both scoring and repeating are requested, the student only scores when the first answer is correct.

A quiz is similar to a drill, except that the student has only one chance to answer. A quiz is usually scored.

The computer tutor gives you a great deal of flexibility. The sequence of display and the options are coded for each frame; types of frames can be combined as appropriate. You can include information frames following question frames. You can mix questions that follow in sequence with those that are displayed in answer-selected sequence. And you can include unscorable questions with scored questions. Similarly, you can repeat some questions but not others. You can use questions with a word or phrase as the answer. However, you should use these questions with care; there must be only one correct

answer. Otherwise, the student may be told that a correct answer is incorrect. Unless you are teaching spelling, this type of question should probably not be used with a student who has spelling problems.

Preparing the Frames

You should carefully plan the frames before you run the frame builder. Remember that the advantages of this type of instruction are immediate reinforcement of correct answers and correction of wrong answers before they are learned. There is immediate reward for correct answers. An incorrect answer is immediately replaced by the correct answer. The student does not have to wait to get the paper back to learn the correct answer.

You may want to use exercises or tests from a workbook, textbook, or work sheet. Use your imagination to adapt the material to the medium of a computer screen. Explore the things the computer does: it varies the sequence depending on the student's answer; it recognizes correct answers immediately; and it gives the student the correct answer when his answer is wrong.

The simplest set of frames to write is a drill: state capital, for example. Write each frame as follows:

THE CAPITAL OF TEXAS IS:

The code that follows the frame specifies fixed sequence, score, and repeat. It also includes the correct answer (Again, for you Yankers!).

Write a number of similar frames. For variety, turn the question around:

TALLAHASSEE IS THE CAPITAL OF:

The coding for the frame is the same as in the previous example; the correct answer is, of course, Florida.

When the frames are displayed, if the

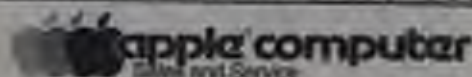
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Tutor, continued...

student answers correctly, the next question is displayed. When the answer is incorrect, the computer displays:

TRY AGAIN!

If the second answer is incorrect, the computer displays:

THE CORRECT ANSWER IS AUSTIN

In each case, the computer then displays the next question.

Every set of frames must end with a special frame, coded as the last frame. When the display driver displays this frame (a special type of information frame), it requests the student to press ENTER. Then the computer displays the score:

YOU ANSWERED 7 QUESTIONS CORRECTLY.

YOUR SCORE IS 70%.

This score means that the student's first answers to seven out of ten questions are correct. The count of questions asked includes only questions coded for scoring. Any other questions in the set do not affect the score.

If you had not specified scoring for any questions, no score would be displayed. If you had not requested repeat, and the student entered a wrong answer, the computer would have displayed:

THE CORRECT ANSWER IS FLORIDA

Multiple-choice questions may be used in drills. Write a multiple-choice question as follows:

A NOUN IS:

1 THE ACTION WORD OF A SENTENCE

2 A WORD THAT MODIFIES A NAME

3 THE NAME OF A PERSON, PLACE, OR THING

4 A WORD THAT MODIFIES THE ACTION WORD

A multiple-choice question may have as many as ten choices, and the questions in a set may have a different number of choices.

Another type of question you can use in a drill is the true-false question. Here's an example:

THE HYPOTENUSE IS THE SIDE OF A RIGHT TRIANGLE OPPOSITE THE RIGHT ANGLE

T OR F?

Each type of question may be scored or repeated or both. (But do you really want to repeat a true-false question?)

A set of frames displayed in the sequence determined by the student's answers is more difficult to write. The questions must be multiple choice with numbered answers. Questions may be scored, but not repeated. An example is:

THE FIRST PRESIDENT OF THE UNITED STATES WAS:

- 1 ABRAHAM LINCOLN
- 2 GEORGE WASHINGTON
- 3 BENJAMIN FRANKLIN
- 4 JOHN ADAMS

The code that follows the frame specifies answer sequence. The sequence is 2,3,4,5 which means that frame 2 is displayed when the answer is 1. Frame 2 is:

ABRAHAM LINCOLN WAS THE 16TH PRESIDENT OF THE UNITED STATES. GEORGE WASHINGTON WAS THE FIRST PRESIDENT.

Frame 3 is displayed when the answer is 2. Frame 3 is:

YOU ARE CORRECT, GEORGE WASHINGTON, THE GENERAL WHO LED OUR TROOPS TO VICTORY IN THE REVOLUTIONARY WAR BECAME OUR FIRST PRESIDENT.

Frame 4 is displayed when the answer is 3. Frame 4 is:

BENJAMIN FRANKLIN LIVED AT THE TIME OF OUR FIRST PRESIDENT. HE WAS OUR MINISTER TO FRANCE DURING THE REVOLUTIONARY WAR. GEORGE WASHINGTON WAS OUR FIRST PRESIDENT.

Frame 5 is displayed when the answer is 4. Frame 5 is:

JOHN ADAMS WAS ELECTED AFTER SERVING AS THE FIRST VICE PRESIDENT. GEORGE WASHINGTON WAS THE FIRST PRESIDENT.

These four frames are coded as information frames. The code for an information frame includes the number of the next frame to be displayed. Usually, these frames specify the same number: the number of the frame of the next question. However, you can specify any frame having a number higher than that of the current frame.

In this example, a different frame was displayed following each answer. If you like, you can display the same frame for more than one answer.

Each set of frames ends with a special type of information frame coded the last frame. All paths through the frames should end at this frame. It might say, for example:

THAT'S ALL, FOLKS!

Writing the Frames

To write a set of frames, load and run frame builder. It begins by displaying a screen of instructions. After you have finished reading them, press the ENTER key to continue.

The computer displays the cassette instructions next. After you rewind the cassette and place it in record mode, the computer writes a leader, clears the screen, and positions the cursor in the lower left corner of the screen. There are only two valid entries when the cursor is at this

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Sales B	45,577	48,123	49,088	3.80	47,929	143.83	50,931	52,761	58,791
Total	87,780	99,974	112,211	13.92	100,041	303.00	131,713	152,961	250,000
% Sales	48.33	52.94	57.00	6.88	52.63	158.1	61.35	65.31	76.48
% Profit	31.87	37.00	42.00	5.00	44.31	141.6	48.63	54.49	63.11
Total	100.00	100.00	100.00	-	100.00	300.0	100.00	100.00	100.00

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Type of frame	Code	Options
Answer sequence	An, n ₁ , ..., n _k Answer An, ..., n ₁ , ..., n	Scoring option No scoring
Fixed sequence	FR Answer F Answer FR Answer F	Repeat and score Score only Repeat only No scoring, no repeat
Information/Last	In L	

n = Number of next frame to be displayed.

n₁ = Number of next frame when answer 1 is entered.

n_k = Number of next frame when answer n is entered.

Answer = Correct answer to the question.

Table 1. Coding Conventions.

position: a line number, or an exclamation point. Press the ENTER key after the digit of a line number from one to nine. It is not necessary to press the ENTER key after the second digit of a two-digit number. The computer places the cursor on the first character position of the line you requested. Enter any spaces you want at the left of the line. Then type the characters. If you make a mistake, you can use the left arrow key to go back to the incorrect character, and the right arrow key to return to the end of the line. When the line is correct, position the cursor after the last character on the line and press the ENTER key. The cursor returns to the lower left corner of the screen. Then enter another line number and the line of characters in the same way. You can write on any line from 1 to 23 in this way.

The reason frame builder requires you to enter the number of each line is that this technique builds the frame exactly as it will be displayed. If you see that a line contains an error, if it is too high or too low, enter the line number again. Then correct the error, press the down arrow key to move the line down, or the up arrow key to move the line up. Use the right key to move the cursor to the end of the line and press the ENTER key to store the line.

You may type faster than the computer processes the character you enter. If so, you will lose a character here and there. Try to wait for the cursor before typing a character. The problem is that the required comments and subroutine calls for entering the characters on the upper lines of the screen are slower than the INPUT statement, which enters characters on the bottom line only. The input is programmed this way to build a screen exactly as you want it to be displayed.

When you have the screen just right, and have pressed ENTER to return the

cursor to the lower left, enter an exclamation point to start processing of the screen. The computer may not actually write anything on the cassette because it blocks the lines and writes five lines at a time. That is, the computer stores five lines in memory to write with one write operation to the cassette. This speeds up the program significantly because it does not take much longer to write five lines than to write one line.

The computer then displays the following screen to request frame coding information:

```
FRAME NUMBER: ENTER:
A FOR ANSWER SEQUENCE
FRAME
F FOR FIXED SEQUENCE FRAME
I FOR INFORMATION FRAME
L FOR LAST FRAME
```

Flashing any of the four letters causes the computer to request the appropriate additional coding. For example, when you enter A, the computer displays:

```
ENTER A FRAME NUMBER FOR
EACH CHOICE. SEPARATE WITH
COMMAS. ENCLOSE IN QUOTES.
```

If you had entered the frame asking who was the first president (previously described), you would now enter:

```
"2,3,4,5"
```

This means to display frame 2 when answer 1 is entered; frame 3 for answer 2; frame 4 for answer 3; and frame 5 for answer 4. The next display is:

```
ENTER % TO SCORE THE QUES-
TION, OR PRESS ENTER ONLY.
Press ENTER only. The screen clears, and the computer displays the following:
```

```
A2,3,4,5
IF CORRECT, PRESS ! AND ENTER.
IF NOT, ENTER CORRECT STRING
(ENCLOSED IN QUOTES):
```

This gives you an opportunity to check and correct the coding line. Had you entered other information, the top line

would be different. Table 1 lists the valid combinations. When you enter the exclamation point and press ENTER, the computer writes the code line, clears the screen, and positions the cursor at the lower left, ready for you to write frame 1.

The computer writes the frames in sequence, with a code line after each frame. The only restrictions to the coding are:

- *Frame numbers of next frames must be larger than the number of the current frame.

- *All paths through the set of frames must end at the L frame.

After you have written all the frames, and are ready to respond to the request for the letter that designates the frame type, enter L for the last frame. The computer writes the code line, repeating it, if necessary, to fill the block. The computer then displays the message that tells you to turn off the recorder, and displays the DONE message.

Displaying the Frames

The load and run display driver to display the frames reads the cassette and displays the frames. It interprets the code line that follows each frame, repeating displays and scoring the answers as specified.

The program first displays the cassette instructions. Insert the cassette on which frame builder has written a set of frames, and follow the instructions. Display driver reads a block of five lines, checks for a code line, and stores each line until all five lines have been stored or a code line has been identified. When the computer gets to the code line, it displays the stored lines on the screen and interprets the code.

The I/O firmware in the computer displays a message telling you to turn off the recorder when there is a read error. This is followed by an error message. However, the program expects the frames in sequence, with a code line following each frame. When the computer reads a frame out of sequence, or display line where there should be a code line, it displays the following message:

```
FRAME SEQUENCE ERROR
Should this message be displayed, return the program to make another attempt to read the tape correctly. If the program fails again, run frame builder to write the tape again, carefully checking the contents of the code lines.
```

When the program displays a frame followed by a code line that starts with the letter A, the frame is an answer sequence frame. The computer displays the following request for an answer:

```
ENTER NUMBER OF ANSWER:
The computer resumes reading the tape, continuing until it finds the frame that corresponds to the answer. If you have entered zero or a negative number, the
```

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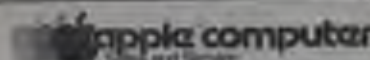
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CIRCLE 18 ON READER SERVICE CARD

Tutor, continued...

mini, line 70, as follows:
70 DIM L\$(23),A\$(10)

You can also leave out statements that are not required for a particular set of frames. For example, if none of the frames in the set is repeated or scored, the statements that compare answers may be omitted (lines 610-630, 810-881, 970-980).

Using Another Computer

Converting frame builder and display driver to run on another computer is not difficult; many of the statements will work as they are shown in the listings. The most important changes are the substrate calls.

Lines 100, 170, 690, and 2000 of Listing 1, and lines 110 and 1100 of Listing 2 are CALL CLEAR statements. They call a subroutine that clears the screen by displaying spaces in all character positions. Substitute the corresponding statement for your computer.

The CALL HCHAR statements display a character at a specified position on the screen, or specified number of identical characters beginning at a specified position. CALL HCHAR statements appear on lines 220, 280, 310, 440, 480, 490, 530, 640, 680, and 2010 of Listing 1. The first parameter is the line number; the second is the character number; and the third is a numeric variable or number that corresponds to the character code. When a fourth parameter is supplied, as on line 310 of Listing 1, it specifies the number of identical characters to display. Substitute a similar statement for your computer.

If your computer has a PRINT # statement, you can use it to replace one or more CALL HCHAR statements.

Subroutine GCHAR reads a character from a designated position on the screen. Listing 1 has CALL GCHAR statements on lines 560 and 200. The first parameter is the line number; the second is the character number; and the third is a numeric variable into which the computer places the code of the character. Replace these statements with similar statements for your computer.

The CALL KEY statement on line 3020 of Listing 1 reads a character from the keyboard. The first parameter is 0, which selects the keyboard. The second parameter is a numeric variable into which the computer places the code of the key you press. The third parameter is the numeric variable for the status code. The status code is zero when no key has been pressed, or $\neq 1$ when a key has been pressed. Use the corresponding substitution of your computer.

The CALL SCREEN statement, line 2030 of Listing 2, produces the colored backgrounds for the display. The value of the parameter selects the color of the

screen. If your computer has color, substitute a corresponding statement for your computer. If not, omit lines 2030 through 2040, and the GOSUB 2000 statement on line 192.

The CALL SCREEN statement, line 2030 of Listing 2, produces the colored backgrounds for the display. The value of the parameter selects the color of the screen. If your computer has color, substitute a corresponding statement for your

Listing 2

```

10 REM COMPUTER TUTOR
20 REM DISPLAY DRIVER
30 REM HARVEY M. TEMPLETON
40 REM 7902 LACY LAKE
50 REM AUSTIN TEXAS 75061
60 OPTS ON BRGELS
70 DIM L$(23),A$(10),IL(5),CLR(5)
80 N = 100
90 C = 2
100 F = 640 ORIZE
105 OPEN "PCSI": INPUT #1: LINE#192
110 CALL CLEAR
120 F = N = 100
140 GOSUB 2000
150 IF N = F THEN 190
160 IF (N > F) THEN 190
170 I = N - F
180 GOTO 140
190 T8 = 40
192 GOSUB 2000
195 FOR J = 1 TO 25
197 PRINT L$(J)
205 L$(J) = ""
240 NEXT J
245 IF = SEG$(F,1,1)
250 IF = "A" THEN 370
260 IF = "B" THEN 720
270 IF = "C" THEN 510
280 IF = "L" THEN 930
290 PRINT "FRAME SEQUENCE ERROR"
300 STOP
305 REM PROCESS 1 FRAME
310 F8 = SEG$(T8,2,3)
320 N = VAL(F8)
330 INPUT "PRESS ENTER"
335 N = N + 100
340 IF N = F THEN 110
350 GOSUB 2000
360 IF N = N THEN 1100:SETB0
365 REM PROCESS A FRAME
370 N = ""
380 X = F8 / (T8 / 10 + 2)
390 IF N = 0 THEN 510
400 N = N + SEG$(T8,1,2)
410 J = 1
420 M = 2
430 Y = F8 / (T8 / 10 + 1,1)
440 IF Y = 0 THEN 510
450 Z = Y - M
460 F8 = SEG$(F8,4,2)
470 WSC(J) = VAL(F8)
480 M = Y + 1
490 J = J + 1
500 GOTO 430
510 X = L$(T8) + 1
520 GOTO 410
530 Z = 0 - M
540 F8 = SEG$(T8,1,2)
550 WSC(J) = VAL(F8)

```

computer. If not, omit lines 2000 through 2040, and the GOSUB 2000 statement on line 193.

The OPTION BASIC statements on line 60 of each listing set the lower limit of all array subscripts to 1. The statements save a bit of memory, but can be omitted if your computer does not have a similar statement.

Probably many of the functions are the same on your computer. Function CHR\$

is a string function that returns the character corresponding to a numeric code. It is used in a statement on line 570 of Listing 1. Function LEN returns the length of a string. It is used in the statements on lines 850, 1090, 1100, and 1190 of Listing 1, and on lines 510 and 750 of Listing 2. Function SEG\$ is a string function that returns a designated portion of a string. The first parameter is the string variable name; the second parameter is the position of the first character the portion; and the third parameter is the length of the portion to be returned. SEG\$ is used in statements on line 860 of Listing 1 and lines 245, 310, 400, 460, 540, 740, 770, 800, 900, 970 of Listing 2.

Function ASC, used on line 370 of Listing 1, returns the code of the first character of the string. Function VAL appears on lines 320, 470, and 550 of Listing 2. It returns the numeric value of a string that represents a number. Function POS is not available on some computers, but a subroutine that does the same thing can be used. The function returns the number of the position of the first appearance of a character or string within a string. Specify the larger string as the first parameter, the smaller string as the second parameter, and the position of the character at which to begin as the third parameter. Function POS is used on lines 380 and 430 of Listing 2. Function STR\$ is used on line 620 of Listing 2; it returns the string that represents the value of a numeric variable. The familiar integer function, which returns the largest integer that is not greater than the parameter, is used on lines 1120 and 2000 of Listing 2. The RND function is also used on line 2000. It returns a random number between 0 and 1.

The other change you may want to make in the program is to a different screen size. The screen of the TI 99/4 displays 24 lines of 28 characters each. The size of arrays LS and LN (DIM statement, line 70, Listing 1) is 24, the number of lines on the screen. The statement on line 180 assigns the value of 24 to variable L2. Replace 24 in these statements with the number of lines on the screen of your computer. Several statements use the number 23, the number of lines minus one. These include an IF statement on line 330, a FOR TO statement on line 610, and an IF statement on line 940, all on Listing 1. In Listing 2, the size of array LS in the DIM statement on line 70 is 23. The value is also used in a FOR TO statement on line 195. Change these statements, replacing 23 with a value that is one less than the number of lines on the screen of your computer. Only one statement uses 28, the number of characters per line. It is a FOR TO statement on line 770 of Listing 1. Replace 28 with the number of characters on each line of your computer screen. □

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Slalom simulates a downhill ski race. It uses the high speed text scrolling capabilities of the Apple II. Slalom has been minimal down to quicken its execution time. The object of Slalom is to maneuver the skier represented by the Y's keeping him between the two poles. This is done by using paddle 0.

When you run the program, you will see HEIGHT/SIZE/ GATES appear at the top of the screen. You should then input three numbers: 1) HEIGHT—A number from 1 to 23, which represents the location of the skier and the time delay between gates; 2) SIZE—A number between 1 and 38, which dictates the width of the gate; 3) GATES—A number which tells how many gates are desired.

At the end of the program the computer tells you the number of gates missed or hit and the percentage of gates missed.

```
1 HOME: PRINT "HEIGHT/SIZE/GATES"; INPUT H,G,A;Z = 24-V = 2
  :FOR L = 1 TO A:X = INT (END (H) * (37-G)/V); VTAB Z
  :HTAB X: PRINT "T" = HTAB X + G: PRINT "T"
2 FOR K = 1 TO Z: H-Q = INT (FOL (H) / T); VTAB H: HTAB Q:
  PRINT "O"; VTAB Z: PRINT "NEXT"
3 IF ABS (Q - X - G - V) = G / V THEN VTAB Z - V: HTAB V +
  Q:P = F + 1: PRINT "BANG"
4 NEXT: PRINT "P" = "A INT (P * 100 / A) %": END
```

Slalom

Alfred J. Bruey

Alfred J. Bruey, 201 E. Chestnut St., Jackson, MO 64301

Bombproofing the PET INPUT Statement

Teddy Nadeau

Much has appeared in the PET literature recently concerning the advantages of using the GET command instead of the INPUT command in Basic programs.

The GET instruction is useful if, for some reason, you need to count characters as they are entered. But there is no reason to resort to the lengthy coding of the GET statement simply to keep from breaking out of the program by pressing the RETURN or STOP key. The INPUT statement is capable of handling this situation easily.

As an example, enter the following three Basic instructions:

```
10 INPUT "HOW MANY $S Δ---" : AS
20 IF AS = "Δ" THEN PRINT "T" : GOTO 10
30 PRINT AS: STOP
```

Δ = space
Δ = shifted space
r = cursor left
T = cursor up

Now run the program. Notice that nothing happens if you press the RETURN or STOP key. That's because when the RETURN key is pressed, the IF statement in line 20 sees a shifted space character and returns to line 10 for a different character. Note that this can be extended to characters other than the shifted blank. If, for example, you were asking a user to enter Y or N for a yes or no and you expected him to enter a Y normally, you could enter the line:

```
10 INPUT "ANSWER $S Y---" : AS
```

Then if the user presses the RETURN, the Y will be entered for him as the default value. Otherwise he can press N before he presses the RETURN key and the Y will be overwritten with the N.

I'm sure you'll find this easier to use than the GET statement in places where you want to protect the user from the RETURN key. □

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CIRCLE 134 ON READER SERVICE CARD

speed reading with the personal computer



One of the first things you learn in any speed reading course is that to become proficient you must practice: practice reading sentences and phrases as units rather than plodding along looking at each word individually. A common suggestion is to practice with a light novel in which actual content is not important. Don't worry about every detail; just try to see whole sentences as you move your hand down the page and never, but never, go back to re-read a sentence that you didn't quite get. At first you may understand little of what you see, but with practice your mind does begin to grasp phrases and sentences without stopping to read or, heaven forbid, say each word.

The following program, written in Atari Basic, does not constitute a speed reading course. Rather it is a tool which allows you to build up your speed gradually as it helps you begin to comprehend groups of words and entire sentences.

There are four basic options: single words, phrases, short sentences, and longer, complex sentences. With each option you choose the number of words per minute that will appear on the screen. If you are a verbalizer, that is if you say each word to yourself as you read, you will find that as you increase your speed in option 1 to five or six hundred words per minute you will understand single words but have no

Robert Wayne Smith

time to say them. This skill can be transferred to longer units as you progress to options 2, 3 and 4. If you are already a fast reader, you will still find option 4 challenging at 2500 words per minute. The ability to select the speed and the inability to go back and re-read a sentence make the computer an ideal reading tool.

The basic idea behind the program occurred to me after reading the Spring Army Demonstration in George Blank's "Outpost Atari" in the October 1981 issue of *Creative Computing*. The program uses a single string array, A\$, which contains nine sets of words and phrases chosen in such a way that a random selection from each set produces a sentence. As you might imagine, the sentences are sometimes a little peculiar, for example: "As the bold elephant meditated sleepily on the roof, Albert drank tea." Remember that content is of secondary importance.

The sentences are created via random choice from an address matrix, A1, which contains the location of every word in each set. Each of the nine sets contains 12 words or phrases, with a few repetitions, so that almost two million distinct sentences can be created. It would be very simple to increase the number of words in each set, or just to change them to suit your own preference.

Another simple modification is to vary the setcolor and color commands. I mention this because my black and white TV renders me color blind. You can change the display to dark letters on a light background by changing to "Setcolor 4,5,14." It may occur to experienced programmers that it would be possible to shorten the program by using a subroutine and a few conditional statements. There are several places where I have sacrificed elegance for speed.

The program controls the words per minute by leaving the display on for the time it takes the Atari to finish an empty "for next" loop (line 165 for option 4). A little statistical analysis indicates that there is a very strong relationship between the words per minute and the length of the delay. For the simplest sentences, which average 11 words, the relationship is given in line 37. To arrive at this equation, the real time clock described by George Blank in the September 1980 issue of *Creative Computing* was used to calculate the time it took to print 30 sentences using different delays. I have left the time in line 108 and lines 180-185 in case anyone wants to check. The required changes are:

```
110 For N=1 To 30
170 Next N
```

Of course, if you convert the program for another computer, you are on your own, but a stopwatch would probably be adequate to calculate words per minute. □

Robert Wayne Smith, Department of Mathematics, University of Puerto Rico, Mayaguez, Puerto Rico 00886.



the learning system.

BY SCOT KAMINS, Ph.D.

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The English SAT Tutorial was written by Eileen Shapiro, a specialist in tutorial education. Her work, teaching tutors more effective methods as well as her educational material, has been widely published. Myrna Helfand has been a creative, proficient teacher of U.S. Constitution and was concerned with more effective teaching methods for many years. The efforts of these two exceptional educators have made each program an exciting addition to our commitment to education in the Micro Lab Learning Center.

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CIRCLE 155 IN READER SERVICE CARD

Speed Reading Program

```

1 REM *****
2 REM BY R.M. SMITH OCT. 1980
3 REM *****
4 DIM A$(50),AL(2,15),R$(25)
5 A$=" "
6 GRAPHICS 1:SETCOLOR 1,0,14:COLOR 0
7 ? "SPEED READING"
8 ? "*****"
9 ? "SPEED READING"
10 ? "*****"
11 ? "TO PRACTICE WITH "
12 ? "WORDS.....(TYPE 1)"
13 ? "PHRASES.....(TYPE 2)"
14 ? "SHORT SENTENCES.....(TYPE 3)"
15 ? "SENTENCES.....(TYPE 4)"
16 ? "THEN CHOOSE M.P.R."
17 ? "M"
18 ? "WORDS 50..600"
19 ? "PHRASES 50..1200"
20 ? "SHORT SENT. 50..1450"
21 ? "SENTENCES 50..2500"
22 PRINT "WHICH OPTION "
23 INPUT D
24 PRINT "M.P.R. "
25 INPUT M
26 IF D=1 THEN DELAY=5370/M-7.2
27 IF D=2 THEN DELAY=10976.8/M-7
28 IF D=3 THEN DELAY=10983.5/M-11.5
29 IF D=4 THEN DELAY=12000.7/M-50.7
30 DELAY=INT(DELAY)
31 FOR I=1 TO 4
32 FOR N=1 TO 12
33 AL(I,N)=LEN(A$)+1
34 READ R$
35 A$(I,N)=R$
36 NEXT N
37 AL(I,13)=AL(I,12)+LEN(R$)
38 NEXT I
39 R1=1:R2=2:R3=3:R4=4
40 R5=5:R6=6:R7=7:R8=8
41 POKE 28,0:POKE 19,0:POKE 10,0
42 ON 0 GOTO 300,400,200,100
43 REM PRINT SENTENCES
44 GRAPHICS 2:16:SETCOLOR 1,0,14
45 COLOR 0
46 IF POS<0 THEN POS=POS+2
47 IF POS>0 THEN POS=0
48 POSITION 0,POS
49 FOR T=1 TO DELAY:NEXT T
50 R1=INT(RND(4)*12+1)
51 R2=INT(RND(4)*12+1)
52 IF R2=7 THEN R2=5
53 ? A$(R1,1),A$(R2,1),A$(R1+1,1),A$(R2+1,1)
54 FOR T=1 TO DELAY:NEXT T
55 GOTO 300
56 REM PRINT PHRASES
57 GRAPHICS 2:16:SETCOLOR 1,0,14
58 COLOR 0
59 IF POS<0 THEN POS=POS+2
60 IF POS>0 THEN POS=0
61 POSITION 0,POS
62 FOR T=1 TO DELAY:NEXT T
63 R1=INT(RND(5)*12+1)
64 IF R1=6 THEN R1=5
65 IF R1=3 THEN R1=4
66 ? A$(R1,1),A$(R2,1),A$(R1+1,1),A$(R2+1,1)
67 ? A$(R1,2),A$(R2,2),A$(R1+1,2),A$(R2+1,2)
68 GOTO 400
69 ? A$(R1,3),A$(R2,3),A$(R1+1,3),A$(R2+1,3)
70 ? A$(R1,4),A$(R2,4),A$(R1+1,4),A$(R2+1,4)
71 GOTO 400
72 DATA AS,WHEN,WHILE,UNTIL,ALTHOUGH
73 DATA BECAUSE,SINCE,EVEN THOUGH,AS
74 DATA JUST AS,SINCE,WHEN
75 REM
76 DATA THE,A,THIS,THAT,THE,A,THIS
77 DATA THAT,THE,A,THIS,THAT

```

534 REN
535 DATA SMART, SKINNY, HENRY, GOOD
540 DATA FAT, HUNGRY, BALD, DIRTY, BLOW
545 DATA FISHY, CREAMY, SLY
550 REN
555 DATA STUBBENT, BOY, GOOD, CAT, DANCER
560 DATA BAKER, HOPKIN, ELEPHANT, MAN
565 DATA TEACHER, MORAN, GROUP
570 REN
575 DATA HALVED, LORDED, MNOTE
580 DATA JUMPED, PAR, TALKED
585 DATA SANG, MIDDLE, HORRED
590 DATA SHEPPED, HEDTATER, DRAVE
595 REN
600 DATA CALMLY, RECEPTIONALLY, BLUMLY
610 DATA SADLY, HAVILY, RAPIDLY
615 DATA CAUTIONBLT, STEADILY, OPENLY
620 DATA QUIETLY, IMPULSIVELY, CAREFULLY
625 REN
630 DATA UNDER THE TREE, WITH A FRIEND
635 DATA IN THE LIBRARY, ON THE BED
640 DATA OVER THE HILL, NEAR THE HOUSE
645 DATA TO AN AUDIENCE, FOR A DOLLAR
650 DATA IN A CORNER, IN THE FLOOR
655 DATA IN THE KITCHEN, ON THE HOO
660 REN
665 DATA HE, SHE, IT, THEY, ME, YOU, BOTH
670 DATA HARRY, ALBERT, DUE, HELL, Y
675 REN
680 DATA HEARD, YELLED, SAT, DOWN, CAME
685 DATA RAN AWAY, COMPLETED, LAUGHED
690 DATA STOPPED, BEARD, TEA, CHOKED
695 DATA LEFT, SHELLED

CLASS OF '82... BOOT UP!

ASSISTANT PRINCIPAL - Should you be small for a big computer or if you're a little big you should have a little more of the "Assistant Principal" in you. What you need is a little more of the "Assistant Principal" in you. What you need is a little more of the "Assistant Principal" in you. What you need is a little more of the "Assistant Principal" in you.

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They took the problem of averaging class grades and showed how a simple program could be written to do this job.

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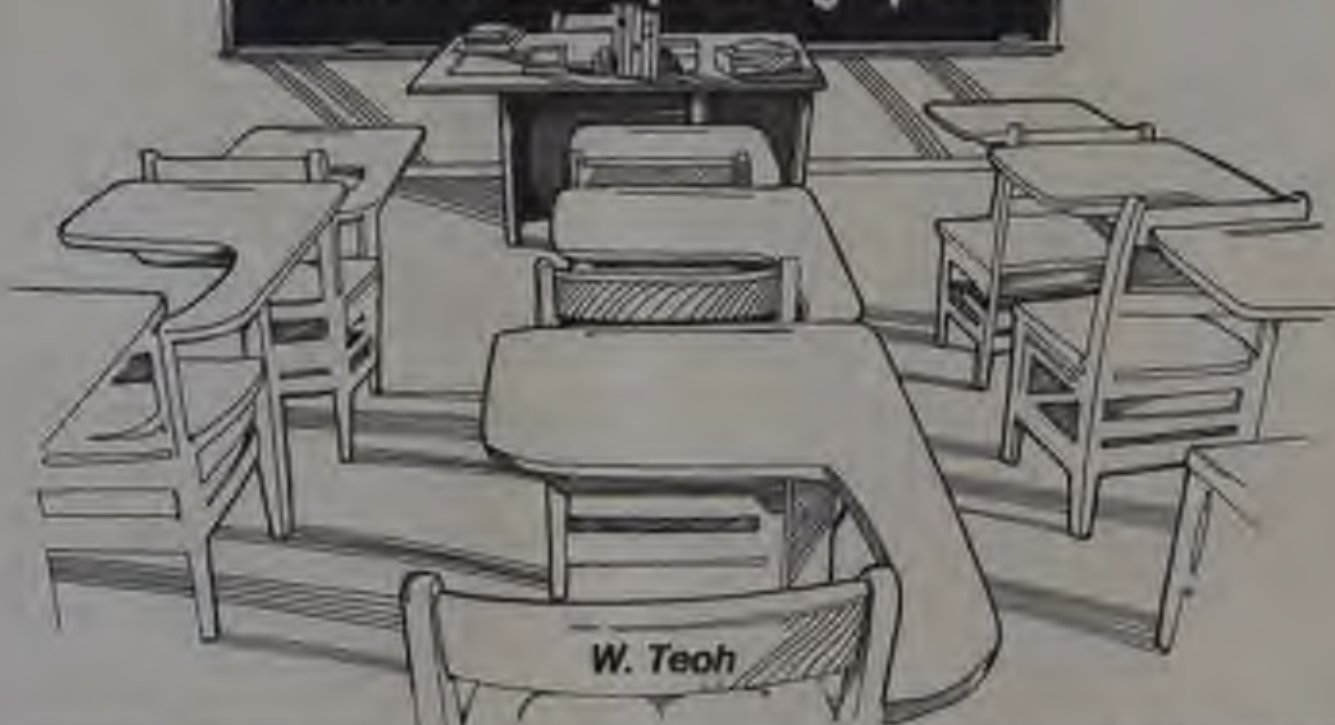
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GRADES: a class record updating system



As microcomputers become more affordable, it has become quite common to find them in schools, colleges and homes. It is obvious to a teacher that a computer can take over many routine chores. Maintaining and updating students' grades is a classic example in a task that can be easily handled with the help of a microcomputer.

A program to achieve this task must have the usual capability to enter, update, list, change or delete grades. In addition, it must be able to handle records where the number of students may fluctuate, as in adult education or introductory courses where the drop-out rate may be high.

A flexible program should allow an instructor to enter his subject title (by subject title I mean any homework, quiz, test, project or exam that is an integral part of a course). The program should also be able to produce a final grade for each student based on the weighted mean (as chosen by the user) of all the scores of all subjects. Finally, it should be able to display some of the information (such as the class average of a subject) graphically, and to produce hard copies if a printer is available.

Grades is a class record updating system

that performs all these functions. It is written in Basic in conversation mode; whenever input is required from the keyboard, the computer first prints a suitable message, and then waits for the user's response. The minimum system required to run Grades consists of a 48K Apple II Plus (or Apple II with AppleSoft in ROM) and a single disk drive. A printer is optional.

Available Functions

When the program is loaded and executed, Grades first requests the course

name. One can enter a course designation such as CIS-118, or HISTORY or whatever is suitable. The user is then presented with the main menu as shown in Figure 1, where a code is displayed with the corresponding function.

If this is a new course, one should respond with a 0 (for utilities) at which point one is presented with a utility menu as shown in Figure 2. The Initialize utility (code 1) allows the program to perform the necessary initialization, after which the user is asked to enter the class list (names of the students in this course).

Figure 1. Grades Program.

CODE	UTILITY
0	RETURN
1	INITIALIZE
2	COPY DATA FILES
3	NAME CHANGE
4	SUBJECT CHANGE
5	SUBJECT SORT
6	DELETE SUBJECT
7	DELETE COURSE

ENTER CODE -

Figure 2. Utilities

COURSE -	
CODE	FUNCTION
0	UTILITIES
1	ADD STUDENT
2	DELETE STUDENT
3	ENTER GRADE
4	CHANGE GRADE
5	LIST GRADE
6	FINAL GRADE
7	CLASS AVERAGE
8	CLASS LIST
9	EXIT PROGRAM

ENTER CODE -

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Grades, continued...

It is not necessary to enter the names in alphabetical order, as a bubble sort is automatically carried out when the list is completed (that is, when the user enters a ZZZ for a student's name).

The program then returns to the main menu to allow the user to choose another function. A short description of each of the available functions is presented below:

1. Utilities (code 0). This function allows one to use any of the available utilities.
2. Add Student (code 1). This allows one to add one or more students to an existing class list. Grades repeatedly asks for the name of a student to be added. Entering ZZZ terminates this mode, at which time, a bubble sort is invoked, so that the class list is always stored in alphabetical order.
3. Delete Student (code 2). This allows the user to delete one or more students from the existing class list. One also enters ZZZ to terminate.
4. Enter Grade (code 3). When this function is invoked, the program will ask the user to enter the subject title, such as HW-1, QZ-2 and so on. One could easily use any other subject designation. Grades then displays each student's name, in alphabetical order, and waits for the user to enter the grades in this subject.
- It should be noted that a student may not have a grade for this subject due to illness or be otherwise excused. In this event, a -1 should be used for his grade. A grade of -1 is ignored in the weighted average, so that the student will not be penalized. When the name list is exhausted, the routine then asks if the user wishes to process another subject. If the answer is yes (actually, a Y will do), the process is repeated.
5. Change Grade (code 4). This allows one to change the grade of any student in any subject in a course.
6. List Grade (code 5). This allows one to examine the grades of each student, either collectively or individually. When operated in the Class mode, the grades of all existing subjects of each student are displayed. The user must use the Return key to display each student's grades. When operated in the Individual mode, the user must supply the first few letters of the student's name; the full name is not necessary. That particular student's grades will be displayed. One again enters ZZZ to terminate.
7. Final Grade (code 6). This allows one to calculate the weighted mean of all the scores in all subjects for each student. The user will be asked to supply the weights for each subject. To tailor the program to our needs here at Purdue, the routine also contains a feature which converts the weighted average into letter grades (A, B, C, D and F) according to the standards defined by the user.

All the information is displayed on the screen, and a histogram of the grade distribution in low resolution graphics (see last section) is displayed. One can operate in either Class or Individual mode.

8. Class Average (code 7). This determines the class average and standard deviation of any subject. A histogram may be displayed, if the user wants it, to show the grade distribution.

9. Class List (code 8). This displays the class list in alphabetical order.

10. Exit (code 9). This allows the user to exit the program, and is the recommended manner to exit Grades, for the simple reason that if any of the records in the current course have been modified in any way, an updated version of the files will be put on the diskette before termination. An updated version of the files will not be written on the diskette if the records have not been altered. If a CTRL-C is used to exit Grades instead, all the updated information will be lost.

5. Subject Change (code 4) allows one to change the subject title.

6. Subject Sort (code 5) allows one to perform an alphanumeric sort on the subject title. This feature is particularly useful if the subject titles are designated as HW-1, HW-3, QZ-2 and so on, and the grades have been entered in different times of the semester. This utility will allow one to arrange the subjects in sequence to produce an organized report.

7. Delete Subject (code 6) allows one to delete a specific subject from the course. This feature allows one to administer a test, for example, which does not count towards the final grade. One could achieve the same end, of course, by assigning a zero weight for this subject.

8. Delete Course (code 7) allows one to delete a course from a diskette. This may become necessary if the record for a given course is no longer needed, but the disk space is required for another course. One only needs to supply the course designation to have the corresponding files deleted.

Conclusion

Grades can handle up to 50 students in a given course of up to 20 subjects. Some 25 sectors are required on the diskette for each course. Thus, on a 5 1/4" diskette, a total of 17 courses can be accommodated. It should be noted that the program itself occupies about 46 sectors.

The program is extremely easy to use. Whenever the program requests a student's name, one can enter the full name or the first few characters, or ZZZ to terminate. A question should always be answered with a yes or no. Whenever the symbol < appears on the screen, it means that the system is waiting for the user to enter a Return to continue.

This feature is included to allow one to proceed at one's own pace. Whenever a histogram is displayed in low resolution graphics, the X-scale is also displayed. Moreover, one can enter a magnification factor to either expand or shrink the Y-scale to produce an optimum display. A magnification factor of zero allows one to exit the graphics mode, and return to the main menu.

Grades has been successfully used by the author for all courses taught in the past two years. Its value lies in its ability to evaluate the class or student's performance rapidly based on the scores obtained in tests, quizzes, exams or homework assignments completed. Further information regarding Grades may be obtained from the author. □

"The object of education is to prepare the young to fulfill themselves throughout their lives."

Robert Maynard Hutchins

**Grades has been
successfully used by
the author for all
courses taught in the
past two years.**

It should be noted that for the List Grade, Final Grade and Class Average modes, one has the option of requesting hard copies. In this event, it is assumed that a printer exists and that the printer control board is plugged into slot #3.

Utilities

The following paragraphs very briefly describe the various utilities available to supplement the functions described in the previous section:

1. Return (code 0) allows one to return to the main menu.
2. Initialize (code 1) allows one to perform the necessary initialization for a new course as discussed previously.
3. Copy Data Files (code 2) allows one to make backup copies of the files of a course on another diskette. Note that a second drive is not necessary, as the routine will inform the user when to insert the correct diskette.
4. Name Change (code 3) allows one to change the name of one or more students in a course.

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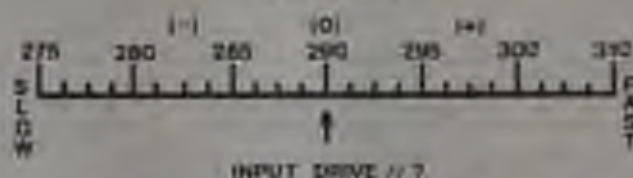
Grades, continued...

```

10 DIM SPS(10), SNA(20), SD(70, 20), ST(20), A(20)
20 DA = CHR$(41104) + 0: HOME = VPOS: G
30 PU = 0
40 PRINT TAB(5): "GRADE PROGRAM": PRINT: PRINT: PRINT
50 INPUT "GRADE: " : IF
60 GOSUB A170
70 HOME = VPOS: G
80 IF PU = 1 THEN GOSUB 1000
90 PRINT "CODE": TAB(20): "FUNCTION": PRINT
100 PRINT "0": TAB(15): "UTILITIES": PRINT
110 PRINT "1": TAB(15): "ADD STUDENT": PRINT
120 PRINT "2": TAB(15): "DELETE STUDENT": PRINT
130 PRINT "3": TAB(15): "ENTER GRADE": PRINT
140 PRINT "4": TAB(15): "GRADE CARD": PRINT
150 PRINT "5": TAB(15): "LIST GRADE": PRINT
160 PRINT "6": TAB(15): "FINAL GRADE": PRINT
170 PRINT "7": TAB(15): "GRADE AVERAGE": PRINT
180 PRINT "8": TAB(15): "GRADE LIST": PRINT
190 PRINT "9": TAB(15): "EXIT PROGRAM": PRINT
200 PRINT: INPUT "ENTER CODE: " : IC
210 ON IC GOTO 230, 270, 200, 200, 200, 1000, 1230, 1070, 1000
220 IF IC = 9 OR IC = 0 THEN G0
230 GOSUB 1010
240 GOTO 60
250 REM --- ADD STUDENT ROUTINE
260 IF SA = 0 THEN GOSUB 1000
270 HOME = VPOS: G: PRINT " --- ADD NAME ---"
280 PRINT: PRINT: PRINT
290 INPUT "NAME: " : NA
300 IF DA = "ZZZ" THEN G0
310 NA = NA + 1
320 SPS(NA) = DA
330 GOTO 250
340 SD(0, 0) = NA
350 SD(0, 1) = ZZ
360 GOSUB 1040
370 DA = 0
380 GOTO 60
390 REM --- DELETE STUDENT ROUTINE
400 IF SA = 0 THEN GOSUB 1000
410 HOME = VPOS: G: PRINT " --- DELETE NAME ---"
420 PRINT: PRINT: PRINT

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R.P.M.



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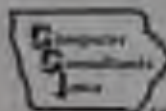
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CIRCLE 217 ON READER SERVICE CARD


```

2868 INPUT = B GRADE - "B1111" PRINT
2878 INPUT = B GRADE - "B1121" PRINT
2888 INPUT = C GRADE - "C1111" PRINT
2898 INPUT = C GRADE - "C1121" PRINT
2908 RETURN

```

```

2918 REM --- FINAL GRADE SUBROUTINE
2928 TS = B112 = B
2938 FOR J = 1 TO 11
2948 IF B112(J) = -1 THEN S1 = S1 + X1(J) GOTO 2968
2958 TS = TS + B111(J) * X1(J)
2968 NEXT J
2978 FD = TS / 100
2988 IF S1 > 0 THEN FD = FD + 100 / 100 = S1
2998 FD = INT (FD + 100 + 0.5) / 100
3008 PRINT "PRINT" PRINT
3018 PRINT "PRINT" PRINT
3028 S112 = FD
3038 RETURN

```

```

3048 REM --- HISTOGRAM SUBROUTINE
3058 HD = 1
3068 FOR I = 1 TO 30000: B1 = NEXT I
3078 FOR I = 1 TO 100
3088 B1 = B1(J)
3098 FU = 0
3108 FOR K = 1 TO 10
3118 LL = 10 - K = 1
3128 IF B1 = -1 THEN 3148
3138 IF B1 = K THEN FU = FU + 1
3148 FU = FU + 1
3158 NEXT K
3168 NEXT I
3178 HOME: VWR: B1: B1: COLOR = B
3188 F = 2000 = B
3198 FOR J = 1 TO 10
3208 AC = 10 = 1
3218 IF AC > 10 THEN AC = 1
3228 COLOR = AC
3238 PP = 10 - H11 = 10
3248 IF PP = 10 THEN F = F + 1 GOTO 3268
3258 IF PP < 10 THEN PP = 0
3268 VLN 20, PP AT F
3278 F = F + 1
3288 VLN 20, PP AT F
3298 F = F + 1
3308 NEXT I
3318 PRINT "10 20 30 40 50 60 70 80 90" PRINT
3328 INPUT "HISTOGRAM FACTOR" F110
3338 IF F110 > 0 THEN 3358
3348 TEXT: HOME
3358 RETURN

```

```

3368 REM --- NAME SORT SUBROUTINE
3378 HOME: VWR: B1: F110: PRINT "SORTING" NAME
3388 F = 100 = 1
3398 IF B111(1) = B111(2) THEN 3418
3408 TS = B111(1)
3418 B111(1) = B111(2) + 1
3428 B111(2) = TS
3438 FOR J = 1 TO 10
3448 H1(J) = B111(J)
3458 B111(J) = B111(J) + 1
3468 B111(J) = H1(J)
3478 NEXT J
3488 F = 1
3498 I = 1 + 1
3508 IF I > 10 THEN 3528
3518 IF F = 1 THEN 3528
3528 RETURN

```

```

3538 REM --- LETTER GRADE CONVERSION SUBROUTINE
3548 PRINT "PRINT" PRINT "PRINT" PRINT
3558 IF FD = 1 THEN H111 = H111 + 1 PRINT "H111" GOTO 3568
3568 IF FD = 1 THEN H111 = H111 + 1 PRINT "H111" GOTO 3568
3578 IF FD = 1 THEN H111 = H111 + 1 PRINT "H111" GOTO 3568
3588 IF FD = 1 THEN H111 = H111 + 1 PRINT "H111" GOTO 3568
3598 PRINT "H111" PRINT
3608 RETURN

```

```

3618 REM --- UTILITY SUBROUTINE
3628 HOME: VWR: B1: PRINT "UTILITY" PRINT
3638 PRINT "UTILITY" PRINT
3648 PRINT "UTILITY" PRINT
3658 PRINT "UTILITY" PRINT
3668 PRINT "UTILITY" PRINT
3678 PRINT "UTILITY" PRINT

```

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CIRCLE 267 ON READER SERVICE CARD



Grades, continued...

```

3670 PRINT = 4 * TAB(15) "SUBJECT CHOICE" + PRINT
3675 PRINT = 5 * TAB(15) "SUBJECT SORT" + PRINT
3675 PRINT = 6 * TAB(15) "DELETE SUBJECT" + PRINT
3675 PRINT = 7 * TAB(15) "DELETE COURSE" + PRINT
3680 INPUT "ENTER LOGS: " TC
3690 ON C (COURSE) GOTO 3710, 3820, 4110, 4200, 4700, 4800, 5100
3700 RETURN

3710 REM --- INITIALIZE ON SUBROUTINE
3720 HOME + VTRB 61 PRINT "INITIALIZATION"
3730 FOR J = 0 TO 20
3740 SUB(J) = "XXX"
3750 FOR I = 0 TO 70
3760 SUB(I, J) = -1
3770 NEXT I
3780 NEXT J
3790 FOR I = 0 TO 70
3800 NAME(I) = "XXX"
3810 NEXT I
3820 HOME + VTRB 61 PRINT "INITIAL ENTRY OF CLASS LIST"
3830 RM = 0
3840 INPUT "NAME --- " NM
3850 IF NM = "ZZZ" THEN GOTO
3860 NM = NM + "XXXXXXXX"
3870 GOTO 3840
3880 SUB(R, 0) = NAME(R, 0)
3890 LOGS(R, 0) = NAME(R, 0)
3900 RM = RM + 1 FORUB 2100
3910 RETURN

3920 REM --- COPY DATA FILE SUBROUTINE
3930 HOME + VTRB 61 PRINT "COPY DATA FILE NAME"
3940 PRINT
3950 GNR = FN
3960 INPUT "ENTER COURSE --- " FC
3970 GNRAB 4170
3980 PRINT + PRINT "INSERT DISKETTE" + PRINT
3990 GNRAB 4210
4000 INPUT "PRESS RETURN TO READ FILE " NM
4010 GNRAB 4200
4020 HOME + VTRB 61 PRINT "INSERT DISKETTE"
4030 GNRAB 4210
4040 INPUT "PRESS RETURN TO START COPY FILE" NM
4050 GNRAB 2100
4060 INPUT "WHETHER COPY OF SAME FILE Y/N" NM
4070 IF NM = "Y" THEN GOTO
4080 INPUT "WHETHER COURSE Y/N" NM
4090 IF NM = "Y" THEN GOTO
4100 FN = GNR
4110 GNRAB 4170
4120 RETURN

4130 REM --- NAME CHANGE SUBROUTINE
4140 IF NM = 0 THEN LOGS LOGS
4150 HOME + VTRB 61 PRINT "NAME CHANGE NAME"
4160 PRINT + PRINT
4170 GNRAB 4200
4180 IF NM = "ZZZ" THEN GOTO
4190 PRINT "OLD NAME IS: " NAME(11)
4200 INPUT "NEW NAME IS: " NAME(11)
4210 GOTO 4170
4220 NM = 2
4230 RETURN

4240 REM --- SET FILE NAMES SUBROUTINE
4250 NM = "Z" + FN
4260 NM = "Z" + FN
4270 RETURN

4280 REM --- LIST OVERLAP SUBROUTINE
4290 PRINT + PRINT
4300 INPUT "WANT TO SEE CATALOG Y/N" NM
4310 IF NM = "Y" THEN GOTO
4320 HOME
4330 PRINT NM "CATALOG"
4340 INPUT " " NM
4350 RETURN

4360 REM --- FINAL STATISTICS SUBROUTINE
4370 HOME + VTRB 61 PRINT "FINAL STATISTICS"
4380 PRINT + PRINT
4390 PRINT "GRADE" + TAB(15) "NUMBER"
4400 PRINT " "
4410 PRINT = 4 * TAB(15) "151" + PRINT
4420 PRINT = 5 * TAB(15) "151" + PRINT
4430 PRINT = 6 * TAB(15) "151" + PRINT
4440 PRINT = 7 * TAB(15) "151" + PRINT

```

```

4390 PRINT "F" TRM (511H155) PRINT
4400 H1205 = H(15) * H(15) + H(17) * H(18) + H(19)
4410 PRINT " "
4420 PRINT "TOTAL" TRM (511H1205) PRINT " "
4430 INPUT " "
4440 IF ON = "ZZZ" THEN G0
4450 RETURN

```

```

4500 REM --- SUBJECT CHANGE SUBROUTINE
4510 IF ON = 0 THEN GOSUB 1000
4520 HOME : VTRM 0
4530 PRINT "SUBJECT CHANGE MODE ---"
4540 GOSUB 1050
4550 INPUT "ENTER CODE " C
4560 HOME : VTRM 0
4570 PRINT C; SUBJ(1) PRINT " "
4580 INPUT "ENTER CORRECT NAME TITLE" HSN(C)
4590 HOME : VTRM 0 : PRINT C; SUBJ(C) : VTRM 10
4600 SW = 2
4610 INPUT "DOY MORE CHANGES ? " XN
4620 IF ON = "Y" THEN G000
4630 RETURN

```

```

4700 REM --- SUBJECT SORT UTILITY
4710 IF ON = 0 THEN GOSUB 1000
4720 HOME : VTRM 0
4730 PRINT "SUBJECT SORT UTILITY"
4740 VTRM 10 : FLASH 1 PRINT "PLEASE BE PATIENT" : NORMAL
4750 P = 22 - 1
4760 P = 0
4770 FOR J = 1 TO P
4780 IF SUBJ(J) < SUBJ(J+1) THEN SWAP
4790 P = 1
4800 TR = SUBJ(J) : SUBJ(J) = SUBJ(J+1) : SUBJ(J+1) = TR
4810 FOR I = 1 TO 100
4820 PD = SUBJ(J) : SUBJ(J) = SUBJ(J+1) : SUBJ(J+1) = PD
4830 NEXT I
4840 NEXT J
4850 P = P - 1
4860 IF P = 1 THEN G700
4870 SW = 2
4880 RETURN

```

```

4900 REM
4910 REM --- DELETE SUBJECT UTILITY
4920 REM
4930 IF ON = 0 THEN GOSUB 1000
4940 HOME : VTRM 0 : PRINT "DELETE SUBJECT UTILITY ---"
4950 GOSUB 1050 : INPUT "ENTER CODE " C
4960 HOME : VTRM 0 : PRINT "DELETING " HSN(C)
4970 P = 22 - 1
4980 FOR J = 0 TO P : SUBJ(J) = SUBJ(J+1)
4990 FOR I = 1 TO 100 : SUBJ(I) = SUBJ(I+1)
5000 NEXT I : NEXT J
5010 P = P - 1
5020 VTRM 10 : INPUT "ENTER SUBJECT " XN
5030 IF ON = "Y" THEN G940
5040 RETURN

```

```

5100 REM
5110 REM --- DELETE COURSE UTILITY
5120 REM
5130 HOME : VTRM 0 : INPUT "COURSE TO BE DELETED " XN
5140 VTRM 10 : FLASH 1 INPUT "ARE YOU SURE ? " YN : NORMAL
5150 IF ON = "Y" THEN G100
5160 GOSUB 1050
5170 PRINT ON : "DELETE " XN
5180 PRINT ON : "DELETE " XN
5190 PRINT ON : "DELETE " XN
5200 INPUT "DOY MORE ? " XN
5210 IF ON = "Y" THEN G130
5220 RETURN

```

```

5300 REM --- PRINTER IN SUBROUTINE
5310 PRM 0
5320 PRINT CHR$(51) "END"
5330 PRINT CHR$(9) " "
5340 PRINT CHR$(27) : CHR$(10)
5350 PRINT CHR$(10)
5360 PRINT " "
5370 RETURN

```

```

5400 REM --- PRINTER OFF ROUTINE
5410 PRM 0
5420 RETURN

```

```

5700 REM --- PRINTER MODE
5710 PRINT " "
5720 INPUT "HOWD COPY ? " XN
5730 IF XN = "Y" THEN PD = 1 : GOSUB 1000
5740 RETURN

```

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Wasps and The Impossible Elevator

Michael Orlove

The two programs described here demonstrate two interesting topics in genetics. In the program *Wasps*, the concepts of "altruism" genes and "selfishness" genes are introduced. An altruism gene is any gene which enables, allows, predisposes or causes an animal to give up its own reproduction, survival or parental care in order to augment the reproductive, parental caring, or survival-oriented activities of someone else.

This is not exactly the same thing as "altruism" in the original sense of the word; perhaps the word "beneficence," which means "having good effects on others," would be more appropriate. "Altruism" in the original sense is equivalent

to "benevolence," which means "having the will or conscious intention to do good for others." We are, however, stuck with the historical precedent of the use of the word "altruism" in the biological literature.

To read more about it, see Dawkins 1976 and Hamilton 1964. To read about altruism in polistes wasps, see West-Eberhard (1967, 1969), and a forthcoming article by Joan Strassmann (in press).

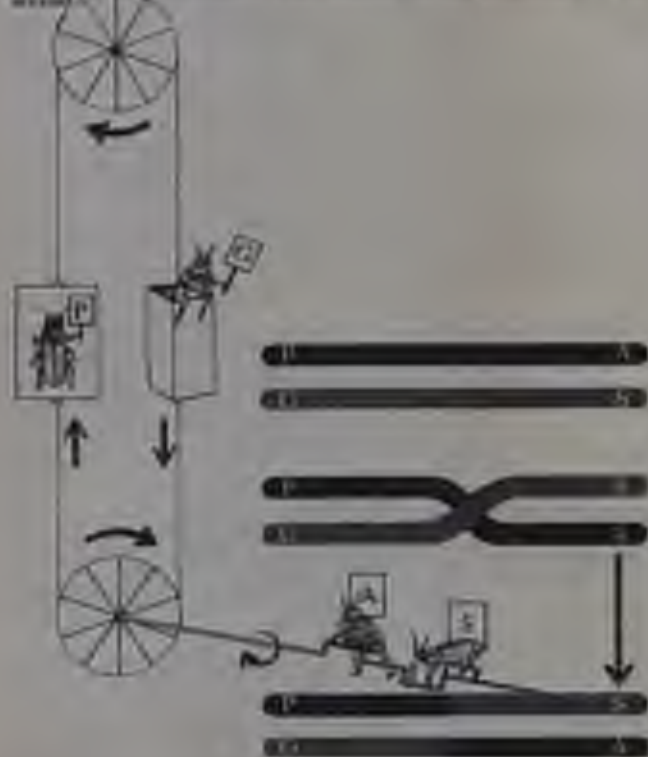
The Impossible Elevator

The Elevator Effect is a phenomenon in evolutionary genetics. It sounds as impossible as the perpetual motion machine, but it really works. The basic process of natural selection occurs when a gene increases in its relative abundance as

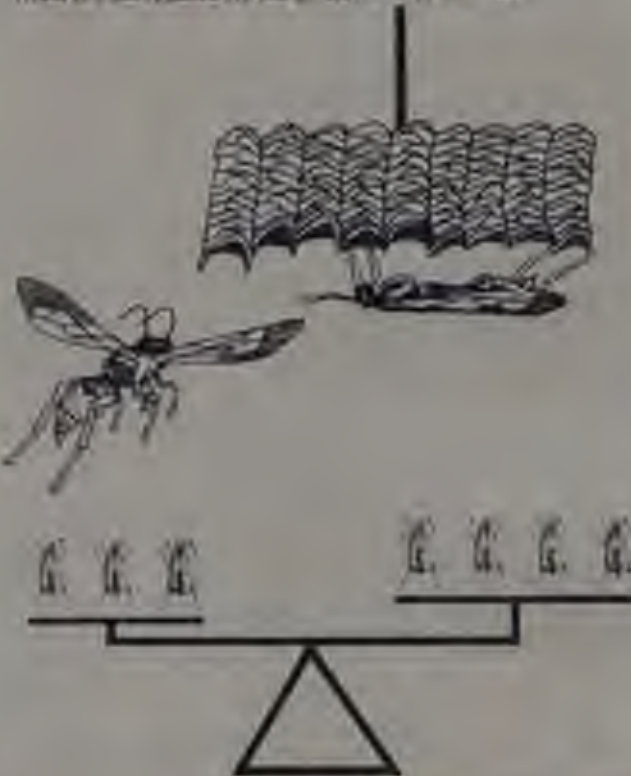
compared to its alternatives; e.g. green eyes becoming commoner while blue eyes and brown eyes become rarer. An increase of this kind is called an increase in gene frequency. Such increases usually occur due to selection, i.e. when one gene makes the animal fitter in some way. Increases also occur when a useless gene is located next to a useful one. If a gene for purple eyelashes was located on the same chromosome next to a gene for immunity to measles, the purple gene would get a free ride. This is called hitchhiking. Both the rider and the gene providing the ride increase. The elevator effect occurs when the useless gene gets a free ride up (like an elevator car) and its alternative goes down in frequency (like the counterweight) and the gene providing the impulse (like

Michael Orlove, Dept. of Biology, Case Western Reserve University, Cleveland, OH 44106.

The "Impossible" Elevator. (Time required for one generation = 100 seconds.)



WASPS. Time required for one generation = 30 seconds.)



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CIRCLE 276 ON READER SERVICE CARD

Elevator, continued...

(the motor) goes nowhere (stays at the same frequency).

The program simulates a population of beetles. In one position on the chromosome is a gene which makes a beetle spend its life rearing twenty nieces and nephews. The alternative gene makes the beetle raise ten of its own kids instead. Since nieces are half as expensive to raise, and also half as related to the rearer, both strategies are equally fit.

Located on the same chromosome is another position with the green-wing gene or the purple-wing gene. Initially, all chromosomes with niece-rearer genes have purple-wing genes and all chromosomes with offspring-rearer genes have green-wing genes. This relationship fades as time passes due to genes crossing over between chromosomes. Thus more and more chromosomes are found each generation with green and niece-rearing or purple and kid-rearing. Although no gene in this model is more useful than any other, the purple gene increases at the expense of the green. The niece-rearing and offspring-rearing genes stay at the same frequencies.

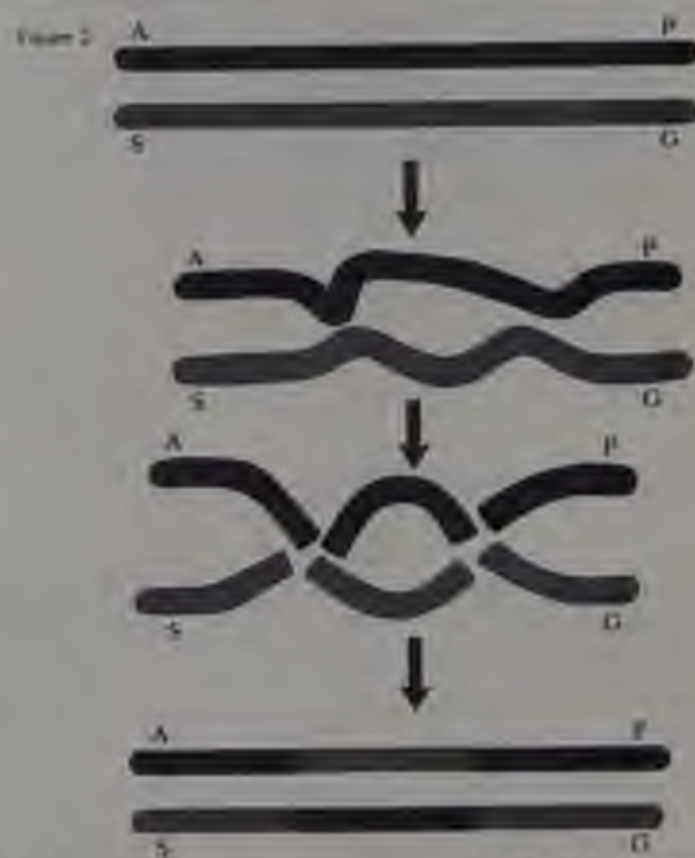
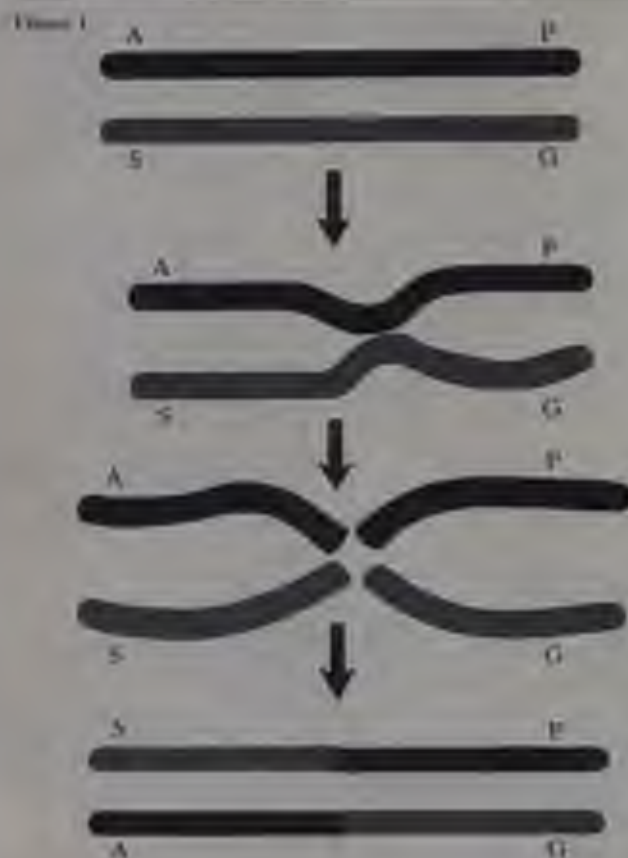
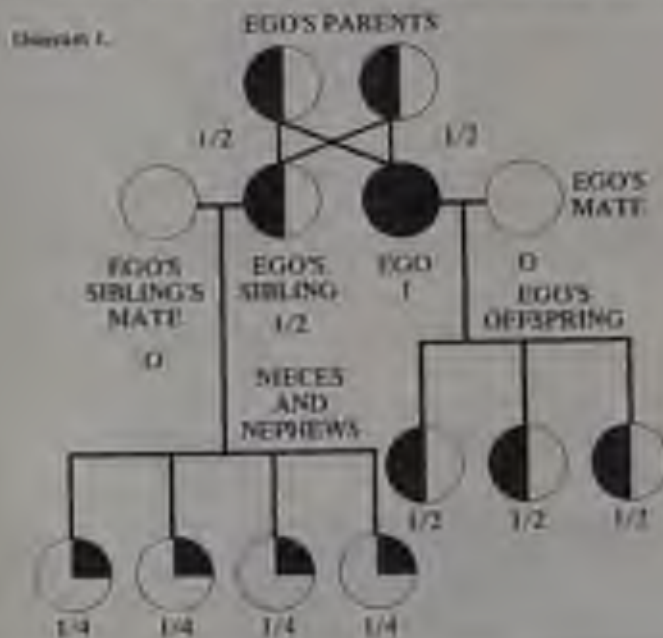
The proof of this effect is given in a paper in the *Journal of Theoretical Biology* (vol. 90 p. 83-100). To fully appreciate the program, it helps (but isn't necessary) to understand how genes cross over between chromosomes. They do not do it like people crossing the street, but by chromosomes exchanging whole segments

with one another as in Figures 1 and 2. The places where chromosomes reach to be cut and spliced are called chiasmata. Figure 1 shows that an odd number of chiasmata between two chromosomal portions is successful. Figure 2 illustrates how an even number of chiasmata cancel each other out, rather like a double negative.

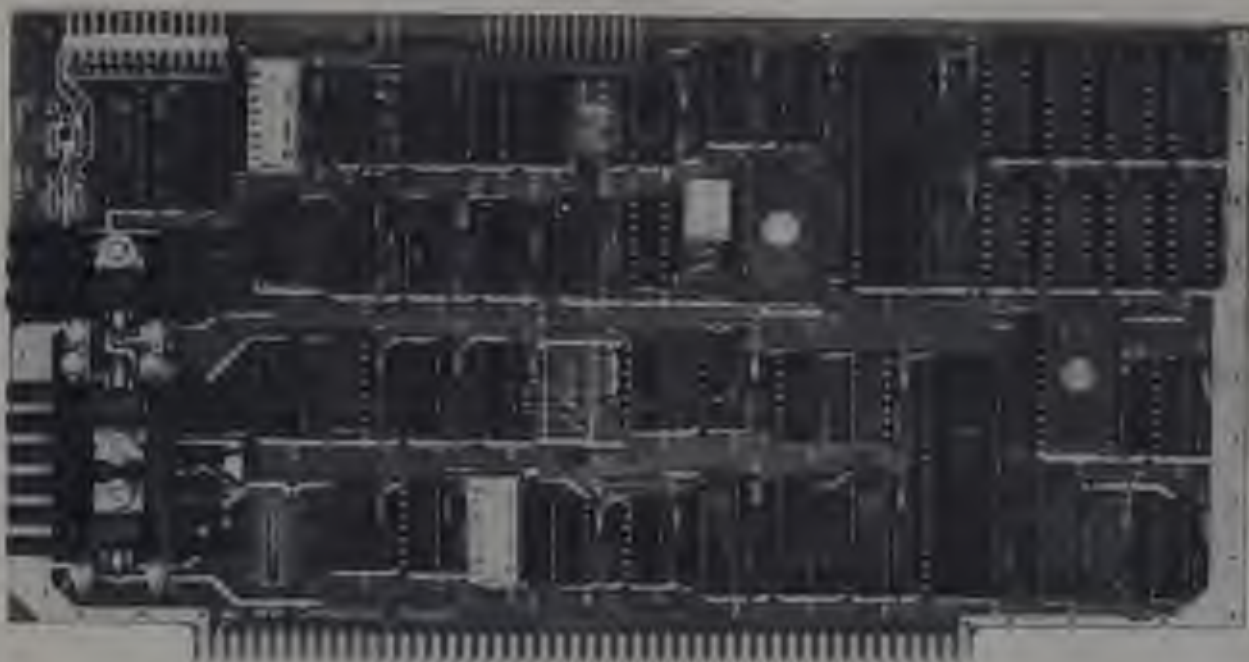
Thus if the number of units of chromo-

somes length between two portions is 2 and the probability of a successful cross over per unit is 0.1, the net probability of a successful crossover is 0.18, not 0.2. The loss is due to cases where an even number of chiasmata exist.

Finally, I should give some space to the idea of 20 nieces or nephews being as precious as ten offspring. The pedigree diagram will elucidate. (See Diagram 1.)



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The VIO-X Video I/O Interface for the S-100 bus provides features equal to most intelligent terminals both efficiently and economically. It allows the use of standard keyboards and CRT monitors in conjunction with existing hardware and software. It will operate with no additional overhead in S-100 systems regardless of processor or system speed.

Through the use of the Intel 8275 CRT controller with an onboard 6085 processor and 4K memory, the VIO-X interface operates independently of the host system and communicates via two ports, thus eliminating the need for host memory space. The screen display rate is effectively 80,000 baud.

The VIO-X1 provides an 80 character by 25 line format (24 lines plus status line) using a 5 x 7 character set in a 7 x 10 dot matrix to display the full upper and lower case ASCII alphanumeric (96 printable character set including true descenders) with 32 special characters for escape and control characters. An optional 2132 character generator is available which allows an alternate 7 x 10 contiguous graphics character set.



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The VIO-X2 also offers an 80 character by 25 line format but uses a 7 x 7 character set in a 9 x 10 dot matrix allowing high-resolution characters to be used. This model also includes expanded firmware for block mode editing and light pen location. Contiguous graphics characters are not supported.

Both models support a full set of control characters and escape sequences, including controls for video attributes, cursor location and positioning, cursor toggle and scroll speed. An onboard Real Time Clock (RTC) is displayed in the status line and may be read or set from the host system. A checksum test is performed on power-up on the firmware EPROM.

Video attributes provided by the 8275 in the VIO-X include:

- FLASH CHARACTER
- INVERSE CHARACTER
- UNDERLINE CHARACTER or
- ALT. CHARACTER SET
- DIM CHARACTER

The above functions may be toggled together or separately.

The board may be addressed at any port pair in the IEEE 8088 (S-100) host system. Status and data ports may be swapped if necessary. Inputs are provided for parallel keyboard and for light pen as well as an output for audio signaling. The internal structure is completely compatible with Digital Research's MP/M.

Additional features include:

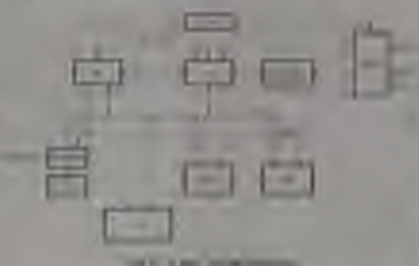
- HIGH SPEED OPERATION
- PORT MAPPED IEEE S-100 INTERFACE
- FORWARD/REVERSE SCROLL or
- PROTECTED SCREEN FIELDS
- CONVERSATIONAL or BLOCK MODE (opt)
- INTERRUPT OPERATION
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Conversational & Block Modes



Elevator, continued...

The pie graphs and fractions indicate the degree to which Ego's genes can be found in each of Ego's relatives. According to modern interpretations of Darwin, animals will attempt to maximize their fitness (i.e., evolutionary success) by maximizing their number of descendants. According to Hamilton, this is not always so. Instead, an animal is said to maximize its fitness by maximizing the amount of shared space (as in the pie graphs). This is how 20 nieces or nephews equals ten offspring.

In wasps, ants, bees, and their allies, males produce sperm asexually. As a result of this, sisters are halfway between ordinary siblings (0.5) and identical twins (1) and come out as 0.75. (See Diagram 2.)

The males are depicted as "half males" because in this group of insects males have half the number of chromosomes that females do. This is why they reproduce asexually. This pedigree and Hamilton's theory explain many things such as why an animal will raise nieces and nephews instead of offspring and why it will do so more readily if it is a bee, wasp, or ant. Also, this explains why in bees, wasps, and ants workers are females but males are lazy. In termites, workers and soldiers come in both sexes. The program *Wasp* will show you that, although Hamilton's theory predicts that four nieces or nephews (as opposed to the usual six in other animals) are worth three offspring. This actually only holds when there is no selection and altruism genes are extremely rare or extremely common or when altruism is half dominant. There are two ways to stop selection in the program. (See Diagram 3.)

When you enter "12345," the program recognizes this as a flag and replaces it with whatever value currently exists for number of offspring worth one niece or nephew.

References

1. Price, R. B. *The Social Insects of North America*. Princeton, 1970.
2. Hamilton, W. D. "The Genetical Evolution of Social Behaviour. I, II." *Journal of Theoretical Biology* 7: 344-352, 357-352.
3. Maynard Smith, J. "Sex Selection and Social Insects." In *Evolutionary Biology of Social Insects*, ed. R. D. Alexander and D. W. Joshi. Chicago Press, New York, 1981.
4. West, M. J. (1981) *Genetics*, 2nd ed., 197, 1982.
5. *Wasp* (Creative Wasp, Publ. Mag. Zool. Univ., 1981), 1, 1980.

Diagram 2

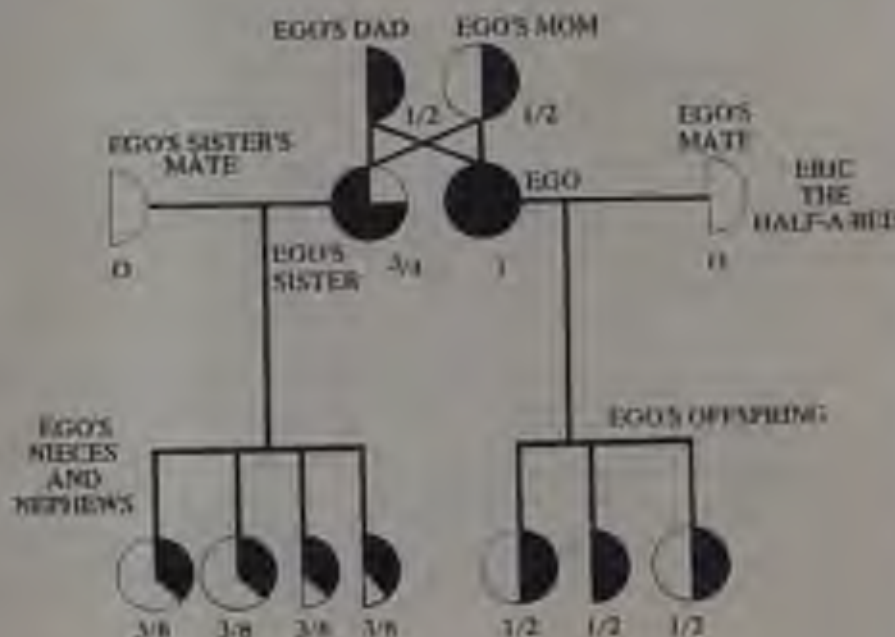


Diagram 3

DATA ENTERED	method 1	method 2
Number of offspring given up by worker	0	12345
Number of offspring queen has anyway	ANY-THING	ANY-THING
Additional offspring queen has when helped by worker, i.e., nieces and nephews gained by worker	0	1

STARSHIP DUEL



By John Karpis

A two-player space game that will deliver graphics and sound. Each player starts with a fleet of starships and must destroy the opponent's fleet and his own. Sound effects that only can be heard when flying around the screen, but when stopped they disappear. And if you run out of fuel during flight, your ship will explode! Four levels of difficulty will keep you occupied for many an exciting hour.

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By James Anderson from Quality Software. Using FORTH programming language, you can produce programs that compute almost as fast as machine code but are much easier to write. A powerful language, this version is based on the microcomputer standard FORTH.

Included modules are: FORTH KERNEL (language for Atari), EXTENSION (added words for more power), EDITOR (to write and modify source code), DOCS (to easily edit up to 100 characters), and ADDRESSER (manages FORTH in assembly).

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By William Robinson from DataSoft

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DUNGEON CAMPAIGN



By Charles E. Roush from Image

A wonderful rendition of a Dungeons & Dragons scenario, full of colorful graphics and vivid sound. As you and your characters head off to adventure, grasp around the dungeons the walls in front, back and on both sides of you. Seeing an intricate maze. You must fight — or buy off — all manner of monsters in your quest to kill the dragon and escape with gold and jewels. Pharmaceuticals can lift you up and drop you in tricky locations, poison you, kill you, and hypnotize and question. Track your own quest. Fun for all ages.

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From The Little Books

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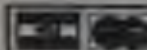
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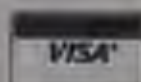
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Sophisticated Music Entry Program

Sheet music is easily entered using the Apple game paddles. The high-resolution ENTRY program features the familiar music staff with a "menu" of musical items listed beneath it (note lengths, rests, edit commands, accidentals, etc.). One game paddle moves a cursor up and down the music staff and is used to select the note pitch; the second paddle chooses from the menu items (note length, etc.). With the ALF hi-res ENTRY program, you won't have to use cryptic codes to select note parameters.

As you program sheet music with ENTRY, measure bars are inserted automatically (and note values are tied over the bar when necessary). Key signatures are also automatic—you don't have to keep writing in every sharp or flat!

Three monophonic, individual parts can be programmed with each ALF Music Synthesizer. Two boards are required for stereo. A total of three synthesizers can be used simultaneously for a maximum of nine voices. By controlling the envelope (or attack) of each voice, many different instrumental sounds can be simulated.

Eight-octave Range

The ALF Music Synthesizer has a pitch range of eight octaves—a wider range than a grand piano. The ALF can also play semitones—"blue notes" or the pitches in between the keyboard notes of a piano. (The pitch range is from 27.5 to 55,000 Hertz, well beyond the limits of human hearing.) Tuning accuracy is virtually perfect within two cents of pitch value.

Every parameter of the ENTRY program can be changed again and again during a musical piece. For example, you can make changes in key, time signature, volume, and timbre (envelope). Parts can be edited at any time, also. Notes can be added or deleted, note length can be changed, as well as pitch, volume, etc.

You can save songs on either cassette or disk, and play them back using either ENTRY or PLAY. The playback speed is adjusted with one of the game paddles, and can be varied during the playback, if you wish to change the overall tempo.

Colorful Playback Display

The ALF Music Synthesizer features a 16-color low-res graphic display during song playback. Each musical part is represented on a stylized piano "keyboard"—the intensity of the note determines the color, and the pitch is shown in relation to "middle C".

The ALF Music Synthesizer requires the use of an external audio amplifier. Stereo programming is possible with the use of two or three synthesizer boards.

The ALF software includes the ENTRY and PLAY programs, sample songs, an introduction to "envelope shaping", and demonstrations of advanced uses of the synthesizer.



With the ALF software, entry of music is easy, fast and accurate.

Nine Voices for only \$198

The new ALF "AM-II" music synthesizer offers an unbeatable value for the Apple owner who is a music hobbyist. With nine voices on a single music board for \$198.00, the AM-II is the most economical device for creating music with the Apple.

The AM-II uses the same excellent ENTRY and PLAY programs as the more sophisticated ALF Music Synthesizer (AMS); the same hi-res graphic display from which notes are selected with the Apple game paddles (not typed with cryptic codes). All of the conveniences of the ENTRY program apply—easy editing, playback with low-res display, ability to save songs on cassette or disk, etc.

The AM-II has stereo output (3 voices in left, 3 voices in the middle, 3 voices in the right).

How can the AM-II offer so much for only \$198.00? The two basic differences between the AM-II and the ALF Apple Music Synthesizer (AMS) are pitch accuracy and dynamic range. The AM-II has an accurate pitch range of about six octaves. Pitch values above the treble staff become increasingly inaccurate. Also, the AM-II has a dynamic range of 28db, with 15 different volume levels; the AMS has a dynamic range of 75db.

The AM-II is manufactured with the same high quality standards as other products from the ALF Corporation. No sacrifice has been made in reliability; the new AM-II is simply a great bargain.

Professional musicians will still want to use the original Apple Music Synthesizer (AMS) for its extended range and volume controls (the AMS has a range of 8 octaves). But for the Apple owner who is interested in music as a hobby, the AM-II is the best music peripheral value available today.

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Inequality, continued...



PLEASE SAVE THIS GOTO
T = TUTORIAL G=GRAPH D=DELETE
EXAMPLE: Y=2X+4 OR Y<X-2 OR Y=3

1 MARK MARK ON THE AXIS = 20 UNITS
Y<=0 IS THE BLUE AREA IS THE ANSWER
THE LINE Y=2X+4 IS DOTTED

```
800 REM: WAS SURF THE CORRECT ANSWER IS FEARLESS
810 IF X = 1 AND Y = 1 THEN 875
820 GOTO 1000
830 REM: GO SET ONE OF THE OTHER CHANGES
840 REM: X = 1 Y = 2 OR 1 OR 3
850 NEXT X
860 PRINT: PRINT "X MARK OF THE ABOVE: 800: 1"
870 INPUT Y
880 IF Y = 1 OR Y = 2 THEN 895
890 PRINT ""
900 PRINT "YOU ARE INCORRECT! THE ANSWER IS 1111"
910 GOTO 1000
920 PRINT "YOU ARE CORRECT!"
930 PRINT ""
940 REM: STOP
950 FOR Z = 1 TO 80000: X = Z: NEXT Z
960 RETURN
970 REM: MAIN LOOP OF PROGRAM
980 T = INT (RND * 3) + 1: A = INT (RND * 2) + 1
990 IF A = 1 THEN 1020: IF A = 2 THEN 1030: IF A = 3 THEN 1040
1000 IF A = 1 THEN 1020: IF A = 2 THEN 1030: IF A = 3 THEN 1040
1010 IF A = 1 THEN 1020: IF A = 2 THEN 1030: IF A = 3 THEN 1040
1020 IF A = 1 THEN 1020: IF A = 2 THEN 1030: IF A = 3 THEN 1040
1030 IF A = 2 THEN 1030: IF A = 3 THEN 1040: IF A = 1 THEN 1020
1040 IF A = 3 THEN 1040: IF A = 1 THEN 1020: IF A = 2 THEN 1030
1050 REM: PICK A RANDOM X & Y TO TEST
1060 IF X = 1 THEN 1070
1070 IF Y = 1 THEN 1080
1080 IF Y = 2 THEN 1090
1090 IF Y = 3 THEN 1100
1100 IF Y = 1 THEN 1110
1110 IF Y = 2 THEN 1120
1120 IF Y = 3 THEN 1130
1130 IF Y = 1 THEN 1140
1140 IF Y = 2 THEN 1150
1150 IF Y = 3 THEN 1160
1160 IF Y = 1 THEN 1170
1170 IF Y = 2 THEN 1180
1180 IF Y = 3 THEN 1190
1190 REM: PUT THE RANDOM NUMBER INTO X & Y TO USE TO CHECK ANSWERS
1200 RETURN
1210 END
```



WHICH LETTER REPRESENTS THE RIGHT ANSWER
A Y=2X+4 B Y=2X+3
C Y=2X+5 D Y=2X+1
E NONE OF THE ABOVE ANSWER



Legal syntax for the graphing mode

Y Relation A X = B

relations < > <= >=

A any real number

B any real number

example: $y > .5x + 22$ or $y < -2x + 35.1$

The tutorial mode will produce whole number slopes less than ten and some rational slopes, most commonly found in high school Algebra. The y intercept ranges from -70 to 70 and all line relations are used.

The program is written in Applesoft Basic and runs on a 32K Apple II+, using high resolution graphics.

The actual graphing starts at line 500. The graphing area on the Apple does not correspond to the xy plane; thus a transformation must be made. I chose to translate the coordinates of Apple screen.

(H,V), is the real value on the coordinate plane (H,V). The FOR-NEXT loop starts at 0, the top of the screen, and goes to 159, the bottom. The translations H=H-140 and V=80-V are used for the x and y values.

Example: (10,10) on the BASIC screen is mapped to (-130,70) on the real coordinate plane. I felt that this method would be the easiest to understand and would give the best speed and accuracy.

At line 570 the program decides which side of the line should be shaded. Line 570 indicates if the edge of the inequality is to be dotted line or solid line.

T = TUTORIAL G=GRAPH D=DELETE
EXAMPLE: Y=2X+4 OR Y<X-2 OR Y=3

1 MARK MARK ON THE AXIS = 20 UNITS
Y<=0 IS THE BLUE AREA IS THE ANSWER
THE LINE Y=2X+4 IS DOTTED

Since the graphing subroutine uses string input, the tutorial subroutine uses random factors for numeric values for the relation, slope and y intercept, and translates them into the same type of string variable as would be found in the input.

Some improvements or variations to this program might include the following: variable scale ability to select the quadrant ability to graph quadratic inequalities keeping the false answers close to the correct answer

A list of variables, line numbers and descriptions is included to help with such possible changes.

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Get in sync



SYNC magazine is different from other personal computing magazines. Not just different because it is about a unique computer, the Sinclair ZX80 (and its version, the MicroAce). But different because of the creative and innovative philosophy of the editors.

A Fascinating Computer

The ZX80 doesn't have memory mapped video. This is the screen goes blank when a key is pressed. To some reviewers this is a disadvantage. To our editors this is a challenge. One suggested that games could be written to take advantage of the screen blanking. For example, how about a game where characters and graphic symbols move around the screen while it is blanked? The object would be to crack the secret code governing the movements. Voilà! A new game like Mastermind or Black Box uniquely for the ZX80.

We made some interesting discoveries soon after setting up the machine. For instance, the CHR function is not limited to a value between 0 and 255, but cycles repeatedly through the code. CHR(9) and CHR(260) will produce identical values. In other words, CHR operates in a MOD 256 fashion. We found that the "=" sign can be used several times on a single line, allowing the logical evaluation of variables. In the Sinclair, LET $X=Y=Z=W$ is a valid expression.

Or consider the TAB function which strips a string of its initial character. At first, we wondered what practical value it had. Then someone suggested it would be perfect for removing the dollar sign from numerical inputs.

Breakthroughs? Hardly. But indicative of the hints and tricks you'll find in every issue of SYNC. We intend to take the Sinclair to its limits and then push beyond, finding new tricks and tips, new applications, new ways to do what couldn't be done before. SYNC functions on many levels, with tutorials for the beginner and concepts that will keep the pros coming back for more. We'll show you how to duplicate commands available in other Basics. And, perhaps, how

to do things that can't be done on other machines.

Many computer applications require that data be sorted. But did you realize there are over ten fundamentally different sorting algorithms? Many people settle for a simple bubble sort package because it's described in so many programming manuals or because they've seen it in another program. However, sort routines such as heapsort or Shell-Metzner are over 100 times as fast as a bubble sort and may actually use less memory. Sure, 1K of memory isn't a lot to work with, but it can be stretched much further by using innovative, clever coding. You'll find this type of help in SYNC.

Lots of Games and Applications

Applications and software are the meat of SYNC. We recognize that along with useful, pragmatic applications, like Sinclair analysis and graphing, you'll want games that are fun and challenging. In the charter issue of SYNC you'll find several games. Acey Ducey is a card game in which the dealer (the computer) deals two cards face up. You then have an option to bet depending upon whether you feel the next card dealt will have a value between the first two.

In Hurtle, another game in the charter issue, you have to find a happy little Hurtle who is hiding on a 10 x 10 grid. In response to your guesses, the Hurtle sends out a clue telling you in which direction to look next.

One of the most ancient forms of arithmetical puzzle is called a "boomerang". The oldest recorded example is that set down by Nicomachus in his *Arithmetica* around 100 A.D. You'll find a computer version of this puzzle in SYNC.

Hard-Hitting, Objective Evaluations

By selecting the ZX80 or MicroAce as your personal computer, you've shown that you are an astute buyer looking for good performance, an innovative design and economical price. However, selecting software will not be easy. That's where SYNC comes in. SYNC evaluates software packages and other peripherals

and doesn't just publish manufacturer descriptions. We put each package through its paces and give you an in-depth, objective report of its strengths and weaknesses.

SYNC is a Creative Computing publication. Creative Computing is the number 1 magazine of software and applications with nearly 100,000 circulation. The two most popular computer games books in the world, Basic Computer Games and More Basic Computer Games (combined sales over 500,000) are published by Creative Computing. Creative Computing Software manufactures over 150 software packages for six different personal computers.

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NUMERICAL INTEGRATION ON A TRS-80

Alan Scheldler

Are you intimidated by seemingly difficult integration formulas? Do you have to search through a table of integrals every time you need to calculate the area under the graph of a curve? Are you a student of college calculus? If so, please read on. I think I can show you how to perform even the most difficult integration—and even save time. If you don't know calculus, I believe I can introduce you to an interesting and valuable tool which can be used to solve many practical problems.

Calculus teaches basically two types of operations which can be performed on mathematical expressions. One such operation is called differentiation which can be used to find the slope of a curve at any prescribed point. This article deals with another operation called integration which can be used to find the exact area under a curve between two specified points. Some people spend years studying and perfecting the techniques needed to perform both operations. More often than not, these techniques involve more art than science and require a great deal of memorization.

A Simple Integration Example

Suppose you are asked to determine the area under the curve $y = x^2$ between the x -values of 0 and 3 as shown in Figure 1. If you use the integration techniques prescribed by calculus you can calculate the exact area. But before you add calculus buffs blow the dust off your textbooks, let's analyze the problem a little more closely. Let's apply an old integration principle called the "Approximation Principle" to the problem. The Approximation Principle states that a difficult integration problem may be reduced to one or more very simple problems if allowance is made for inaccuracy. In other words, if you allow yourself a bit of inaccuracy, you can get an approximation of the area under the curve $y = x^2$. For example, you can obtain a very rough estimate of the area by connecting points (0,0) and (3,9) with a straight line (Figure 2). Then by calculating the area of the triangle formed by the three points (0,0), (3,9), and (3,0) you find that the area under the curve is $1/2 \times 3 \times 9 = 13.5$.

Alan Scheldler, 3700 54th St., Apt. 213, Melrose, IL 61265.

Normally this crude estimate is not good enough. The Approximation Principle can be carried a step further to get a better approximation. You can divide the area under the curve into three equally spaced sections as in Figure 3. Each segment is one unit wide. Again connect the points by straight lines. Now calculate the area under each trapezoid. The formula to calculate the area under a trapezoid is:

$$\text{Area} = \frac{(h_1 + h_2)}{2} \times b$$

where h_1 = height of the left side of trapezoid
 h_2 = height of the right side of trapezoid
 b = base of the trapezoid

A difficult integration problem may be reduced to one or more very simple problems if allowance is made for inaccuracy.

In Figure 3, the first area starting on the left is actually a triangle which is merely a special case of a trapezoid with the height of the left side equal to zero. If you proceed to calculate and sum up the individual areas using the above trapezoid formula you will find the area under $y = x^2$ to be:

$$\text{Area} = \frac{(0 + 1)}{2} \times 1 + \frac{(1 + 4)}{2} \times 1 + \frac{(4 + 9)}{2} \times 1$$

$$\text{Area} = 9.5$$

This is a much better approximation—but probably still not good enough for you budding mathematicians. No doubt you've already guessed the exact area is somewhat less than 9.5. This is true because the curve $y = x^2$ always lies on or below the straight lines which connect the top corner points of the trapezoids. The error in our area approximations is equal to the small crescent shaped areas which lie between the oblique trapezoid sides and the curve.



Figure 1. Area under $y = x^2$ between 0 and 3.



Figure 2. A very rough estimate of the area under $y = x^2$.

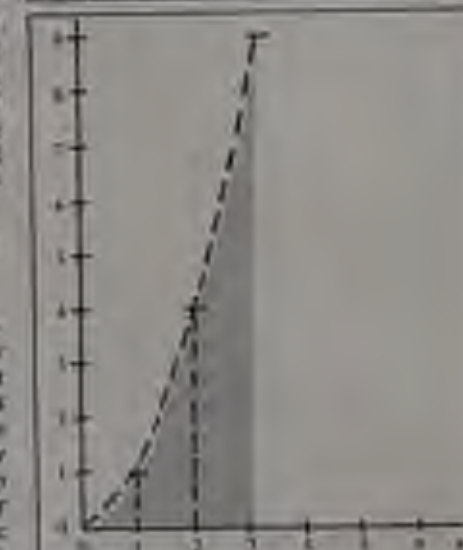


Figure 3. A better estimate of the area under $y = x^2$.

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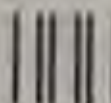
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**Before you spend \$200 — or \$2000 —
on a computer system that won't
meet your needs, read this.**

Straight Talk About Buying A Small Computer

A personal computer. If you don't already have one you're probably thinking about it.

The Plunge

Spending a couple of thousand or even a few hundred dollars is not something you do lightly. Making a decision about which computer to buy is not easy. Deciding about peripherals is even harder. And making intelligent decisions about software is nearly impossible.

But there's a way. *Creative Computing*. It's the magazine with the toughest evaluations in the industry.

In an industry prone to dazzling sales pitches filled with technical doubletalk, some straight advice from an unbiased source could make a lot of difference. Some of the newest computers on the market will be extinct before the first orders are filled; others will achieve astounding popularity. Which would you rather own?

Why Buy One?

The uses of a personal computer would fill several books. Some people have a specific use in mind, others just a general desire to join the computer age. In general, it's advisable to have a good idea of at least one or two things you want a computer to do for you. If you want to analyze stock options, for example, you'll want a computer for which a stock option package is available. If you want to work with color graphics your choice of computer is narrowed to those units with high resolution color output. Even after you've chosen some applications, the choice of a machine isn't easy. Here are a few things that might help.

Hard and Soft

Besides encountering hard and soft sells, you'll also encounter the terms "hardware" and "software." Hardware refers to the electronic parts of a computer system: the circuit boards, chips, peripherals, and other components.

An important part of hardware is memory. The amount of memory a computer has determines how much it can do. Most people start out with systems having 16K (K is short for kilobyte, which means 1024 bytes, or characters like a letter or number) of memory. Later, many people decide to expand their systems, and buy more memory.

Some of the new computers can be purchased with as little as 1K of memory. They can usually be expanded, but the upper limit varies. If you want to play games and write short programs, 16K is adequate. If

you want to add a disk drive, or do word processing, you'll probably need 48K or more.

By themselves, these parts are rather dumb. The programs that instruct the computer how to do the more interesting applications (stock option analysis, animation, play a game) are usually contained on magnetic tape or disks. This is software.

Both hardware and software are important. A system with the wrong hardware can be as worthless to you as a sports car would be for a six-member family. Some computers cannot be connected to a printer. Others can't be expanded without a great deal of additional expense. You may not need these extras now, but if you anticipate needing them later, you'll want to select an appropriate system now. And a computer without good software is just an expensive dust catcher.

The Software Cycle

When a computer first hits the market, the only software available will be from the manufacturer. This limits the uses of the machine. As soon as a computer becomes popular, new software pours from dozens of sources. But there is a catch. People won't buy a computer until there is plenty of software available. And vendors won't produce the software until people start buying the computer. Where does this leave you? You can go with one of the established computers, or take a chance on a new machine.

The Newcomers

New computers are appearing almost monthly. One might be right for you. Can anyone tell for sure which will survive? Probably not. But the new machines can be compared against the old. If a computer does everything and more than another does, and costs less, it has a good chance of catching on. If it does less than existing computers, and costs about the same, it is probably doomed.

The Survivors

A few computers currently have the majority of the market. They all have good points and disadvantages. One costs less to start with, but costs more to expand. Another has great graphics, but no lower-case letters—a bit of a problem if you want to do word processing. The limitations of any machine can be overcome, for a price. But it is better to get what you want at the start. If you know what you plan to use the computer for, the first step is to determine what that use requires. Do you want to play

games? Then you have to decide how important joysticks, paddles, and other controllers. Some computers are supplied with these attachments as extras. Do you want to use your own television? Or would you prefer a computer that comes with its own monitor? Will you demand complicated math capabilities from your computer? Certain computers can only handle integers.

Your Choice

Where does this leave you? If you've read this far, you are probably concerned about making the right choice. The following hints could be a good starting place. Take your time, and don't let your first impression of any computer prevent you from taking an honest look at its good and bad points. All computers seem impressive at first. Once you've looked at a few, you'll find that the initial awe is replaced by cold comparison. If you have a specific application in mind, ask to see the computer perform that application. If the salesman starts talking in technical terms while assuring you the machine will do what you want with only a few modifications, find another store. Ask about warranties. Will it be repaired at the store or sent out? Will they provide a loaner during repairs? Is the dealer authorized by the manufacturer?

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This error can never be totally eliminated, but it can be minimized. You've already seen how it can be reduced by calculating three areas instead of one. Well now, let's divide the area into 10 segments and again sum the areas enclosed by the trapezoids. If this sounds like too much work, well, you're right—but this is just the sort of thing that computers were intended for. The Basic program listed in Figure 4 is designed to run on a TRS-80 Level II microcomputer to perform just such a task. This program can also be run on a Level I machine by eliminating line 20 and changing all variable names to just the first letter of each variable name as listed.

If you run this program, you will find that with 10 segments, the estimated area is 9.085. As long as you have the computer handy, try 100 segments. Here the calculated area will be 9.00044. If you are a calculus expert you've no doubt already calculated the exact area to be 9. So you can see the computer result comes very close to the correct value.

This technique for calculating the area under a curve is called Numerical Integration using the Trapezoidal Rule. As we have seen, the Trapezoidal Rule approximates the area under a curve by summing the areas of a specified number of trapezoids. The height of a vertical side of a trapezoid is equal to the y-value which corresponds to particular x-value. Each x-value is found by dividing the integration interval into the desired number of equally spaced segments. The y-value which corresponds to a particular x-value is found by substituting the x-value into the equation of the curve. Thus, for the curve $y = x^2$, the y-value which corresponds to an x-

value of 2 is 4. For an x-value of 2.5, the corresponding y-value is 2.9 or 6.25, and so on.

The program listed in Figure 4 functions in just this way. First the program asks you to input the upper and lower limits (U and L respectively) which mark the interval over which the integration will be performed. Then it will ask for the number of calculation increments, N, which is actually the number of trapezoids which will be used to approximate the area. With this information, the computer calculates a DX value which is the width of each trapezoid.

The trapezoidal numerical integration program can be used to solve difficult, practical problems.

Then with X starting at the lower limit, $N + 1$ y-values are computed, incrementing X by DX each time until the upper limit for X has been reached. A(i) is an array used to represent the y-values. Once all of the y-values have been computed, the accumulated area under the curve is calculated by summing the areas of each individual trapezoid using the trapezoid area formula. Then this accumulated area is displayed by the computer. The accumulated area is the result of the numerical integration.

```

10 CLS
20 REM A1011
30 PRINT "NUMERICAL INTEGRATION USING THE TRAPEZOIDAL RULE"
40 PRINT "ENTER THE FORMULA TO BE INTEGRATED IN LINE 100"
50 INPUT "ENTER THE LOWER LIMIT " L
60 INPUT "ENTER THE UPPER LIMIT " U
70 INPUT "ENTER THE NUMBER OF CALCULATION INCREMENTS " N
80 AREA = 0
90 DX = (U - L) / N
100 Y = L
110 FOR I = 1 TO N + 1
120
130 'REPLACE THE NEXT LINE WITH THE FORMULA TO BE INTEGRATED
140
150 A(I) = Y * Y
160 Y = Y + DX
170 NEXT I
180 FOR I = 1 TO N
190 AREA = AREA + ((A(I) + A(I + 1)) * DX) / 2
200 NEXT I
210 PRINT "THE AREA UNDER THE CURVE FROM " L " TO " U
220 PRINT "IS " AREA
230 PRINT "DO YOU WISH TO CHANGE THE INPUT PARAMETERS (Y / N) -"
240 INPUT A$
250 IF A$ = "Y" THEN GO
260 IF A$ = "N" THEN END
270 GOTO 230
    
```

Figure 4

A Practical Example Problem

The trapezoidal numerical integration program can be used to solve difficult practical problems. Here is an example of the type of problem that can be solved using this method.

You are the engineer in charge of emergency power systems at a nuclear power plant. Your responsibility is to make sure that two 3000 horsepower emergency diesel generators start up to provide standby electrical power upon the loss of both normal and reserve power sources.

Large quantities of diesel fuel must be stored at the plant at all times to ensure that there is enough fuel for even the longest power outages. For maximum safety and reliability, each diesel generator is supplied by its own diesel fuel storage tank. Part of your responsibility is to monitor the oil level in these tanks. Each tank measures 12 feet in diameter by 30 feet in length and is buried lengthwise underground to reduce fire hazard. The level indicator gauge on one of the tanks indicates an oil level of nine feet. How many gallons of diesel fuel does this represent?

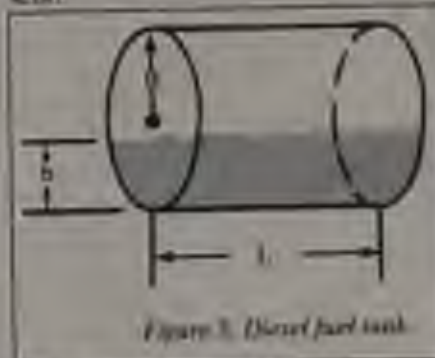


Figure 5. Diesel fuel tank.

The essentials of this problem are diagrammed in Figure 5. To calculate the maximum volume of a tank, you must multiply the cross sectional area of the tank by its length. Thus, the maximum volume of a cylindrical tank is the area of a circle whose diameter is equal to the diameter of the tank multiplied by the length of the tank. This is simple enough, but what about a partially filled tank? Basically the problem is still the same—determine the area of the diesel fuel cross section and multiply by the length. In this case, the diesel fuel cross section will appear to be a circle with its top cut off. This sounds very simple until you actually try to calculate this area.

This problem may appear to be a very difficult problem—and it definitely is difficult if you want absolute accuracy, but let's not forget about the time-honored Approximation Principle. If we can tolerate a small degree of inaccuracy, we can make use of the Trapezoidal rule integration program.

To make use of this program, we must determine the equation of the curve to be

Numerical Integration, continued...

integrated. You've probably already guessed that the curve to be integrated will be the equation of a circle whose diameter is equal to the diameter of the tank. To simplify the derivation of this equation, I suggest that you place the origin (0,0) at the bottom of the tank with the x-axis pointing straight up as shown in Figure 6. By using this orientation, you can integrate under the circle from a lower limit of 0 to an upper limit equal to the depth of diesel fuel in the tank. This will give you the area of the diesel fuel cross section in the tank. The general equation of the circle which describes the tank is:

$$(x-a)^2 + (y-b)^2 = R^2$$

where: R = the radius of the tank
 a = R
 b = 0

(the point (a,b) is the coordinates of the center of the circle or tank in this case)

Substituting the values for a and b, the equation becomes:

$$(x-R)^2 + y^2 = R^2$$

Before we use this equation in the integration program, it must be rearranged so that y is isolated on the left side of the equation:

$$y = \sqrt{R^2 - (x-R)^2}$$

You can now use the integration program in the same way you did when you calculated the area under $y = x^2$. Just substitute this new equation in its place. The lower limit of integration will be 0 and the upper limit will be 9, which is the depth of diesel fuel in the tank. This result will be the area under the curve which is described by the above equation.

You have probably guessed that if you perform this integration, you actually get only one-half of the area of the desired cross section. This is because the Trapezoid integration program only calculates the area above the x-axis. We can easily correct this discrepancy by multiplying by 2. Multiplying this result by L, the length of the tank, will give you the volume of diesel fuel in the tank in cubic feet:

$$y = 2L\sqrt{R^2 - (x-R)^2}$$

Now if you want to get real fancy, you can multiply this equation by a factor of 7.4805195 to convert cubic feet to U.S. gallons. The final equation to integrate is then:

$$y = 2L\sqrt{R^2 - (x-R)^2} \times 7.4805195$$

where: L = 50
 R = 6

x varies from lower limit to upper limit (0 to 9)

Simply substitute this equation for $y = x^2$ in the integration program, and you're all set. Using a lower limit of 0 and an upper limit of 9 with 20 increments, the calculated volume is 33862 gallons. The exact volume which can be derived very painstakingly by the methods of calculus is 34031 gallons. This amounts to an error of only 0.50%, which is good enough accuracy for most situations. When you actually substitute this equation into the integration program I suggest that you avoid using the raising-to-a-power function which is available in TRS-80 Basic. This is just a precaution against negative numbers. In other words you cannot raise a negative number to a power, but you can always multiply a negative number by itself. Thus instead of using $Y = X \uparrow 2$, use $Y = X * X$.

By the way, for all you die-hard calculus addicts, here is the closed form solution for the volume of the diesel fuel in the tank:

$$\text{Volume} = L \left[(h-R)\sqrt{2Rh-h^2} + R^2 \arctan\left(\frac{Q}{\sqrt{1-Q^2}}\right) + \frac{\pi}{2}R^2 \right] \times 7.4805195 \text{ (gallons)}$$

where: $Q = (h-R)/R$
 h = diesel fuel depth (ft)
 R = radius of tank (ft)
 L = length of tank (ft)
 all angles are in radians

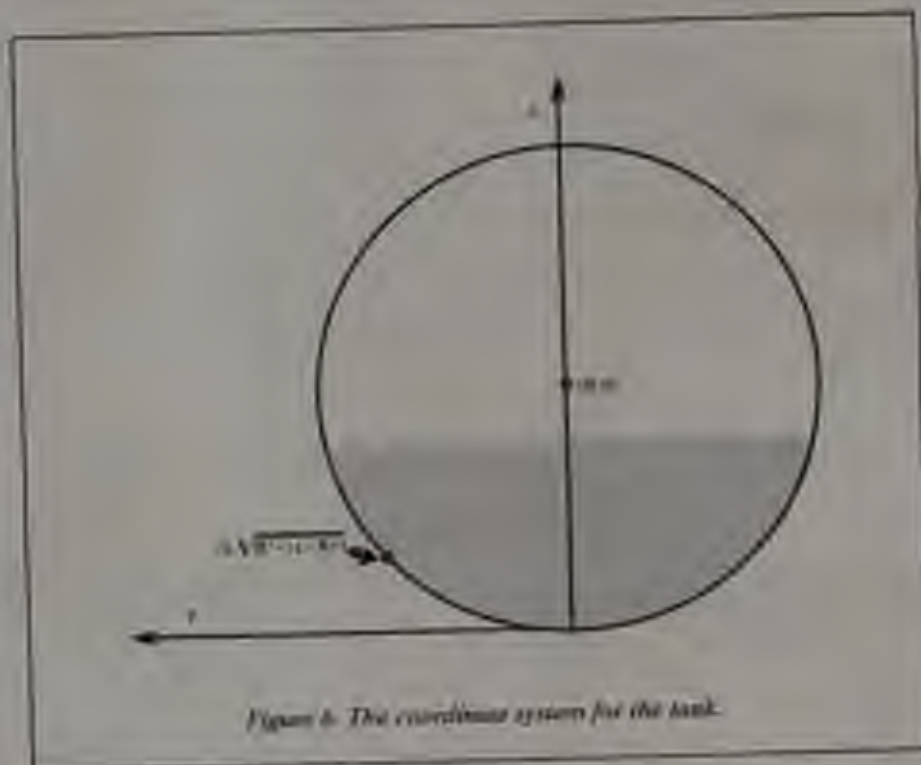


Figure 6: The coordinate system for the tank.

As you can see, you don't need to be a mathematician to perform complicated integrations, and thanks to the computer, numerical integration can be performed to practically any desired degree of accuracy. You can probably think of many more examples where this technique can be used, but here are a few more:

1. Estimation of the weights of irregularly shaped objects.
2. Estimation of the energy consumed by an electric motor operating under a known but varying load cycle.
3. Estimation of the speed of a space capsule which free-falls from a very high altitude to the surface of the earth. □

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5. LEASINT	Interest rate on lease
6. DEPRACN	Depreciation analysis
7. DEPRAC	Straight-line depreciation
8. DEPRAC	Sunk of the depts. depreciation
9. DEPRAC	Determining balance depreciation
10. DEPRAC	Double declining balance depreciation
11. TAXDEP	Cash flow vs. depreciation tables
12. CHECKD	Print 7020 checks along with daily register
13. CHECKBNI	Checkbook maintenance program
14. MORTGAGE/A	Mortgage amortization table
15. MORTGAGE	Computes loan needed for money to double triple, etc.
16. SALVAGE	Determines salvage value of an investment
17. RISKAN	Rate of return on investment with variable inflows
18. RISKAN2	Rate of return on investment with variable inflows
19. EFFECT	Effective interest rate of a loan
20. FVAL	Future value of an investment (compound interest)
21. FVAL	Present value of a future amount
22. LOANPAY	Amount of payment on a loan
23. RECAPTH	Equal withdrawals from investment to know if over
24. SPREADS	Simple discount analysis
25. DATEINC	Equivalent U. measurements used values for 183
26. ANNUITY	Present value of deferred annuities
27. FANNU	S & Markup analysis for items
28. SPREADS	Sinking fund amortization program
29. BONANAL	Value of a bond
30. DEPRITE	Depreciation analysis
31. BLANSH	Black-Scholes options analysis
32. STOCKAL	Expected return on 100% vs. discounts dividends
33. WARRAL	Value of a warrant
34. BONANAL2	Value of a bond
35. EFFECT	Estimate of future earnings per share for company
36. BECANALPH	Computes Alpha and beta statistics for stock
37. SARETC	Portfolio selection module - what stocks to fund
38. OPTWATE	Option writing computations
39. RTVAL	Value of a right
40. EXVAL	Expected value analysis
41. BAYES	Bayesian decision
42. VALANAL	Value of perfect information
43. VALANAL2	Value of additional information
44. UTILITY	Derives utility function
45. TRIPLEA	Linear programming solution by simplex method
46. TRAPN	Transportation method for linear programming
47. EQD	Economic order quantity inventory model
48. CDRIDE1	Single server queueing (waiting line) model
49. CVP	Cost-volume-profit analysis
50. CONCORDP	Conditional profit index
51. OPTLOAS	Opportunity loss table
52. PQDQD	Fixed quantity economic order quantity model

53. WACC	Weighted average cost of capital
54. CONREAL	True rate on loan with compounding but assumed
55. CRONAL	True rate on discounted loan
56. MEDICAN	Managerial analysis computations
57. FPRNT	Financial ratios for a firm
58. NPV	Net present value of project
59. FPRNT/A	Laborer price index
60. FPRNT/A	Passive price index
61. SEASPEC	Constructs seasonal quantity index for forecasting
62. TRENCH	Time series analysis (moving average trend)
63. TRENCH	Time series analysis (moving average trend)
64. TRENCH	Future price prediction with inflation
65. WALING	Waiting line system
66. LUTARY	Letter writing system (links with WALING)
67. SORT3	Sorts list of names
68. LABEL1	Shipping label maker
69. LABEL2	Phone label maker
70. BUDGET	DOPE business bookkeeping system
71. TRENCH	Computerized total return from investments table
72. ACTIVITY	Inventory accounts payable system (average payment)
73. FINANCE	General finance on loans and paid on interest
74. FINANCE	Inventory investment control system
75. TRENCH	Computerized telephone directory
76. TRENCH	Direct cost analysis
77. ASSIGN	Devil's assignment algorithm for optimal job assign.
78. ACTIVITY	Inventory accounts payable system (average payment)
79. FINANCE	General finance on loans and paid on interest
80. FINANCE	Inventory investment control system
81. TRENCH	Computerized telephone directory
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100. TRENCH	Direct cost analysis

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Creative Computing normally isn't the place to discuss the philosophy of teaching physics, but when this philosophy affects the manner in which a computer program is written, then maybe the discussion is permissible.

Having taught physics at the high school level for 18 years, it has become obvious that today's students, while just as intelligent as we, are accustomed to the "cater to me" attitude generated by hours of mindless watching of that electronic gem of the living room.

The television offerings currently available require almost as much participation from the viewer as watching a freshly painted wall dry. A mild "burrish" is in order for the microcomputer and the advent of arcade games of the "Invaders" variety. These at least require a certain amount of hand-eye coordination, and the emotional involvement that developers can't be denied.

Adventure type games proceed one step further toward the abstraction that will awaken the creativity latent within a person's mind.

With all this talk of involving TV screens and interactive game programs, we have attempted to incorporate the microcomputer into our classroom environment. Most of our programs are laboratory analysis programs or the classic "Good

John Hitchcock

Job, Joe!" type of computer assisted instruction. While these programs serve a useful function and are enthusiastically used by the students, we are the first to admit that plugging data points into an

The object of Aircraft Rescue is to pilot a small plane from Rescue Base to Sick City with a load of emergency medical supplies.

Apple II isn't nearly as exciting as repelling invaders from outer space.

Our recent programming efforts have been directed toward simulation types of programs in which students are involved in an interactive situation that is fun (even exciting) and yet teaches or reinforces certain physics concepts.

The program described in this article is one such effort which resulted in a student response much more favorable than we ever anticipated. Programming purists will immediately notice the glaring lack of

exciting, or even unexciting, computer-generated graphics. This lack is intentional since we wanted the program to maintain a "mind-hand-eye" coordination rather than deteriorate into an exercise in moving the airplane around the screen with a joystick.

The object of Aircraft Rescue is to pilot a small plane from Rescue Base to Sick City with a load of emergency medical supplies before the residents expire from an unknown disease. (One method student suggested that the malady afflicting the residents was undoubtedly "physics phever.")

The primary difficulty facing the pilot is an extremely foggy night. Thus, all flying must be done by instruments using a contour map which describes the land over which he must fly. The educational motive of the program is to review the physics concepts of speed, acceleration, vectors, and simple distance-time relationships.

Our expectations were that the program would be entertaining; we didn't expect it to be exciting. Students who are piloting the plane to the rescue usually acquire quite an audience, and considerable co-piloting occurs as onlookers analyze the techniques and routes chosen by the pilot. The program approximates real-time, and tension begins to mount as the pilot starts to run out of fuel and time or begins the approach to his landing.

The instructions in the program listing

John Hitchcock, 7330 East Hunter Road, Corvallis, NY 13045.

Rescue, continued...

give a fairly complete idea of the problems facing the pilot and the data concerning his plane. Some techniques and hazards are not mentioned in the instructions, but the pilot soon discovers them as the rescue mission progresses.

Some of our more creative students have developed interesting innovations in completing the rescue. They have flown off the chart and around Disaster Desert, perfected take-off and landing techniques which save fuel and time, and have found that they can fly faster if they have a navigator to call out directions. More aggressive flyers have found the quickest way down from high altitudes is to put the plane into a "stall" condition and then pull out just before crashing.

An existing concept in creating computer programs is that almost all programs have the potential to be improved. This program is no exception, and offers ample oppor-

tunity for change, both in the esthetics and the techniques of programming. Several of these possibilities are noted here:

1. Runways could be narrowed or shortened to increase difficulty.
2. Carburetor icing could be included as another hazard.
3. The speed of the plane could be a function of climb/descent rate.
4. Hi-res graphics could be used to create a more authentic-looking instrument panel.
5. For those who want a "control the dot on the screen" game, hi-res graphics could be used to display the map and show the actual position of the plane.
6. The game was written without any truly random disasters, but these could easily be included. One possibility is for a hijacking to occur and then the game could turn into an adventure-type game

in which the player attempts to make the proper decisions to thwart the hijacker.

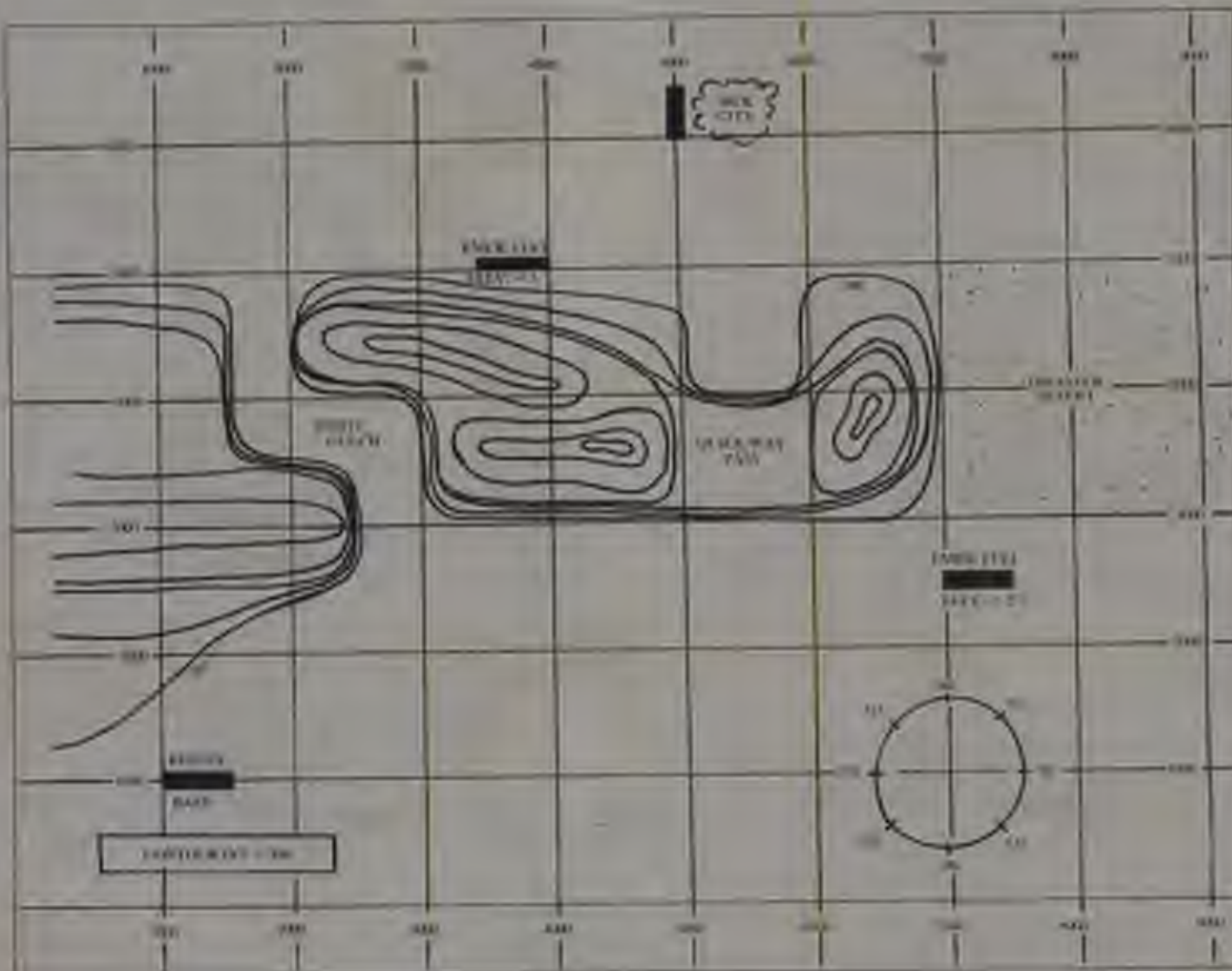
The Program

The program flow is fairly obvious from the listing provided, but certain areas might need explanation for those readers not familiar with AppleSoft Basic.

In line 160 $X = \text{PEEK}(-16287)$ reads the pushbutton on the game control #0. Pushing this button is the signal that the user wants to change the velocity of the plane. $V = \text{PDL}(0)$ sets the value of the game control equal to the velocity (V) and then this value is adjusted by $V = V * V / 8$ to allow a maximum speed of 128.

Line 170 is similar to line 160, except the game control is #1 and the variable changed is the heading of the plane. B1 adjusts the value to range from 1 to 360 degrees.

In line 180 $X = \text{PEEK}(-16284)$ checks



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- Indicate end of page.
- Set tabs from one to many.
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- Repeat all typing keys as needed.
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- Print perfectly spaced proportional letters.
- Return to typing position after correction with miscaution key.
- Allow one character to overlap another (H).
- Right margin justification.
- Print two columns with both right and left margins justified and the center ragged.
- Lift off errors (from single character to entire line).

IT WILL EVEN:

- Allow a carriage return without a linefeed or a linefeed without a carriage return.
- Allow you to pre-set an impression control for high-quality carbon copies.
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- Number of lines left to end of page.
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Z.T. Spaans

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Possible enhancements to the program might include: adding color to the program; including division; programming a good strategy, if possible, with multiple levels of difficulty.

Notes on the Program

POS(A5,B5,L) looks for the position of B5 in A5 after position L. Example: POS("THE THIEF","TH",2) returns 5. If B5 is not a part of A5, the returned value is 0.

SEGS(A5,N,M) gives the segment of A5 from position M to position N. Example: SEGS("MOCKEY MOUSE",A,6) gives "KEY".

Z.T. Spaans, Weizmann Institute, 187, 2511 DD, Rehovot.

Sample Run

```

ZIM, YOU'RE AT 22 YOUR CARDS: +4,-2,+1, +1,7
PRT, YOU'RE AT 22 YOUR CARDS: +4,-2,+1, +1,7
PRT, IT'S YOUR TURN WHICH OPERATION DO YOU CHOOSE *
WHICH NUMBER DO YOU USE? 1
2 * 4 = 8
EXCELLENT
YOU MOVE 4 FORWARD
YOU DRAW 8 -2 AND 4
1 2 3 4 5 6 7 8 9 10
2 3 4 5 6 7 8 9 10 11
48 2
39 3
38 -4
37 -5
36 -4
35 0
34 -2
33 -1
32 0
21 -3
2 0 -1 2 3 4 5 6 7 8 9 10
19 20 21 22 23 24 25 26 27 28 29

```

```

ZIM, YOU'RE AT 22 YOUR CARDS: +4,-2,+1, +1,7
PRT, YOU'RE AT 22 YOUR CARDS: +4,-2,+1, +1,7
PRT, IT'S YOUR TURN WHICH OPERATION DO YOU CHOOSE *
WHICH NUMBER DO YOU USE? 8
2 * 4 = 8
EXCELLENT
YOU MOVE 8 FORWARD
YOU DRAW 8 -2 AND 4
1 2 3 4 5 6 7 8 9 10
2 3 4 5 6 7 8 9 10 11
44 2
39 3
38 -4
37 -5
36 -4
35 0
34 -2
33 -1
32 0
28 -3
2 0 -1 2 3 4 5 6 7 8 9 10
419 20 21 22 23 24 25 26 27 28 29 30

```

```

ZIM, YOU'RE AT 24 YOUR CARDS: +1,-2,+3, +1,7
PRT, YOU'RE AT 24 YOUR CARDS: +1,-2,+3, +1,7
PRT, IT'S YOUR TURN WHICH OPERATION DO YOU CHOOSE *
WHICH NUMBER DO YOU USE? 3
2 + -2 = 0
EXCELLENT
YOU MOVE 3 BACK - THAT'S A NEW
YOU DRAW 3 -4 AND 4
1 2 3 4 5 6 7 8 9 10
2 3 4 5 6 7 8 9 10 11
49 2
39 3
38 -4
37 -5
36 -4
35 0
34 -2
33 -1
32 0
24 -3
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Algebra Program Listing

```

10 REM ALGEBRA: 1984 WEISSMAN INSTITUTE TEL AVIV, WRITTEN BY TONY SPARKS
20 REM
30 REM H = NUMBER OF PLAYERS
40 REM N(1) = NAME 1 1
50 REM P(1,1) = CARD 1 1
60 REM P(1) = NAME 1 1
70 REM N(1) = NAME
80 REM
90 REM SUBROUTINE: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000

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Algebra, continued...

```

1210 NEXT J:PRINT " "
1220 PRINT USING "##",X:RETURN
1230 PRINT USING "###",N:PRINT:RETURN
1400 REM
1410 REM --- GET NUMBER ---
1420 REM
1430 PRINT "2: LINPAT 10
1440 ON=MOD(12,2)*.1:IF 15=0 THEN 1520
1450 15=MOD(15,1)+1:MODS(15,ON+1,LEN(15)):GO TO 1520
1460 IF MOD(15)=0 THEN 1510
1470 IF 15="STOP" THEN 1000
1480 IF MOD(15)/2 THEN 1510
1490 IF MOD(15)=1:MODS(15,1,1)+2 THEN 1510
1500 IF MOD(15)=2:MODS(15,2,2)+4 THEN 1510
1510 IF MOD(15)=3 THEN 1540
1520 IF MOD(15)=4:MODS(15,3,3)+8 THEN 1540
1530 PRINT "PLEASE USE ONLY + OR - AS SIGN, MOD '1'
1540 PRINT "AND DON'T USE NUMBERS HIGHER THAN 15":GO TO 1510
1550 UNVAL(15):RETURN
1560 REM
1570 REM --- DOING ---
1580 REM
1590 REM
1600 REM --- INSTRUCTIONS ---
1610 REM
1620 PRINT
1630 PRINT "YOU PLAY ALGEBRA ALONG THE SIDINGS OF A SQUARE"
1640 PRINT "10" * 10 BOARD. THE FIELDS HAVE NUMBERS FROM ONE"
1650 PRINT "UNTIL 48. THE SIDINGS OF THE PLAYERS ARE MARKED"
1660 PRINT "BY AN ARROW (*) BEFORE THE FIELD NUMBER."
1670 PRINT "EACH FIELD HAS A VALUE BETWEEN -4 AND +4. EVERY"
1680 PRINT "PLAYER HAS FIVE CARDS. THREE WITH A NUMBER (MAIN)"
1690 PRINT "BETWEEN -4 AND 4. AND TWO WITH AN OPERATION (+,-)"
1700 PRINT "OR *."
1710 PRINT "TO MOVE, YOU GIVE ONE OF YOUR NUMBER CARDS AND"
1720 PRINT "ONE OF YOUR OPERATION CARDS. THESE CARDS WILL BE"
1730 PRINT "COMBINED WITH THE FIELD ON WHICH YOU ARE."
1740 PRINT "EXAMPLE: YOU ARE ON FIELD 3 WHICH HAPPENS TO HAVE"
1750 PRINT "A VALUE OF 2. YOU PRESENT A NUMBER CARD WITH VALUE"
1760 PRINT "-1 AND AN OPERATION CARD *."
1770 PRINT "THEN YOU MOVE 2 - (-1) = 3 PLACES TO FIELD 6."
1780 PRINT "THE FIRST PLAYER WHO REACHES 50 WINS!"
1790 GO TO 170
1800 PRINT "WE STOP WITH YOU HERE"
1810 GO TO 1000
1820 PRINT
1830 PRINT "CHROMATIZATION: YOU HAVE WON FIVE CARDS!"
1840 END

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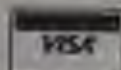
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WOMBATS



Wombat.

A program to generate word-problems

WOMBATS is a word-problems generating program for TRS-80 (Model I, Level 2, 16K or above). It appeals to a desire common to children aged 7 to 11 to create nonsense and test limits—"If I type in absurd nonsense, what will the computer do?" My object was to get the children to read, analyze and solve problems in order to find out what intrude the machine will next perpetrate. As a motivator, I've found nothing to three years of teaching with a computer that works better than surprise.

I also wanted my children to work on some "iterate" programming, make up of sentences in which subjects and objects agree in number, and the words are spelled right... that kind of thing (lamentably overlooked in lots of Computer-Aided Instruction programming. But that's another story)...

Word problems are important educationally because they synthesize two very different and demanding disciplines—reading and math—and also bridge the gap between abstract math facts (like $2+5=7$) and real applications. (Like this box has 32 raisins and there are 4 of us, how many do we each get?) These are surprisingly tough tasks for many children. The abstract word-book approach bores children—at least it did me when I was a child. Why not use the computer?

The challenge for me was to build in a reasonable amount of variation and surprise, enough repetition to help the shaky reader along, and some word-kneading tells and whistles to help the parent or teacher incorporate WOMBATS into the child's curriculum. Without the superior string-handling functions of the TRS-80, this program would be a mere shadow: Kodex to Radio Shack!

Let's walk right through the program

Michael Potts, P.O. Box 90, Chaper, CA 95421.
Michael Potts retains the copyright in WOMBATS.

and see what's there. (Numbers in parentheses are line numbers.)

Scaling

The first part of the program takes the four-core driver and housekeeping and the problems for each child.

**Word problems are
important educationally
because they
synthesize two very
different and
demanding
disciplines—reading
and math.**

The teacher/operator should set this program up with the abilities of the specific child in mind. For the first time or two, a conservative estimate will over-usage repeat business—and learning... but please, not too simple: the "Help" part is one of the nicest parts of the program.

MAX (100) limits the hardest operation. A child who can't multiply or divide can use the program with MAX set at 1 or 2. The work in the Add and Subtract sections are simpler than in the later problems. The DEFAULT option sets the initial variables at 4 (all operations), largest number 10.

LARGEST NUMBER (110) limits the numbers used. 5 or 6 is very easy, while 40 will generate some that challenge the best mental number-cruncher. (For specifics on number generation, look at lines 500-590.)

5 OBJECTS (120) gives the operator a chance to salt the program with five words

wom-bats (wŏm'băt's) *n.*
Either of two Australian marsupials, *Phascolomis ursinus* or *Lasiorninus latifrons*, somewhat resembling small bears. [Native Australian name.]

Michael Potts

of interest to the child—possibly words in the domain of harder words, perhaps words of specifically funny resonance for the reader. Always remember: this program is for children—keep the words in range.

Invitation (180)

I try to have programs document themselves for the child—with her the rules before she breaks them. Seems only fair.

The child should be invited on the first reading, because the helper will be able to tell how the child's reading ability fits the reading level of the problems. A child who can't read the invitation will have difficulty with the easiest problems... and probably isn't ready for word problems yet.

The child should be encouraged to experiment, push the machine (while, of course, respecting its mechanical quibbles); the program doesn't ask for a name, but for a few characters of address (190): Bat Man is perfectly acceptable. Similarly, encourage imagination in other names and objects.

Nonsense Screen

The program scans each child-entry for appropriate capitalization (2300), except in UWOMBATS; balance of vowels/consonants, and for length < 16 characters (2300).

I've enjoyed watching my children try to figure out just what the machine thinks nonsense is, anyway. They're required.

The Problem

A few examples will give you the idea. "This morning, George looked in his pocket and found 7 hairships. Later he saw 5 more in a box with Bat Man. (That's you.) How many hairships does he have now?"

"Mathilda gave you 4 word stories because she had too many. Later she had

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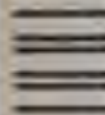
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We started publishing *Microsystems* almost two years ago to fill the void in the microcomputer field. There were magazines catering exclusively to the TRS-80, Apple, Pet, Heath etc. system users. There were also tried and true publications that cover the entire field but no one system in depth. But no magazine existed for CP/M users—nor did one exist for S-100 users.

The why and what of a software bus

First of all what is a "bus"? And why do we call CP/M "the software bus"?

A "bus" is a technique used to interface many different modules. Examples are the S-100/IEEE-488 Bus and the IEEE-488 Bus. These are hardware buses that permit a user to plug a bus-compatible device into the bus without having to make any other hardware modifications and expect the device to operate with little or no modification.

CP/M is a Disk Operating System (DOS). It was first introduced in 1974 and is now the oldest and most mature DOS for microcomputer systems. CP/M has now been implemented on over 250 different computer systems. It has been implemented on hard disk systems as well as floppy disk systems. It is supported by two user groups (CP/M-UG and SIG/CP-M-UG) that have released over sixty volumes containing over 1,500 public domain programs that can be loaded and run on systems using the CP/M DOS. Add to this another 1,500 commercially available

CP/M software packages and you have the largest applications software base in existence.

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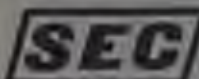
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wrote the original version, they put a jump address at an easy-to-remember location. Since this address changed anyway, I shortened the wasted space and used a new jump address. The actual entry address is \$5492 and you can use this if you choose. I used this version of mini to make this listing, but there is no guarantee it is bugless. All effort was made to check it out. But, you're on your own.

When you write a program be sure to start and end it at safe locations. The program you write can start at \$0800 and end at \$55FF. Or they can start at \$555F and end at \$05FF. Or the program can use any combination of the addresses between these two ranges. Any other addresses used may clobber the assembler, DOS or something else. Be sure you know where your program is located and what it is doing. Of course it's fun to experiment, too. The most that can happen is you will have to reload DOS and the assembler. Be sure you have the program saved and

use a scratch disk to do the experimenting. You might do something that causes the system to write on the disk when you don't expect it.

BUGS

The column in the May '81 issue contained a billboard program by Brian J. Winkler. My word processor made a mistake and inserted some typos in Brian's program. (Doesn't everyone blame it on the computer?) Paul Raymer pointed out that JERSY line 50 should be JERSEY. He also pointed out that the second asterisk in line 146 should be a colon. The program will run as Brian intended it when you make the changes.

NEXT TIME

I'll talk about getting started with the Apple—its versatility, how to find good Apple software, what hardware and peripherals you should consider—and a whole lot more.

Listing 2 continued

0400-	FA	04	004	000
0401-	FA	02	004	000
0402-	FA	04	004	000
0403-	FA	06	004	000
0404-	FA	08	004	000
0405-	FA	0A	004	000
0406-	FA	0C	004	000
0407-	FA	0E	004	000
0408-	FA	10	004	000
0409-	FA	12	004	000
040A-	FA	14	004	000
040B-	FA	16	004	000
040C-	FA	18	004	000
040D-	FA	1A	004	000
040E-	FA	1C	004	000
040F-	FA	1E	004	000
0410-	FA	20	004	000
0411-	FA	22	004	000
0412-	FA	24	004	000
0413-	FA	26	004	000
0414-	FA	28	004	000
0415-	FA	2A	004	000
0416-	FA	2C	004	000
0417-	FA	2E	004	000
0418-	FA	30	004	000
0419-	FA	32	004	000
041A-	FA	34	004	000
041B-	FA	36	004	000
041C-	FA	38	004	000
041D-	FA	3A	004	000
041E-	FA	3C	004	000
041F-	FA	3E	004	000
0420-	FA	40	004	000
0421-	FA	42	004	000
0422-	FA	44	004	000
0423-	FA	46	004	000
0424-	FA	48	004	000
0425-	FA	4A	004	000
0426-	FA	4C	004	000
0427-	FA	4E	004	000
0428-	FA	50	004	000
0429-	FA	52	004	000
042A-	FA	54	004	000
042B-	FA	56	004	000
042C-	FA	58	004	000
042D-	FA	5A	004	000
042E-	FA	5C	004	000
042F-	FA	5E	004	000
0430-	FA	60	004	000
0431-	FA	62	004	000
0432-	FA	64	004	000
0433-	FA	66	004	000
0434-	FA	68	004	000
0435-	FA	6A	004	000
0436-	FA	6C	004	000
0437-	FA	6E	004	000
0438-	FA	70	004	000
0439-	FA	72	004	000
043A-	FA	74	004	000
043B-	FA	76	004	000
043C-	FA	78	004	000
043D-	FA	7A	004	000
043E-	FA	7C	004	000
043F-	FA	7E	004	000
0440-	FA	80	004	000
0441-	FA	82	004	000
0442-	FA	84	004	000
0443-	FA	86	004	000
0444-	FA	88	004	000
0445-	FA	8A	004	000
0446-	FA	8C	004	000
0447-	FA	8E	004	000
0448-	FA	90	004	000
0449-	FA	92	004	000
044A-	FA	94	004	000
044B-	FA	96	004	000
044C-	FA	98	004	000
044D-	FA	9A	004	000
044E-	FA	9C	004	000
044F-	FA	9E	004	000
0450-	FA	A0	004	000
0451-	FA	A2	004	000
0452-	FA	A4	004	000
0453-	FA	A6	004	000
0454-	FA	A8	004	000
0455-	FA	AA	004	000
0456-	FA	AC	004	000
0457-	FA	AE	004	000
0458-	FA	B0	004	000
0459-	FA	B2	004	000
045A-	FA	B4	004	000
045B-	FA	B6	004	000
045C-	FA	B8	004	000
045D-	FA	BA	004	000
045E-	FA	BC	004	000
045F-	FA	BE	004	000
0460-	FA	C0	004	000
0461-	FA	C2	004	000
0462-	FA	C4	004	000
0463-	FA	C6	004	000
0464-	FA	C8	004	000
0465-	FA	CA	004	000
0466-	FA	CC	004	000
0467-	FA	CE	004	000
0468-	FA	D0	004	000
0469-	FA	D2	004	000
046A-	FA	D4	004	000
046B-	FA	D6	004	000
046C-	FA	D8	004	000
046D-	FA	DA	004	000
046E-	FA	DC	004	000
046F-	FA	DE	004	000
0470-	FA	E0	004	000
0471-	FA	E2	004	000
0472-	FA	E4	004	000
0473-	FA	E6	004	000
0474-	FA	E8	004	000
0475-	FA	EA	004	000
0476-	FA	EC	004	000
0477-	FA	EE	004	000
0478-	FA	F0	004	000
0479-	FA	F2	004	000
047A-	FA	F4	004	000
047B-	FA	F6	004	000
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047D-	FA	FA	004	000
047E-	FA	FC	004	000
047F-	FA	FE	004	000

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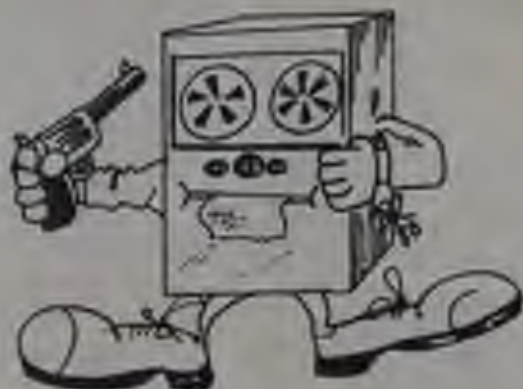
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New Functions for Uncertainty Calculations

M.P. Antonovich



Suppose you are a computer programmer. (This is a very realistic assumption.) Now suppose you are a mathematician. (This is a very realistic assumption.) Now suppose you are a computer programmer and a mathematician. (This is a very realistic assumption.) Now suppose you are a computer programmer, a mathematician, and a physicist. (This is a very realistic assumption.)

In these modern times, when everything seems to be less certain, I have found the need to expand the current capabilities of the modern computer programming languages in order to allow them to adjust to reality. I have listened to the words of many experts to derive my additional functions to be incorporated into future Basic and Fortran compilers. Without further delay, here they are:

1. A < B * C = 5

The above function will allow the user to specify A to be any number other than the result of B * C = 5. Variations on this function include:

A < B * C = 5

which specifies A to be less than B * C = 5, and

A > B * C = 5

which specifies A to be greater than B * C = 5.

It should be noted that any function can be used on the right side of the equation in the majority of cases except A < A which may lead to incorrect results.

2. IF A = 73 SOMETIMES 200

This statement provides the user with the capability of inserting uncertainty into a conditional GOTO statement. A similar statement can be applied to unconditional GOTO statements as follows:

SOMETIMES 200

As the user becomes more familiar with these statement forms, he can begin to write more complicated examples such as:

IF A = 73 SOMETIMES 200

OR OTHERTIMES 300

IF NOT THEN 405

OR ELSE MAYBE 475

3. NOPRECISION A,B,D

This statement will reduce variables A, B and D to a no-precision status in all calculations. This function is important in

uncertainty calculations where numbers are not even known to one significant figure, especially where calculations are of type 1, above.

4. REDUCEPACE

REDUCEPACE is a special function I have found to be in great demand. It has been reported that most computer errors occur in the most difficult parts of the program. Therefore, I have found the need for the REDUCEPACE statement to slow calculation speed so the computer does not

This function has three arguments which specify whether the answer must be an integer number, a floating point number, or a simple "YES" or "NO".

make a mistake by rushing over these sections. A RESUMEPACE statement should precede the next easy section to optimize computer time.

5. GRAB (A) FROM ARRAY (C)

This function will pick any element from the array C and assign the value to the variable A for all further calculations.

6. EXTRAPOLATE (C)

In the above function, C is an array defined in a previous DIMENSION statement. The purpose of this statement is to help all of those programmers who have on occasion had to write, read, or use values beyond the dimension of the array C. This function will extrapolate as far as necessary to accommodate all reasonable requests for array C, or any other array. If the specified array is not known to the program, tasteful default values are supplied.

7. DELPHI (X,A)

In the course of most business decisions, you often hear the words, "I won't believe it unless you have the computer back it up." Everyday businessmen are turning to the computer for the answers to their business and social problems. This function will help the computer make these decisions by relying on an ancient technique used since the beginning of recorded history. This function has three arguments which specify whether the answer must be an integer number, a floating point number, or a simple "YES" or "NO". Use this function with care because it will carry great weight.

8. SHUFFLE

The SHUFFLE command provides an additional way to add uncertainty into your program by randomizing the order of all lines in the program. I believe that this statement provides the most profound and powerful degree of uncertainty that can be input into a program.

9. GIVEUP 600

This statement tells the computer where to go when it is so totally confused that it no longer knows where it is. In this case it should go to 600.

10. SUICIDE

This statement is an extreme version of the GIVEUP statement and should only be used as a last resort. It tells the computer that if giving up does not help because the problems are too severe, that it should end it all. At this point, all systems will go down, lights will go out, air conditioning will turn off, printers will silence, and all the little floppies will stick up in the air. This statement has the additional benefit of replacing software error by hardware error, which can in principle be fixed more easily. It is especially useful as a debugging approach.

I sincerely hope that these new functions will help the frazzled programmer in dealing with the uncertain world we live in. Remember that nothing in this world is perfect, and indeed, neither are these commands, but they may help you over some tight spots.

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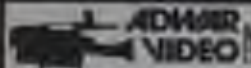


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outpost: atari



A Beginner's Guide to Player-Missile Graphics

Back when I was first working on an Atari 800, I tried to figure out Player-Missile graphics. First, I asked everyone I knew what P-M was and how it worked. "Well, like, man, it's a special subsystem with a reserved memory area that's really hard to use and you use Peek() to find an open page, man, then bump it 1024 and do a DMA write then hit D-Mack-Tall and Gack-Tall and it fires up."

And perhaps the best of all, "It's how they did Star Raiders." (Mind you, these were people who programmed Atari for a living!)

Said I, "There's got to be a better way." I then retired to a hilltop in Tibet with an Atari, and several hundred pages of manuals lent to me by some kind soul in a San Jose computer club, and started trying to figure it out. Long did I puzzle over the hardware manual (and still do). My back issues of *Creative* arrived with snow on them, all wrinkled up. But at last I won out: I returned understanding Player-Missile graphics. And in this column I shall try to impart to you, willing disciple, some of this knowledge, and help you achieve good karma.

In order to understand P-M graphics, it's best to start at the low level hardware functions and work up to the automatic DMA. So let's start at the TV.

A TV picture is made up of horizontal scan lines output from a source in time with the scanning of the TV. In our case, the source is the Atari, busily outputting data to the TV and trying to keep up with it. A special chip, called Artik, was designed to aid the main 6502 processor of the Atari in generating displays. (A longer and more detailed view of how the Atari

David and Sandy Small

generates these graphics appeared in the July 1981 issue of *Creative*, but is too long to repeat here.)

There's another chip called CTIA. CTIA is the chip which handles the assignment of color and such. Artik is more concerned with getting data from memory locations for CTIA (by DMA) is time to keep up with the TV. Because they are reincarnated slave drivers and prone to such behavior, the Atari designers felt that CTIA just didn't have enough to do, so they thought up another task for it.

CTIA already keeps track of where he is horizontally on each scan line like they reasoned. So let's have him keep an eye on a memory location at the same time for a special purpose. In this location is a number that corresponds to a horizontal position on the TV screen. I'll refer to the memory location where horizontal information is stored as a "horizontal position register."

Now, let's say CTIA should find that his horizontal position at the moment happens to equal this horizontal position register. Great things begin to happen! CTIA looks to another register to get one byte of data (this one I'll call a "graphics data register"). He then takes the first bit of data in this register, puts it onscreen as a dot if 1, or skips it if 0. For the next dot over, when he gets there, he does the same thing. He works his way from left to right onscreen, left to right through the eight bits of data—most significant bit first. He puts these eight bits of data onscreen at a color and luminance specified

by yet a third special register, the "color/lum register."

To get an overview of this process, let's say we have 150 stored in the horizontal position register, a color of bright green at 10 intensity in the color/lum register, and a bit pattern of 11001001 stored in the graphics data register. When CTIA,

Listing 1:

```
1. REM PROGRAM 1
2. REM NAME DO/DOVE
3. REM SPEED=50000
4. REM HORIZ=50000
5. REM VERT=50000
6. REM SIZE=50000
7. REM HORIZ=50000
8. REM VERT=50000
9. REM HORIZ=50000
10. REM VERT=50000
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90. REM VERT=50000
91. REM HORIZ=50000
92. REM VERT=50000
93. REM HORIZ=50000
94. REM VERT=50000
95. REM HORIZ=50000
96. REM VERT=50000
97. REM HORIZ=50000
98. REM VERT=50000
99. REM HORIZ=50000
100. REM VERT=50000
```

Listing 2:

```
1. REM PROGRAM 2
2. REM NAME DEFINED
3. REM SPEED=50000
4. REM HORIZ=50000
5. REM VERT=50000
6. REM SIZE=50000
7. REM HORIZ=50000
8. REM VERT=50000
9. REM HORIZ=50000
10. REM VERT=50000
11. REM HORIZ=50000
12. REM VERT=50000
13. REM HORIZ=50000
14. REM VERT=50000
15. REM HORIZ=50000
16. REM VERT=50000
17. REM HORIZ=50000
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94. REM VERT=50000
95. REM HORIZ=50000
96. REM VERT=50000
97. REM HORIZ=50000
98. REM VERT=50000
99. REM HORIZ=50000
100. REM VERT=50000
```

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CIRCLE 136 ON READER SERVICE CARD

Listing 3.

```

1 SET PROGRAM 0
2 REM NAME DEFINED
3 HPPOS=51240
4 SETOS=51241
5 COLS=794
6 SIZE=51254
7 REM NAME PROGRAM 0
8 REM NAME ROTATE A PLAYER
9 REM
10 POKS HPPOS,1541000 HORIZ POS
11 REM NAME SET SIZE
12 POKS SIZE,1541000 H. GND,1541000 H.
13 REM NAME SET SIZE
14 POKS SIZE,1
15 REM NAME ROTATE HIT PATTERN
16 FOR I=0 TO 255
17 POKS HITP,1
18 FOR I=0 TO 255
19 POKS HITP,1
20 NEXT I
21 END

```

travels scanning across the screen, finds his current position is 150, he will plot—dot dot (skip) (skip) dot (skip) dot dot—from his current position, working to the right (continuing the sweep). The dots will be green. CTIA will then finish the rest of the scan line with display list stuff. In the next line, he will again get to the 150 midway across the screen, and copy the graphics data register at the same color onto the TV. This process will happen every time he hits 150 horizontally. (Figure 1.)

What we end up with is a vertical green stripe at horizontal position 150, exactly matching the hit pattern above. Let's go ahead and run a program to do just this, so you can see what it looks like. (See Listing 1.)

Now, I'd like to have you briefly play around with this program to learn about

Listing 4.

```

1 REM PROGRAM 4
2 REM NAME DEFINED
3 HPPOS=51240
4 SETOS=51241
5 COLS=794
6 SIZE=51254
7 REM NAME PROGRAM 4
8 REM NAME ROTATE A PLAYER
9 REM
10 POKS HPPOS,1541000 HORIZ POS
11 REM NAME SET SIZE
12 POKS SIZE,1541000 H. GND,1541000 H.
13 REM NAME SET SIZE
14 POKS SIZE,1
15 REM NAME ROTATE HIT PATTERN
16 FOR I=0 TO 255
17 POKS HITP,1
18 FOR I=0 TO 255
19 POKS HITP,1
20 NEXT I
21 END

```

the registers. Let's change the color, turn the graphics data, and the horizontal position registers. The effects will be, respectively, changing the color, the hit pattern, and the horizontal position of the stripes. Run the programs in Listings 2, 3, and 4 to see these effects.

Next, I'll have to introduce you to the "size register." The size register tells CTIA how big to make his dots when he plots them on screen. He can make them normal size, twice as large, or four times as large. (All he does is plot the same data two or four times as he scans across the screen if we tell him to. Thus the stripe will grow from the left, with the left border (at 150) staying constant.) Run the program in Listing 5 to see this particular effect. A zero in this register means times one, a one means times two, and a three means times four.

Listing 5.

```

1 REM PROGRAM 5
2 REM NAME DEFINED
3 HPPOS=51240
4 SETOS=51241
5 COLS=794
6 SIZE=51254
7 REM NAME PROGRAM 5
8 REM NAME ROTATE A PLAYER
9 REM
10 POKS HPPOS,1541000 HORIZ POS
11 REM NAME SET SIZE
12 POKS SIZE,1541000 H. GND,1541000 H.
13 REM NAME SET SIZE
14 POKS SIZE,1
15 REM NAME ROTATE HIT PATTERN
16 FOR I=0 TO 255
17 POKS HITP,1
18 FOR I=0 TO 255
19 POKS HITP,1
20 NEXT I
21 END

```

The object you see in front of you, this stripe, is known as a "player." If you imagine an object that is exactly the same as a player, but is only two bits wide instead of eight, you have a "missile." Hence the name, "player-missile."

Well, you say, is that all? What good is a green stripe in the middle of the TV that doesn't even shut off when I quit running my program?

That's a good point. The thing is, we don't have to leave the data in the graphics register on all the time. Let's say we leave it all 0's for a while from the top of the screen. CTIA will plot nothing, just putting the usual background stuff (display list) on that scan line at 150. But if we should suddenly put some data—for example, 111111—in the graphics data register, it will plot in the next scan lines from

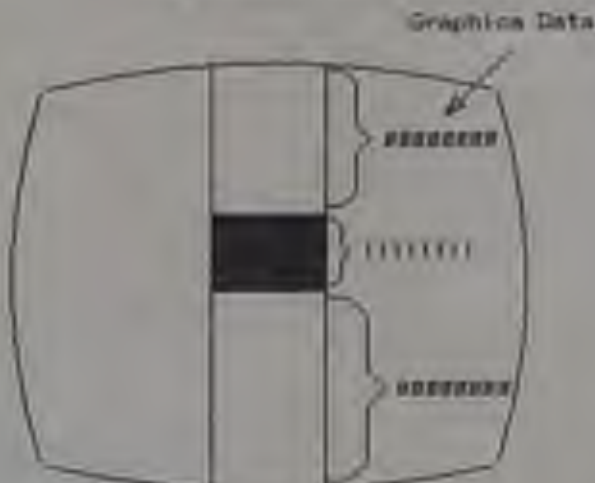
Figure 1.

The Player



Figure 2.

The Square Player



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CIRCLE 300 ON READER SERVICE CARD

Atari, continued...

then on. Then we can turn it off, by putting 0's back into the register, and we will have a square onscreen. It will really be a stripe, with a lit square in the middle of it, but so as it will appear to be just a square. (Figure 2.)

Now this is starting to get useful. We could change the shape of the square by changing the data we put in the graphics control register. We can move it horizontally by changing the horizontal position register, or vertically by changing where we decide to clock the graphics data register on and off. Then we will have an object moving around on the TV screen. Did I say "an" object? I should mention there are four players and four missiles available, each with separate controls. Table 1 lists the control memory locations.

Missiles have the same colors as their players. Missiles can also be grouped together to form a fifth player. Four missiles two bits wide equal one player eight bits wide, get it? All missiles have the same size and same data (usually two on bits anyway).

Some of the above demo programs should now become clear. I have set Player 0's horizontal position to 140, his color/lum to bright green at intensity ten (color/lum register = 16 * (color number) + Lum).

and his graphics data to CB hex, or 203 decimal. Alas, I haven't written the color/lum information to the location listed above, however. Let me pass on a sad experience to tell you why.

Inside the operating system of the Atari, invisible to you, exists what are known as "shadow registers." These registers contain what the O.S. currently thinks the color/lum and so forth of the players and missiles are. Now at the beginning of every screen refresh, the hardware registers for P-M are reloaded from the O.S. data. This means if you go in and change the addresses shown above, with a POKE, in some cases the change will only last until the next refresh: 1/60th of a second. So for the O.S. shadowed hardware locations listed above, POKE into the O.S. shadow register, not the hardware register, for a permanent effect.

Another good use for this table is direct Setcolor paking. Now all a Setcolor does is take the color, multiply it by 16, add the lum you specify, and POKE it into the above O.S. shadow locations. For a much faster Setcolor, just do a POKE (playfield O.S. shadow location), (16*color) + Lum. The O.S. locations to look for are the playfield areas, also known as color registers

Listing 6

```
10 REM PROGRAM 6: USE ALL PLAYERS
20 REM DEMONSTRATED PRIORITY
30 POKE 523,0:REM PA ADDRESS
40 REM TIME & = 70 HAVE PLAYERS
50
55 REM HAVE LINEAR PRIORITY FROM
  PLAT
60 POKE 784,0:REM COLOR PA GRAY-LO
70 POKE 785,0:REM COLOR PA
  GRAY-HI
80 POKE 786,0:REM COLOR PA
  PURPLE-HI
90 POKE 787,0:REM COLOR PA
  GREEN-HI
100 REM
110 POKE 52241,255:REM BITH PA
120 POKE 52242,255:REM BITH PA
130 POKE 52243,255:REM BITH PA
140 POKE 52244,255:REM BITH PA
150 PRINT "PLAYER 0 = GRAY"
160 PRINT "PLAYER 1 = GRAY"
170 PRINT "PLAYER 2 = PURPLE"
180 PRINT "PLAYER 3 = GREEN"
190 REM CYCLE THROUGH PRIORITIES
200 FOR I=0 TO 10
210 POKE 522,0
220 PRINT "PRIORITY CODE = 10"
230 FOR T=24 TO 255 STEP 8
240 POKE 52245,24+T:REM PLAYER 0
250 POKE 52246,24+T:REM PLAYER 1
260 POKE 52247,24+T:REM PLAYER 2
270 POKE 52248,24+T:REM PLAYER 3
280 FOR Z=1 TO 15:REM T
290 NEXT T
300 NEXT I
310 GOTO 100
```

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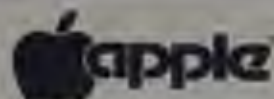
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Table 1. Player-Missile Controls

Object Number	Horizontal Position Register	Graphics Data Register	Color/Lum Register	O.S.* Shadow	Size Register
Player 0	D000 (53248)	D00E (53261)	D012 (53266)	704	D008 (53256)
Player 1	D001 (53249)	D00F (53262)	D013 (53267)	705	D009 (53257)
Player 2	D002 (53250)	D010 (53263)	D014 (53268)	706	D00A (53258)
Player 3	D003 (53251)	D011 (53264)	D015 (53269)	707	D00B (53259)
Missile 0	D004 (53252)	D011 (53265)	same as P0		D00C (53260)
Missile 1	D005 (53253)	same	same as P1		same
Missile 2	D006 (53254)	same	same as P2		same
Missile 3	D007 (53255)	same	same as P3		same

O.S. Shadow Registers**

O.S. Location	Hardware Register	
- ANTIC -		- CTIA -
220 H (558D)	D400 H (DMA CTL)***	26F H (623D) D01B (PRIOK)
2FA H (755D)	D401 H (CHA CTL)	2C0 H (704D) D012 (Player 0 Color)
280 H (5A0D)	D402 H (Dis L)	2C1 H (705D) D013 (Player 1 Color)
231 H (561D)	D403 H (Dis H)	2C2 H (706D) D014 (Player 2 Color)
2F4 H (756D)	D409 H (CH BASE)	2C3 H (707D) D015 (Player 3 Color)
		2C4 H (708D) D016 (PlayField 0 Color)
		2C5 H (709D) D017 (PlayField 1 Color)
		2C6 H (710D) D018 (PlayField 2 Color)
		2C7 H (711D) D019 (PlayField 3 Color)
		2C8 H (712D) D01A (PlayField 4 Background Color)

Refer also to Atari columns listing hardware register addresses.

* O.S. or Operating System—A control program that allows the computer to *talk* with other programs, and handle input and output.

** Shadow Register—An area in memory that stores information to be transferred to a hardware control device.

*** DMA or Direct Memory Access—Allowing information in memory to be transferred from one location or device to another without using the main microprocessor. The Atari uses the Antic microprocessor to transfer information from memory to the television screen.

Abbreviations: CTL = Control; Dis = Display List; H = High Byte; L = Low Byte

to the Basic programmer. (2C4-2C8 H)

The information provided so far will be quite helpful. You can get some really neat color effects running players back and forth. Try the program in Listing 6 for this effect and feel free to modify it in all sorts of ways. Note the effect, though, when two players run over one another, or when a player runs over some background (display list) data!

When two players or missiles (or more) "collide," what happens? CTIA will have two "on" bits of data from two objects

and has to resolve the priority conflict. First, it lets you know they have collided (remember, that doesn't just mean their horizontal position has matched, it means that while plotting "on" bits of graphics data registers CTIA encountered two in the same place) writing into a "collision register." CTIA then follows a priority scheme to tell it which player to plot over which, and whether to plot players over display list data. You select the scheme you want with a POKI. Table 2 lists the different schemes.

Player-Missile DMA

So far we have a vertical stripe constant and some interesting color effects. Basic is nowhere near fast enough to switch the thing off and on to get an "object" on screen. And even if we were to work in assembly language, we would tie up the 6502 processor doing all this on/off stuff and writing the graphics registers, and it wouldn't have time to do much else.

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Table 2. Priority table.

Location 001B (53275) contains the priority data. Use OS 632D as this address is shadowed.

Select either 8, 4, 2, or 1 to POKE with. Adding them gives odd results consisting of black overlapping regions. (Experiment!)

8	4	2	1	
P-F 0	P-F 0	Play 0	Play 0	Highest Priority
P-F 1	P-F 1	Play 1	Play 1	
Play 0	P-F 2	P-F 0	Play 2	
Play 1	P-F 3&5	P-F 1	Play 3	
Play 2	Play 0	P-F 2	P-F 0	
Play 3	Play 1	P-F 3&5	P-F 1	
P-F 2	Play 2	Play 2	P-F 2	
P-F 3&5	Play 3	Play 3	P-F 3&5	
BACKGROUND	BACKGROUND	BACKGROUND	BACKGROUND	Lowest Priority

Add 00H (16 D) to let all missiles become the color of playfield 3. Thus you can position all the missiles for a fifth player object. Add 20H (32D) to have a different color (a logical 00H occurs during an overlap).

"Play" refers to a Player. "P-F" refers to a playfield, or display list generated, object. (Remember the four available color registers?)

Use this priority chart after you have decided who should have priority over whom, to select the scheme that you wish.

Designer 1: Well, the problem is, we don't want to tie up the 6502 with all this player-missile stuff.

Designer 2: Yeah, kinda reminds me, though of another situation. Remember when we did the display list, and we didn't want to tie up the 6502 with doing the screen refreshes?

Designer 1: Right. We let Antic do all the display work to free up the 6502. Hmmmmmm.

(Antic, hearing this, realizes something is about to happen and quietly slinks toward the door, tail between legs and ears drooping, trying to attract as little attention as possible.)

Player-Missile DMA Memory Mapped to TV Screen

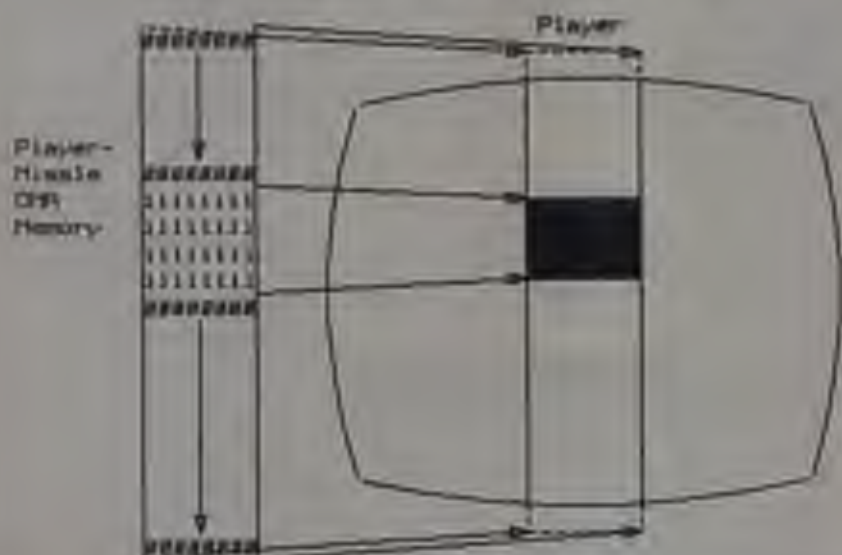


Figure 3.

Designer 1 and 2 have the same idea at the same instant: "Let Antic do it! We've already assigned him to do display work; why not let him help us with P-M? Antic! Here boy! Now where did he go?"

Naturally to say, they caught old Antic and set him to helping with P-M graphics. You don't *have* to use Antic to help you, as we've seen with our demonstration program. Antic is just there to help if you want him to, to take some of the load off the 6502 (and you). There are applications which benefit from both using Antic and not using him, so keep the above "simplest" player-missile graphics method in mind. It's what Antic uses anyway.

Let's set up a table in memory. It will be 256 bytes long. Each byte in that table corresponds directly to one horizontal scan line on the TV. (Well, yes, there are 192 scan lines on the TV, so there's a bit of overkill. You'll note a player extends all the way offscreen, past where Antic is generating display list scan lines.)

Now if we tell him to, CTIA will tap Antic on the shoulder each time one of his horizontal position registers matches his current position, and say, "Hey, give me the graphics data byte for this particular line number." Antic will go to memory, fetch the byte, and feed it to CTIA. The next thing is, once you set up the 256 byte area and tell them to get going, the 6502 is free to do whatever you want it to. The "Player-Missile DMA" becomes completely automatic then. (Figure 3.)

In this method, an object is defined by a few bits in this table which correspond directly to a vertical stripe onscreen. If we turn on a few bits, they show up in the corresponding screen position. If we copy them upwards in the byte table, the object they show will move up. We control their horizontal position via the horizontal position register, color through the O.S. shadow register, size, and so on.

This technique is what most articles on P-M graphics use. As we've seen, it is a higher-level technique than the more direct method of writing to the hardware registers: it just involves letting Antic do our work for us. Be sure to keep the earlier technique in mind, though.

There are many things you have to do to initialize P-M DMA and get things rolling. You have to reserve a location in memory for player-missile DMA. Finally, you must set colors and such (as shown here) to get the players to show up.

It is difficult to learn to apply P-M graphics using the DMA table, with all the pesky details, any other way than by example. There are just too many registers and options in a list to be anything but a reference aid. So what I'll do is take a P-M example from an earlier issue and go through it, in detail, with you, pointing out the mischance on the way. There really isn't much new, now that we've

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Player-Missile Memory Map Example

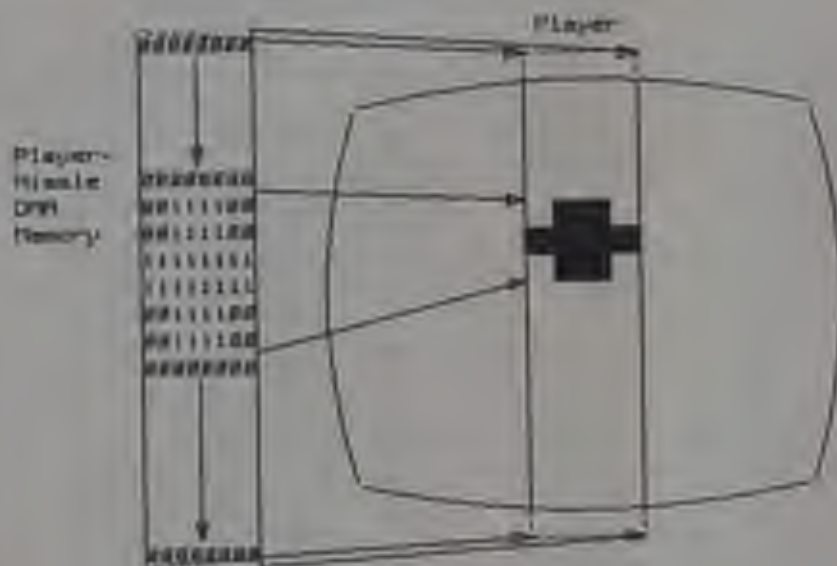


Figure 4.

covered the hardware addresses and concepts.

In January, George Bink gave a fine example of DMA P/M graphics. (See Listing 7.) Let's go through the program briefly to see how it works in relation to our example.

Line 30 POKES into an O.S. location which instructs the system to work with a normal size playfield: $\text{O.S.} = 80$ characters across. This location is really an O.S. shadow, however, for a hardware register called DMACTL (Direct Memory Access Control). There are two electrical switches between Antic, CTIA, memory, and the world, which tell them whether to do automatic DMA or let you do all the work. DMACTL is one. GRACCTL (Graphics Control) is the other. Both switches must be on for P/M DMA to occur. This

POKE turns on DMA by poking DMACTL, so now all Antic is waiting for is the GRACCTL switch to be switched on.

And now, for another brief detour: DMACTL also controls whether Antic can go to memory at all, as in whether he can generate display list graphics. A POKÉ (DMACTL=0 will turn your screen completely off, because Antic can no longer fetch bytes from memory.

Now why would we ever want to do this? For one thing, it is a good way to flash something on screen. Another is that if we change display lists, we want Antic turned completely off so that he can't run wild between them in the time it takes to POKÉ both bytes of a new DL start address.

Line 40 is a POKÉ to Player 0's horizontal position register, putting the player at 120. Line 50 POKES Player 0's O.S. shadow register to a pink color. (No surprises so far, right?) Now, you'll recall we need 256 bytes for our table. I hate to tell you this, but if we're going to run one player this way, we have to run them all this way, which means four players and one missile times 256 bytes. There's some wasted space, so the total comes out to 2048 bytes for our bitmaps of the player missile stripes. We'll fetch the 2048 bytes at the end of available user memory. To do this, we find where the Atari thinks the end of memory is, which it figures out upon startup, and then back up 2048 bytes from there. We do this by looking at location 106, which tells the number of 100 hex, or 256-byte, "pages" of memory it has available. Since 2048 is 8 x 256 bytes, we use that value to tell the Atari where the

Table 3. P/M Table Area

PMBASE * 256 = start of this area	
BASE ADDRESS	
+	0
= wasted space.	
+	768
+ 768	
- Missile Data. Missile data is packed side by side, 4 missiles of 2 hex per byte.	
M3 - M2 - M1 - M0	
+	1024
+ 1024	
- Player 0 bitmap. Top byte is top line of TV (above viewing area)	
+	1272
+ 1280	
- Player 1 bitmap.	
+	1536
+ 1536	
- Player 2 bitmap.	
+	1792
+ 1792	
- Player 3 bitmap.	
+	2048

Listing 7.

```

10 BTA: A4181,04181:
20 GRAPHICS 0
30 POKÉ 529,42
40 POKÉ 53246,128
50 POKÉ 754,100
60 POKÉ(134)=0
70 POKÉ 54279,2
80 POKÉ 53277,3
90 POKÉ 53254,3
100 J=2048+1024
110 FOR T=0 TO 1024
120 READ J
130 POKÉ J,J
140 NEXT J
150 FOR K=0 TO 2048/256-1
160 NEXT K
170 DIFF 150
200 POKÉ 106,7
210 POKÉ 53246,0
220 POKÉ 53246,0
230 POKÉ 53246,0
240 DATA 04,04,04,04,04,04,04,04
250 DATA 04,04,04,04,04,04,04,04
260 DATA 04,04,04,04,04,04,04,04

```

beginning of our Player-Missile data table will be. We POKÉ that location into 54279, which is "PMBASE," the base address of the Player-Missile data.

Next, we must POKÉ into a switch known as GRACCTL. GRACCTL and DMACTL, remember, are the switches that keep P/M graphics off. We already turned DMACTL on at the start of the program. We POKÉ a 3 into 53277, which translates to, "Turn Player-Missile graphics on and enable Antic to start getting bytes from memory." You've seen 53256 before; this is player 0's size register. A 3 POKÉd in there means size times four.

Well, our player-missile graphics are now running. Whatever junk is in memory at this point is being busily pulled out of memory by Antic, fed to CTIA, and displayed on the TV. We had best get some sort of bit pattern in the table, so let's do that now. Line 280 sets J equal to

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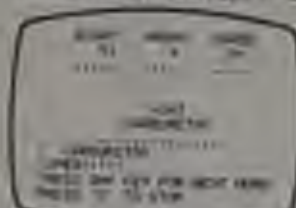
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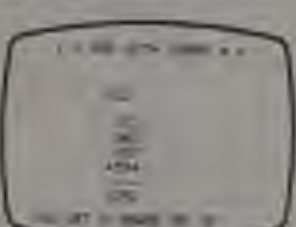
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Atari, continued...

1 (which you will recall was the start of the P-M table) + 256 (because this value was in 256 byte pages). Thus, J points to the beginning of the P-M table in real memory. We add 1024 to it, because that's how far in this table the Player 0 data is, with the data for the other players and missiles around it. (See Table 3.)

Hence, J now equals the beginning of the Player 0 data. The FOR loop in the program runs from J+120 to J+137, which is from the 120th to the 137th byte in the middle of the player, or right about midway down the screen. We read in data and POKE it into the middle of the player bit map. This data is in the form of a "cross," where the 0's are 00111000, and the 2's are 11111111. This data will be output in the form of dots for 1 bit and blanks for 0 bits, so at this point we have a cross onscreen, still in pink. Next, we have a loop which POKEs the horizontal position register from 98 to 221, and over again.

This will move our player stripe, with all but the cross on it invisible, across the screen. (Figure 4.)

There shouldn't be much mystery left in players and missiles now. Artie is just poking our hardware graphics register for us, with a table of data we feed him, so the 8502 isn't kept busy. We still move him horizontally as always, set his color, and select his size the same way. To move him vertically, we have to re-POKE the data in the byte table, and here a clever program in the April "Output: Atari," page 195* may help you. The data in a string are specified as the data in the player field, so by manipulating the string, you manipulate the player (at high speed). This is very valuable when you try copying a list from Basic and see just how slow it really is.

*[Note: there is an error in line 580, which should read 580 POKE VTAB+7,1.]

There are many options open to us, some of which you may never use, but some of which may be just the ticket for displays you're thinking of. I'll try to go over one of these options, now that we have a bare-bones P-M example going and the basics down, in a later article. You may also want the information on the Atari hardware registers which has appeared recently; it will give you the exact patterns needed to POKE into such areas as DMACAL, or a size register.

Now that you have the essential information about player missile graphics, you may wish to experiment with moving players around on the screen. Listing 8 will display the horizontal memory pointers. Listing 9 will demonstrate vertical scrolling. Listing 10 combines horizontal movement with vertical scrolling, and Listing 11 demonstrates vertical scrolling combined with altering the display list in a test mode. Have fun, and be sure to experiment! □

Listings for Programs 1-4 were inadvertently omitted from the August "Output: Atari." They are listed below.

Program 1.

```
10 REM PROGRAM 1: HORIZONTAL
20 START=PEEK(244)+256*PEEK(245)
30 REM ARTIE DISPLAY MEMORY POINTER
40 REM IS AT START+4 AND START+5
50 REM
100 X=PEEK(START+4)+256*PEEK(START+5)
110 PRINT "START OF OESP MEMORY="X
200 FOR Y=0 TO 99
205 PRINT "POINTER="Y
210 REM SPLIT Y UP INTO TWO BYTES
220 YH=INT(Y/256)
230 YL=Y-YH*256
240 POKE START+4,YL:POKE START+5,YH
250 FOR DELAY=1 TO 20:NEXT DELAY
260 REM
270 NEXT Y
```

Program 2.

```
10 REM PROGRAM 2: VERTICAL AND HORIZ
20 START=PEEK(244)+256*PEEK(245)
30 REM ARTIE DISPLAY MEMORY POINTER
40 REM IS AT START+4 AND START+5
50 REM
100 X=PEEK(START+4)+256*PEEK(START+5)
110 PRINT "START OF OESP MEMORY="X
120 REM
130 REM SCROLL UP
140 FOR Y=0 TO 8+10000:STEP 50
150 GOSUB 1000
160 REM
170 NEXT Y
180 REM SCROLL DOWN
190 FOR Y=8+10000 TO 0:STEP -40
200 GOSUB 1000
210 NEXT Y
220 REM
230 REM SCROLL LEFT
240 FOR T=0 TO 8+40
250 GOSUB 1000
260 NEXT T
270 REM SCROLL RIGHT
280 FOR T=0+40 TO 8:STEP -1
290 GOSUB 1000
300 NEXT T
310 REM CALCULATE HL, LOW BYTES
320 YH=INT(Y/256)
330 YL=Y-YH*256
340 POKE START+4,YL:POKE START+5,YH
350 RETURN
```

Program 3.

```
10 REM PROGRAM 3: VERTICAL
20 START=PEEK(244)+256*PEEK(245)
30 REM ARTIE DISPLAY MEMORY POINTER
40 REM IS AT START+4 AND START+5
50 REM
100 X=PEEK(START+4)+256*PEEK(START+5)
110 PRINT "START OF OESP MEMORY="X
120 REM
130 REM SCROLL UP
140 FOR Y=0 TO 8+10000:STEP 40
150 GOSUB 1000
160 REM
170 NEXT Y
180 REM SCROLL DOWN
190 FOR Y=8+10000 TO 0:STEP -40
200 GOSUB 1000
210 NEXT Y
220 REM
230 REM CALCULATE HL, LOW BYTES
240 YH=INT(Y/256)
250 YL=Y-YH*256
260 POKE START+4,YL:POKE START+5,YH
270 RETURN
```

Program 4.

```
1 REM PROGRAM 4: VERTICAL SCROLL TEST
2 VSCROLL=0
3 START=PEEK(244)+256*PEEK(245)
4 REM *** PUT SOME DATA UNDERNEATH ***
5 GRAPHICS 0
6 FOR T=0 TO 24
7 PRINT "THIS IS LINE #27"
8 NEXT T
9 REM *** ALTER DISPLAY LIST TO 7 ***
10 REM *** IN TWO WORDS, 2*4-12=24 ***
11 FOR Y=START+12 TO START+12
12 POKE Y,0
13 NEXT Y
14 FOR Y=START+17 TO START+24
15 POKE Y,24
16 NEXT Y
17 REM *** SCROLL UP ***
18 FOR T=0 TO 7
19 POKE VSCROLL,T
20 GOSUB 200
21 NEXT T
22 REM *** SCROLL DOWN ***
23 FOR T=7 TO 0:STEP -1
24 POKE VSCROLL,T
25 GOSUB 200
26 NEXT T
27 GOTO 10
28 REM *** SHORT DELAY LOOP ***
29 FOR T=0 TO 50:NEXT T
30 RETURN
```

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ngs...TRS-80 strings...TRS

Stephen B. Gray

For the 32nd entry in this merry-go-round, we'll look at a music synthesizer, a music synthesizer, an audio tape that helps you compare two synthesizers, a computer demonstration tape, a 3D graphics program, and a short program to help you pack strings.

The Music Box

If you play a keyboard instrument (musical, that is), there are probably many pieces you'd like to perform, but which are beyond your capability, because they're too difficult to play.

Sometimes a piece is impossible to play because it isn't available in a keyboard version. One example of this is the *Casuarie for String Orchestra*, by Johann Pachelbel (1652-1706), which has enjoyed a new popularity recently. Although it has no known programmatic connotations, "its serene simplicity has given it a certain spiritual mystique," according to the jacket notes on one album featuring it.

Although originally written for organ, it seems to be available now only for three violins and continuo. Which means you can rewrite it for the organ or piano, by combining the three violin parts, or get three violinists to help you play it.

Or you can write it in the simple language of the Music Box, a music synthesizer program, and the canon will be played back much more precisely than you could ever do it yourself on any instrument.

The Music Box, by Muscraft, is \$149.95 from Newtech Computer Systems, Inc. (210 Clinton St., Brooklyn, NY 11201). It comes in a plastic box, about 7" by 5" by 2 1/2".



discreetly with a keyboard unit, containing a latching digital-to-analog converter followed by a low-pass filter and audio amplifier, plus a ribbon-cable connector (which plugs into the 52K single-disk expansion interface on your TRS-80), power supply, demo disk, and Music Program disk.

Disk Only

The Music Box was originally available on both disk and cassette, but the cassette version was dropped because users had to spend too much time loading each of the five program modules separately, one after another, after another, after another, etc. With disk, all five modules are available instantly—well, almost instantly.

First you call up the EDIT module, which you use to enter music, either transcribing it from written notes, or composing as you go. Or you can change music already stored.

At the beginning of EDIT, you either load what the manual calls a "song," to be edited in some fashion, or write a new "song." You enter the number of voices, from one to four, then call up the menu of options, which has half a dozen, from setting the number of intervals per octave (for microtonal music, you can use from 1 to 99 intervals per octave) to changing the tempo.

You enter tempo and key, then start entering the notes and their durations, one voice at a time. For the bar of the canon in which the first violin comes in, you write

```
0002 Q F#5  
0003 Q B#5  
0004 Q D#5  
0005 Q C#5
```

The line numbers are displayed automatically, as is the # sharp sign and the B natural sign. You enter Q for quarter notes, and 5 for the octave they're to be played in.

Voices 2 and 3 have to be accounted for, even if they're not heard, so you fill in the blanks with rests. For example, in the third bar in which the violin ac-

ceeds, only violins 1 and 2 are played, so violin 3 is indicated with rests:

```
0012 Q D#5 F#5 B#5  
0013 Q C#5 B#5 B#5  
0014 Q B#5 D#5 B#5  
0015 Q A#5 C#5 B#5
```

Because this is a canon, the second voice, which starts at line 0012, uses the same notes as the first voice that began at line 0002. How nice it would be if you only had to write the first voice, then tell the program to use the same notes for the second voice, only starting two bars later, and the same for the third voice. However, I've found that the only personal-computer music synthesizer that can do this is the ALP, which is designed for the Apple computer.

After entering your song, you compile it, which will give you a playable song file. Call up COMP, enter the name of the song to be compiled, and the module translates the song lines into the numerical values required by the PLAY module.

Then you write the compiled song onto disk, and call up the PLAY module, which enters the waveform-load sequence. You can either call up a waveform you've built with the WAVE module (which uses Fourier synthesis), or use the pre-loaded waveforms, and your song is played right away.

A fifth module, UTIL, permits working up a "jokebox" menu of songs, printing out the music, transmitting a song or a waveform via the RS-232 port, etc.

The Music Box has many more capabilities than space permits describing here, such as calling a chorus, repeating phrases, transposing, extensive editing commands, etc. You can practice an instrument by writing a song and then playing it back with a single voice missing; you play along with the other voices, just like Music Minus One records.

PLAY offers an interactive option, allowing you to use the TRS-80 keyboard as a programmable interface. In EDIT mode you assign a note or chord or melody to a key, and later, as a song is being



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"is the computer into her schedule" thanks to the editors and occasional disk programs she received from CLOAD. She was writing about it to all in the people of her mailing list (November, 1979 issue).

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TRS-80, continued...

played, press a key you have pre-assigned and, right in the middle of whatever is being played, the note or chord or melody will be heard. That would make for some very interesting music...

The major problem with The Music Box is the 91-page manual. If you're used to railway manuals, with paragraph number IV.A.Ah.1.7, and have knowledge of music synthesizers and waveform-building, you can probably get a great deal out of the manual. If not, it may drive you right up the wall.

There's no simple step-by-step how-to section, so that a beginner can write simple music within a reasonable time, and then get into the more complex aspects. You're supposed to read the entire manual first, and then try to remember where to find the various bits and pieces, scattered here and there, that are necessary for running the various modules. It's more a reference manual than a how-to manual. It has no index, gives only a sketchy idea of how to build a waveform, and provides no information in the UTIL section on how to use the RS-232 port.

The Music Box, then, is not for the neophyte or the faint-hearted. But if you're adventurous and like a challenge, and would like to use a music synthesizer that has many excellent and versatile features, try The Music Box.

Comparison With Orchestra-80

The only other polyphonic (more than one voice at a time) TRS-80 music synthesizer, at this writing, is Orchestra-80 (Feb. 1981 p. 102).

The Orchestra-80 manual is much better, and the music easier to write, than with The Music Box. Although Orchestra-80 uses numbers for the notes in the two octaves above and below middle C, before long you begin to remember most of the numbers.

Using Music Box, I had to keep looking at the manual to find out exactly where the scales change from octave 4 to octave

5, for example. Also, since mistakes can't be changed on the spot using The Music Box (they can with Orchestra-80), I first typed out all the information for the Pachelbel Canon before entering it on the keyboard, to make sure I'd get it right, especially all those added rests.

However, the proof of the synthesizer is in the music. The polyphonic music made by the two systems is basically about the same. But The Music Box contains a low-pass filter. Orchestra-80 doesn't, and its music is marred by incessant, unwanted harmonics. You can de-emphasize these high pitched squeaks with the tone controls in your amplifier, but that's at the expense of the music.

Incidentally, you can run the Music Box software on Orchestra-80 hardware, and vice-versa, although for the latter you have to change one byte in the assembly-language program. This isn't a case of a copied product; there's only one accepted technique of digital-to-analog conversion.

Music Sweetener

There's a way to get rid of those unwanted harmonics created by Orchestra-80. Newtech sells a low-pass filter, similar to the filter in The Music Box, which will remove those high squeaks, for \$39.95. You can use it with any DAC music synthesizer that doesn't have a filter in it. (I've called the Music Sweetener.

Synthesizer Sampler Tape

If you want to compare the two TRS-80 music synthesizers, there's a C-46 cassette tape with over two dozen selections, played by The Music Box and by Orchestra-80.

The audio tape is \$3.95 postpaid, from Computer Information Exchange (CIE for short), Box 159, San Luis Rey, CA 92068. Many of the selections are played on both systems, so you can compare them directly.

Although the tape can be played in any cassette player, for best results it should be played through a hi-fi system.

The music includes a couple of Scott Joplin rags, the Bach *Prelude in C minor*, his *Fugue and Invention No. 9*, and the first movement from his *Concerto for Two Violins*. There are also selections by Handel, Beethoven, Mozart, Gounod, and Rossini, plus Dixie and a chorale.

On the tape, Orchestra-80 seems to be the winner, despite the unwanted harmonics, which are not filtered out. Part of its superiority is due to most of the Orchestra-80 selections having been arranged more skillfully, with more attention to the techniques that show off a synthesizer at its best.

For another thing, the Orchestra-80 selections sound mellower, which may be

because of the waveform used or perhaps because of the hi-fi system used.

Although the Orchestra-80 selections outnumber those played on The Music Box by two to one, CIE president Bill McLaughlin says, "We worked with all the material we were able to dig up, and worked mostly with material from the vendors."

Compiler Demonstration

CIE has another demo tape, which shows how a Basic or Tiny Pascal compiler can speed up your programs. The \$3.95 tape for 16K Level-II TRS-80, offers the games of Mine and Life in two versions: interpreted Basic and the compiled native code.

Mine, compiled by Southern Software's ACCEL2 compiler, runs 30 times faster than the interpreted version, which is so slow you'll soon give up.

Life runs about five times faster in the compiled version than in the interpreted version, which will put you to sleep.

The tape contains a third game, in a compiled version only: Ballzeye, compiled on CIE Tiny Pascal, which is the tape version only. ACCEL2 works on either disk or tape. Both compilers are available from CIE: Tiny Pascal is \$19.95; ACCEL (for Level-II Basic) is \$44.95; ACCEL2 (handles full disk Basic) is \$88.95.

Sublogic 3D Graphics

RUN the demonstration side of the 3D graphics program tape from Sublogic Distribution Corp. (Box V, Savoy, IL 61876) and you get three "snapshots" or samples of a flight simulation. A Cessna 74 is five miles northeast, traffic is a Learjet in the mountain pass about to make a low pass at runway 25, and you're cleared to land on runway 7, according to the second display.

The third display is a 3D display of half-a-dozen intersecting lines plus something that may be a mountain, not all that easy to visualize, perhaps because low-



Figure 2: The screen shows a more sophisticated display than provided by the demo-tape snapshots: it's from Sublogic's TRS-80 Flight Simulation program that runs at three frames a second.



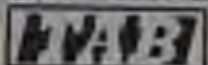
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TRS-80, continued...

resolution raster-scan isn't all that great for graphics to begin with, and for 3D it can present problems.

However, the two following 3D displays make more sense, as you head toward the numbered runway.

On the other side of the \$30 16K Level II tape is the Microcomputer 3D Graphics program, with a sample database, for a cube, to help you become familiar with 3D graphics. RUN it, and you're asked for field of view, which allows you to select either wide-angle or telephoto views of the object to be viewed, which is a 50-by-50-by-50 unit cube located at the upper-right side of the X,Y origin, 100 units back on the Z axis.

Then you enter the location of the object (X,Y,Z) as 0.0,0. For Direction of View (P,B,H), you enter data for Pitch, Bank and Heading; enter 0.0,0 for raw.

The screen shows you a cube as viewed from the Z-axis. Now you can begin to move the cube around. Press ENTER, and you're asked to enter the location of the object (X,Y,Z). If you input -25,-25,0, while holding the other parameters constant, you enter the view of the closest face of the cube.

To move the cube closer to you, move it in a negative direction along the Z-axis with -25,-25,-50.

To rotate the object image relative to itself, change Bank by entering 0.30,0 for P,B,H. The small 25-page manual then tells how to move the cube around by changing X,Y,Z and P,B,H data, and provides several examples.

The program redraws the cube each time; this is not dynamic graphics, which would show the cube moving from one aspect to another. That takes much more memory and a longer program, because you've got to display all those intermediate views.

Experience with different entries will give you the ability to judge the P,B,H necessary to view the object, according to the manual, which goes on to show how to create and enter your own database for any image you wish. You sketch the object on paper first, label points, organize the database, and enter start and end points, replacing the data in program lines 2000-2033 (or more, if necessary) with your own. The booklet ends with a listing of the program.

A larger and longer manual, the 60-page Basic 3D Graphics Manual, goes into detail, explaining 3D concepts, moving objects in 3D, the 3D program, etc. Everything is explained as simply as possible, without math in the main text. Appendix 1 gets into the graphic principles of point translation using transformation matrices, without getting too heavy on the math.

The projection method, by the way, is

```
1 CLS:DIM B$(12)
10 PRINT CHR$(223); PRINT "THE STRING PACKER"
20 FOR I=1 TO 100: NEXT I: CLS: PRINT CHR$(12)
30 B$(12)="*****"
40 B$(12)="*****"
50 B$(12)="*****"
60 B$(12)="*****"
70 INPUT "ENTER THE ARRAY NO. FOR 'B$()':";I
80 L=LEN(B$(I)):M=LEN(B$(I)):N=LEN(B$(I))
90 W=L+M+N
100 W=L+M
110 FOR X=1 TO 30
120 IF 0=1 GOTO 170
130 PRINT X; INPUT "ENTER THE REG. NO.":I
140 PAGE W+X-1:2
150 PRINT B$(I)
160 NEXT X
170 D=0: GOTO 140
180 REMARKABLE PROGRAM BY BILL BARABANIAN—1/29/81
```

"3D to 2D wire-frame perspective transformation with 3D clipping."

Appendix 3 describes (although without showing how) using 3D graphics in flight simulation (another Sublogic package), computer art, architectural design, engineering drawing, etc.

Sublogic leaves to the imagination of the user the details of how to carry out such projects, which are only a few of the vast number of projects possible, with side areas such as removing hidden lines, adding shadows and surface textures, etc.

Short Program #22: String Packing

Bill Radabaugh of St. Marys, OH, sent a program that shows you what a line of string-packed graphics characters looks like while you're creating it:

"After reading your article in the Jan. 1981 column (p. 164), I began experimenting with the string-packing technique. After running the program a few times and packing some strings for some simple graphics, I noticed that there were some things that could help the program work better.

"First, there was the time in writing out all the data for each string. This problem was easily solved by putting an input for each character. I made the string into an array so that many strings could be made with one run of the program.

"The next problem was the spaces involved with the strings. To insure that I had enough spaces between the quotes, I simply put in the ones that I would need in each string; then, to get rid of the spaces left when all of the characters were packed, I entered 1 for the decimal number. This puts the program in a loop and zaps the rest of the spaces, since there is no character represented by the 1.

"In the program, lines 30, 40 and 50 have been put in as examples. Actually, the strings can be put on any line. The more strings you want, the more you will have to DIM B\$.

"Be sure to put enough spaces, and change the FOR/NEXT loop in line 540 to the new number. One good thing about the program is that if you wish to change

a string you have already packed, you can do so as many times as you want.

"P.S. One more thing. Be sure to use the same number of spaces in each string, or you might end up poking away the parts of the program."

RUN the program, which first asks for the array number that, in this program, is 1, 2 or 3. Then you're asked to enter the graphics codes for that array.

If you enter 1, and then 183, 179, 179, 187, 128, 183, 179, etc., the line of periods will be replaced one by one, with the graphics characters that make up a line of boxes. Then, if you LIST the program, you'll find that line 30 is no longer a line of periods, but has been string-packed:

```
30 B$(1)="AUTOCONTCONTNEW
INDAUTOCONT etc."
```

so that if you type

```
PRINT B$(1)
```

the display will be that line of boxes, while line

```
PRINT B$(2)
```

you'll get just the line of periods.

This program has some interesting characteristics, which you'll discover when you try to change part of a packed string, or enter a few codes and then just keep on pressing ENTER instead of entering more codes.



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Hail to the Chief

by
Philip M. Brubaker
and
Richard G. Vance

CS-0101 TRS-80 Disk 490 EPA 50



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Contract Bridge is one of the most interesting and skilful of card games, ranking alongside poker in its complexity. Many computer programmers are also bridge enthusiasts, so I expect that many of my readers will, at some time or another, have considered the possibility of writing their own bridge program. Let me warn you from the outset — this is a most daunting task. I would expect a competent programmer to take three times as long to write a bridge program as to write a fairly respectable chess program, and the size of the bridge program would be much larger — with less than 32 kbytes you might as well forget it. But since most of you who own or have access to computers will have at least 32k at your disposal, writing a bridge program is a task that can be undertaken by anyone who is prepared to devote a lot of time and effort.

In writing about computer bridge I shall attempt only to outline some simple principles which will enable the reader to write a working program. The game is sufficiently rich in ideas that stronger bridge players will be able to extrapolate from my article and include a number of more advanced concepts in their programs. Anyone who writes a 'simple' bridge program based on these articles will be able to enjoy an understanding game without the need to find three other (human) players.

How to play bridge

I do not wish to go into a detailed description of the rules of the game, but some of my readers may not know how to play, so some explanation is essential. This will also enable those of you who play other bidding games to learn the principles of programming the bidding phase, which can be varied over

to other games. The principles of playing the cards might also be useful in programming other games which are based on taking tricks. So don't give up if you are not attracted to the idea of programming bridge — what you learn here may help you in other games.

Contract bridge is played by four players, who form two partnerships. A normal deck of 52 cards is used, and at the start of a hand each player is dealt 13 cards. The players start by bidding for the right to play the hand, and whichever side makes the highest bid then tries to make the number of tricks indicated by that bid. If the partnership is successful in making the desired contract it scores points according to the size of the bid, and the number of extra tricks (overtricks) made by the partnership. If the contract is not made, the partnership which was playing to make the contract loses penalty points, the number of penalty points depending upon the number of tricks by which the contract failed, and whether or not the defending partnership decided to 'double' the contract (doubling, as one might expect, doubles the number of points gained or lost on a hand, and also affects bonus points which can be scored in certain situations).

The player who deals the cards opens the bidding. He may say 'pass' or 'no-bid' if he doesn't wish to make a positive bid at this stage, or he may make a bid of the form 1 Club, or 2 No Trumps — the number part of the bid indicates the number of tricks that must be made if this bid is the final contract (number of tricks = number bid + 6); the suit part of the bid indicates what will be the trump suit if this bid is the final contract.

After the first player has made his bid or passed, it becomes the turn of the player sitting to his left. This player may also pass, or he may make a higher bid, or he may double the opponent's previous bid. In order to make a higher bid he must indicate a greater number of tricks, or he must bid a higher ranking suit (or no-trumps) than the previous bid. The ranking of the suits goes (from lowest to highest) Clubs, Diamonds, Hearts, Spades and then comes No-Trump. So one Heart is higher than one Diamond, one No-

Trump is higher than one of any suit, and two Clubs is higher than any bid at the one level.

The bidding proceeds in this way, moving round the table in a clockwise direction and coming to an end only when three successive players pass. Even if a player doubles or redoubles an opponent's bid, there must then be three successive passes before the bidding is at an end. Once the bidding is over, the players who won the bidding (ie made the final bid) are obliged to play the contract, or to be more precise, whichever of them first bid the suit (or No-Trump) of the final contract — he is the one who must play the cards for his partnership. He is referred to as 'Declarer' and his partner as 'Dummy'.

The player on the declarer's left leads any card that he chooses and, at this point, dummy places all of his cards on the table, face up so that everyone can see them. From now on dummy has nothing to do with the hand is over. His partner, declarer, must play the cards for both of them.

The rules of play are very similar to those of Whist and many other trick-taking games. The player who wins one trick leads the first card to the next trick, and players must follow suit if possible, or if this is not possible they may trump a card if they possess any trumps. (In a No-Trump contract this is not applicable.) Cards rank in the usual order, from Ace, King, Queen and Jack down to 4, 3 and 2.

The bidding phase

The point of the bidding phase is to try to reach the optimal contract, partly by conveying information to your partner about the strength and 'shape' of your hand. In order to be able to determine what contract you and your partner should be playing, it is important for you to know something about each other's hand. This is accomplished by the bidding, but because every bid must be higher than the previous bid, a partnership does not have a completely free license to pass information back and forth during the bidding, as this would lead them into an impossibly high contract. So the most important thing to do during the bidding is to try to reach the ideal contract by conveying the maximum

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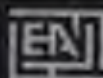
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Diamonds:	A J 9 5 4			Diamonds:	K 10 7
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		N			
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Hearts:	Q J 10 7 6				
Diamonds:	Q 8 2	W	E		
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		S			
Spades:	A Q J 8 3				
Hearts:	A 8 5 3				
Diamonds:	6 4				
Clubs:	7 2				

information about your hand in the most economical manner. Let us examine the bidding of a hand of bridge to see how information is conveyed.

For the sake of convenience we usually refer to the four hands by the four points of the compass North, South, East and West. We shall assume that West was the dealer, and that the bidding goes like this: (players' thought processes in brackets).

West: Pass (I have a weak hand).

North: One diamond (I have a stronger-than-average hand with two good suits. I shall bid the lower ranking suit first to give my partner a chance of bidding hearts at the one level).

East: Pass (I also have a hand that is no better than average, and since my partner is weak we will not have enough combined strength to make any contract).

South: One spade (I have two biddable suits, but I have more spades than hearts so I shall bid spades first).

West: Pass.

North: Two spades (My partner has at least four spades in his hand so we at least have nine spades out of 13 between us. Obviously spades will be a good suit for us to play a contract in).

East: Pass.

South: Three hearts (I must show my partner that I have another biddable suit).

West: Pass.

North: Three spades (My first spade bid indicated only that I had reasonable spade support for my partner. Now I should tell him that I have more than minimal spade support and that I do not have enough strong cards in the unbid suits to make a no-trump contract possible).

East: Pass.

South: Four spades (My partner has at least four spades and probably holds the king of spades. He also has four or five diamonds so he does not have many clubs and hearts. I have the Ace of hearts so we are unlikely to bid more than one heart trick, and I only have two clubs so we cannot lose more than two club tricks before I can trump any further clubs that are led. So we ought to be able to avoid losing any more than three tricks, and four spades seems quite possible).

West: Pass.

North: Pass (Enough is enough).

East: Pass.

The above bidding and thought processes represent an oversimplification of what was going on in the minds of the players. But it does serve to explain the type of thought processes that one goes through when bidding in a simple fashion. I ought perhaps to mention at this stage that by reaching certain contracts a partnership may qualify for a 'game bonus' if the contract is made. These game contracts are: 3 No-Trump; 4 Hearts or 4 Spades; 5 Clubs or 5 Diamonds. Making a lesser contract allows you to score the game bonus later on if you can make another contract that counts, together with the earlier contract, for enough points to make a game. I will not go into the scoring system in this article, but you should study an elementary book on bridge before writing your program, so that the scoring will be correct.

In order to make the bidding phase easier and to ensure that information is conveyed economically, various bidding systems have been invented. In a bidding system, each bid has a fairly precise defined meaning, and by correctly interpreting a bid, a player will understand more about his partner's hand. One useful tool employed in many bidding systems is what are

known as 'high card points'. This points method usually counts 4 points for holding an Ace, 3 for a king, 2 for a queen, 1 for a jack or singleton (a suit with only one card, other than an Ace), 4 for a void (a suit with no cards), 1 for each card after the first five in a suit. Using this point count method, various rules of thumb have been developed, including:

- Do not open the bidding with fewer than 12 points.
- If you hold 12-15 points you should open one of your best suit.
- If you hold 16-18 points you should open one No-Trump.
- In order to make a three No-Trump contract the combined hands should have not less than 24 points, preferably 25 or more.

The above rules can all be broken, under the correct circumstances and, in fact, the same bid can mean many different things in the same situation, depending on which system of bidding the partnership is employing. The most important thing to remember about bidding is that bridge is a partnership game, and you should be trying to help your partner during the bidding by making meaningful bids that he will understand. There is no point in making a brilliant bid on one bidding system if your partner is using a different system - he will not understand what you mean and before you know what is happening you and your partner will have overbid, and found yourselves in an impossible contract.

How to progress a bidding system

Before writing your program, decide what bidding system will be used in the program and make a long list of what the various bids can mean in different circumstances. Whenever the program must make a bid it determines the circumstances and makes the appropriate



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As they bounce longer and longer the walls begin to close in so you're faced with either zapping the bombs or being hit. Each hit knocks you a little further toward the gutter. But you can survive two hits which is usually enough to zap all the bombs.

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bid. Whenever the program must interpret a bid made by its partner, it determines the circumstances under which the partner's bid was made, and then looks at the list of bids to see what the particular bid should mean in those circumstances. These two processes, the making of the correct bid and the interpreting of the partner's bid, can each be aided by keeping a number of important variables and updating them in the light of new information transmitted or received. The following variables might usefully be employed when deciding what bid to make or when interpreting a bid made by one's partner.

Max Clubs (what is the maximum number of clubs that have been shown so far by the player who is bidding this hand);

Min Clubs (the minimum number of clubs shown by the bidding);

Max Diamonds

Min Diamonds

Max Hearts

Min Hearts

Max Spades

Min Spades

By storing values for all the above variables, the program can build up an idea of the way in which the suits are distributed in his partner's hand, or he can keep track of the extent to which he has described the distribution of the suits in his own hand. In addition to knowing how long a suit might be, it is also very useful to have some indication as to how strong a particular hand might be.

This can be accomplished using two variables called **Max Points** and **Min Points**, which indicate the known limits of strength of a hand as indicated by the number of high card points in the hand. For example, if a partnership is using a bidding system in which 13 points is the minimum number for making an opening bid, a player who makes an opening bid is known to have at least 13 points so his **Min Points** is initially adjusted from 0 (the default value when the hand is dealt) to 13.

Adjusting the distribution variables is not a particularly difficult matter. At the start of a hand the four **Max** variables are set at numbers which may be deduced from the holding of the hand under scrutiny. For example, if the computer is making the first bid for West in the above hand, it sets **Max Spades** for North, East and South at 12, since it has one spade and knows that no other player may therefore have more than 12. Similarly, **Max Hearts** is set at 8, **Max Diamonds** is 10 and **Max Clubs** is 9. The minimum values of the suit variables are all set at 0 since no bids have been made and therefore nothing is known about the distribution in each of the hands other than the program's 'own' hand.

If we follow through the bidding of the above hand again, assuming that the computer is playing South, we can

see how easy it is to adjust the distribution variables for the other hands. (Here I shall make certain assumptions concerning the bidding systems employed by the N-S pair and the E-W pair.)

West: (West's **Max Points** is set to 1, as he would open the bidding on 12 or more. West's **Min Points** remains at 0.)

North: One diamond (North's **Min Points** is set at 12, **Max Points** is set at 15, since with 16-18 points North would have opened one No-Trump, and with 19 or more he would have opened two of a suit.) Also, **Min Diamonds** is set at 4, the minimum number needed to bid, and **Max Diamonds** is set at 7, since with 8 he would have opened higher.)

East: Pass (East's **Max Points** = 11, **Min Points** = 0)

South: One spade (South, the program, has indicated that he holds at least 7 points, otherwise he would have passed. So **Min Points** = 7, **Max Points** = 11, otherwise he would have made a stronger bid to indicate that he, too, held an opening hand. **Min Spades** = 4 and **Max Spades** = 6, since with seven or more spades, South would have made a stronger bid than one spade.)

West: Pass

North: Two spades (**Min Spades** = 3, **Max Spades** = 6, since with six or more spades North would be able to bid higher in spades, and would have opened in spades rather than diamonds. Also **Max Hearts** = 4 and **Max Clubs** = 4, by subtraction from 13.)

East: Pass

South: Three hearts (**Min Hearts** = 4, **Max Hearts** = 6 and, by subtracting from 13, we find that **Max Diamonds** = **Max Clubs** = 4. Note that neither clubs nor diamonds can be longer than a four card suit, as this would have required South to bid the suit before now.)

West: Pass

North: Three spades (**Min Spades** = 4)

East: Pass

South: Four spades (**Min Spades** = 3)

This example is not intended to indicate exactly how the variables should be adjusted, nor is it intended to be complete in the summary of information conveyed by each bid. The sole reason d'être for the example is to show the reader the type of information that can be gleaned from a bid, and how this information may be used to update some of the more useful variables. When you have decided on the bidding system that will be employed in your program, the method for updating each of the variables will suggest itself.

Special Conventions in Bidding

There are a number of special bidding conventions, each of which may be used in a particular situation. Often these

conventions take the form of a question and an answer. For example, the **Blackwood** convention is a method of asking your partner how many aces he holds, and how many kings. This information is particularly useful if your partnership is hoping to make a small slam (12 tricks) or a grand slam (13 tricks). The asking bid in Blackwood is 4 No-Trumps, and the replies are: 5 clubs, when holding no aces (sometimes this reply is given when holding all four aces);

5 diamonds, when holding one ace;

5 hearts, means two aces;

5 spades, means three aces.

In order to ask how many kings your partner has you simply bid five no-trumps, and he bids the number of kings at the six level (6 clubs is 0 or maybe 4), 6 diamonds is 1, etc.

When the **Blackwood** convention is employed, the program can update variables such as **Number of Aces**, **Number of Kings**, and the tri-state variables **Ace of Clubs**, **Ace of Diamonds**, etc., which can indicate yes, no or don't know, depending on what may be deduced from the bidding. For example, if you hold two aces and find that your partner holds the other two, you know which aces he holds and so you can set the values of the tri-state variables (**Ace of Clubs**, etc.) accordingly. This detailed use of variables can be most helpful when making a slam decision.

Another popular convention is known as **Stayman**, and consists of a two club asking bid after your partner has bid one no-trump. The asking bid enquires whether partner has at least four cards in either hearts or spades (or both), in which case he should respond by bidding the appropriate suit (or the better suit if he holds at least four cards in each of the two suits). If the program asks this question of its partner, it can use the reply to update the variables **Min Spades**, **Max Spades**, **Min Hearts** and **Max Hearts**, according to the reply bid.

Deciding What to Bid - a Simple Algorithm

When faced with the decision of what bid to make, a number of complex factors enter the thought processes of a good bridge player. Here we are discussing the problems of writing a relatively simple bridge program, and so we must try to employ a relatively simple bidding algorithm. I have devised such an algorithm, which lacks the subtlety of an advanced bridge player, but which ought to provide the computer with the ability to make bids that are reasonably intelligible and reasonably sensible. The algorithm applies to any bidding system, so you may choose any system that you like, preferably from a good book on bidding. One word

of advice — try to use a 'natural' bidding system (one in which the bids tend to reflect the obvious features of the hand) rather than an 'artificial' system (in which most of the bids form an apparently obscure code).

Most books on bidding will offer advice on how many high card points are needed to make contracts at various levels. In 'Bridge for Beginners' (by Victor Mollo and Nico Gardener), for example, we find that a useful guideline is:

22-23 points are needed in the combined hands to make any contract

26 points are needed to make 3 No-Trumps, 4 Hearts or 4 Spades, or 5 Clubs or 5 Diamonds

34 points are needed to make a slam (12 or 13 tricks)

These guidelines are extremely useful, inasmuch as they can set an upper limit on the program's bidding. In our earlier example, once the program knows that it and its partner (playing North-South) hold less than 34 points, which is when the second bid is made (South's one Spade), it is immediately obvious that a slam is not a real possibility, so the maximum contract is a game contract and the highest possible bid is 5 Diamonds.

The manner in which the algorithm operates is simplicity itself. The program first asks the question 'can I bid again without exceeding the safe limit?', where the safe limit is defined by the above guidelines. If the answer to this question is 'yes', the program simply examines every one of its legal bids, determines what would be meant by each of these bids, and then performs some sort of matching exercise to produce a list of bids which represent the accuracy with which each bid describes the hand (bearing in mind what has already been bid). In a situation where the program is responding to an asking bid (eg, Blackwood or

Stayman) there is no problem — the program simply gives the correct answer to the asking bid. But in the general case the program must evaluate each bid and then choose the bid with the highest score, or, if two or more bids have a similarly high score, the program selects the lower bid so that it can convey information in an economic manner.

How exactly this matching procedure is programmed will depend entirely on the type of bidding system you employ in your program, but a few hints may be useful for setting you on the right track. Firstly, we should consider a situation in which the program ought to make an asking bid. This might happen when it has discovered that it and its partner have 34 points or more between the two hands. The program may wish to know how many aces and kings are in its partner's hand (unless it has all the aces and kings itself). In which case it bids 4 No-Trumps. If the answer indicates that its partner has all the missing aces, the program can then ask how many kings are in its partner's hand. It will then find out whether the partnership is missing any of the important top cards and make its decision as to whether it can afford to bid 7 (for a Grand Slam) or only 6 (a Small Slam). Asking bids and their responses are as easy for a computer program as for a human player.

In a more general situation, the program must decide the extent to which a bid conveys information that has not already been conveyed. One way to do this is to count the number of variables which can be updated after making a particular bid. If a bid provides information which gives useful information about three of the variables, then the bid is, in some sense, more useful to the program's partner than a bid which gives useful information about only two variables.

One final point, which is important to implement because of the necessity of playing a contract in the best suit (or in No-Trumps if that is better than a suit contract): throughout the bidding the program should keep some kind of measure for each suit and for No-Trumps. This measure should indicate the desirability of playing a contract in that suit. At the start of the hand, when the cards are dealt, the measures might simply be the number of high card points in each of the suits (excluding the points for singletons and voids). For No-Trumps the measure should be zero. When the program's partner makes a bid, the number of high card points for the suit bid should be increased by (say) 8 for the first time that partner bids the suit, 4 for the second time and 2 for the third time. If the program's partner bids all of the suits in which the program does not have adequate control (either an ace, or a king and one other card, a queen and two other cards or a jack and three other cards), then the number of points assigned to No-Trumps can be adjusted to some high value (say 15). Each time that the partner bids another suit, which he has not yet bid, this score is increased by 2. The program then has a relatively easy measure of whether such suit is worthwhile, and whether No-Trumps is a possibility. Then, as the level of the bidding gets nearer and nearer to the guideline limits, the program can easily make a decision about the final contract. It is then only important to avoid making a bid which is so high that partner can no longer make a safe bid (ie, a bid within the guideline limits) in a suit which is deemed to be acceptable.

Next month, I shall write about playing the hand once the bidding is over. In the meantime, I suggest that you find a good book on bidding and select an easily programmable system. □

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...software legal forum...so

A funny thing happened on the way to the forum; not the content, but the writer's office. A letter was delivered that discussed a new twist in the attempt to obtain legal protection for computer programs. The program is a video game and the protection attempted was a copyright of a computer video game as evidenced by a videotape of a game being played.

Interesting, to say the least.

Suppose that the computer video game is embodied in a ROM and the intention is to sell an integral computer system. The system includes the ROM, a power supply, a microprocessor and supporting chips, a video monitor, a video board, an operator's control panel, and the interfacing electronics, all housed in a single cabinet. Where would the copyright notice be placed? Suppose further that someone copies only the ROM's and sells only the ROM's. Is there any copyright infringement? What if this is a very popular game and someone else extracts the computer program from the ROM, disassembles the program, changes the program to delete only the unmarked words from the video presentation and adds other titles, and then sells a complete system. Any copyright infringement? What if a third person only observes the game, and writes a similar computer program using a substantially similar video presentation. Now is there any copyright infringement?

The rhetorical questioning isn't over, though. Assume further that the copied game is itself an authorized variation of another well known game. How does one protect the game? If copyright protection is used, where is the notice placed and what "copies" are filed in the Copyright Office? There is a saying among computer people that any computer program can be replaced with hardware and anything in hardware can be replaced with software.

If the game is not patentable (it can no longer be patented; it was first sold on a small scale two years ago), how can the game be protected?

The amazing thing about the law is that it is constantly being confronted with unique, exotic problems. The scenario that gave rise to the above questions is presently being acted out in numerous variations. With the exploding proliferation of computer video games, new corners, late comers and counterfeits are attempting to reap their profits quickly. As this writing (in early June), there are no fewer than 25 or 30 different parties involved in defending numerous legal actions. The above series of questions was derived from an attempt by the United States Houses of the video arcade game Galaxian, the Midway Manufacturing Co. of Franklin Park, IL, to protect its game and stop the importation of numerous variations. Midway claimed a copyright for the game; printed a copyright notice on the game cover of the video monitor; videotaped a game being played; and filed in application for the registration of the copyright claim together with the video tape for the "entire work" on a form used only for audiovisual works.

Next came ye old "infringers," some of whom allegedly copied the ROM's, made their own integral systems outside the United States, and tried to import the system into the country. Midway, following the example of all good software proprietors, went to court to stop them. More accurately, Midway filed a petition with the International Trade Commission, a governmental agency, to exclude the allegedly pirated systems under the unfair competition clause in the Tariff Act.

Although Midway may have been correct in most cases, in one case it was obviously wrong. The accused infringer was an independent, but simultaneous developer of a very similar game. It appears that when the Space Invaders game was displayed by Taito at a show in Japan in

April, 1979, the video game industry went wild. Universal Company, Ltd. of Japan developed its variation called Cosmic Alien at the same time the Galaxian game was being developed by Namco Ltd. It turned out there were two variations were "substantially similar" to one another. Interestingly.

Midway, Namco's licensee, had said that the Cosmic Alien game was an infringement of its Galaxian game because of the following similarities: same background on video display; a plurality of rows of aliens; top two rows of aliens having a different color; a nearly identical overall color pattern; two alien squad leaders; these defenders to shoot missiles; the aliens peel off in groups and the squad leaders peel off; the aliens flap their wings, but the squad leaders do not; similar screen organization, scoring and location of defenders; rows of aliens move back and forth; when two players play, the screen is restored for each player.

As a result of these similarities, Midway accused Universal of unfair trade practices and of copyright infringement. Of course, Midway was wrong. But this does raise the questions of how to tell when there is copyright infringement and of how to protect the first produced computer video game from subsequent variations.

Traditional copyright law does not adequately protect the computer video game. In traditional copyright law, infringement requires a proof of the ownership of a valid copyright and a copying by the infringer. In the Midway case it appears that there are problems in providing both elements. What is copyrighted in a computer video game? The computer program? The visual presentation when the analogy is made to a videotape?

In the present case, Midway decided not to register its copyright claim in the computer program. This columnist was unable to find out its reasons. However, if those reasons included an attempt to keep secret the computer program, they failed.



Small Business Computers NEWSLETTER

Small Business Computers Acquired by Creative Computing

August 1, 1981, Morris Plains, NJ—Publisher David H. Ahl announced today that *Small Business Computers* had been acquired by Creative Computing. Howard Falk will remain in editor of *Small Business Computers*; however, the rest of the staff will be substantially enlarged. The publication, a bimonthly, also will be substantially enlarged with both editorial material and advertising.

Ahl, a strong believer in synergy, believes that Creative Computing has much to offer to *Small Business Computers*. On the editorial side, Creative Computing has a large staff of contributing editors with a wide range of experience in all areas of the computer field. "Indeed, we have not been taking advantage of the business expertise of our contributing editors," said Ahl. "Because Creative Computing was just not the right vehicle to run a large number of business-related applications, articles and programs." These articles, applications, and evaluations will now appear in *Small Business Computers*.

One contributing editor, Glenn Hart, is vice-president of a major consumer goods manufacturer and has responsibility for distributing products to super markets, drug stores, and other similar outlets throughout the United States. His sales people use handheld terminals to record and report each day's orders. Mr. Hart has developed a series of computer programs to analyze these data and to pinpoint potential trouble spots in inventory, shipping, and production before they occur. In addition, he has a large group of programs for the TRS-80 pocket computer as well as larger units which aid him in managing all aspects of the business.

Another contributing editor, George Miller, works for a major bank and is responsible for selecting equipment and implementing office automation throughout the hundreds of branches of the bank. Thus, he is concerned not only with the automation of an individual branch, but with the communication of the equipment within the branch and regional centers and to the home office. Mr. Miller wrote a major article on office automation which



Photography of Anthony Datta, Creative Computing.

appeared in the May, 1981 issue of *Creative Computing*.

Other regular contributing editors include the manager of a radio/television/electronics store, the president of a fish farm, the general manager of a PBS television station, and the director of a major market research company. In addition, scores of other contributors representing all types of businesses will be tapped for *Small Business Computers*.

In addition to editorial expertise, Creative Computing also has a long history of editorial integrity, particularly with respect to product evaluations and reviews. "While many magazines don't want to risk offending an advertiser," Ahl said, "we feel that our first obligation is to our readers." Thus Creative Computing has a well-deserved reputation in the industry for running hard-hitting, in-depth product evaluations.

For example, Creative Computing compared word processing printers and found two losers among highly promoted makes. All serious educational packages, Creative Computing found, had only seven different word training tapes.

On the other hand, occasionally the policy turns up a diamond in the rough," said Ahl. "For example, we found one computer had far more than its advertised capability." While unbiased, objective reviews can occasionally cost an advertiser,

usually temporarily, Ahl believes that in the long run editorial integrity pays off both to readers and to advertisers. If the contents of the magazine are honest, the readers keep coming back for more and high loyalty is maintained. In addition, if the reviews and evaluations are entirely believable, this believability carries over to the remaining contents of the magazine including the advertising.

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Legal Forum, continued...

As mentioned above, copying is the other part of the infringement question. On the other hand, if Midway wanted to protect other variations of the game produced by a means other than copying the computer program, then at least that would provide a justification for filing a copyright claim in the visual presentation. This they tried to do by filing a videotape of a game being played as the best edition of the work whose copyright claim was being registered. In fact it seems that this latter approach is the one being adopted by many of the arcade computer video games.

How one can or should protect a video game is not an easy question to answer based on the present advanced state of the technology and the present delayed state of the law. However, the ownership of a copyright in a videotape is not a copyright in the "game." It may or may not be the best edition of the work which must accompany the application. It is the opinion of many that a game cannot be copyrighted; a game can only be patented. A copyright does not extend to the ideas, methods, and concepts, only to their particular expression.

Take the well known board game, Monopoly. The game was patented sometime around 1934. The particular visual image of the board was not patented; it was copyrighted. Only the theory and the play of the game were patented. The instruction set which was a particular way of expressing the play of the game was also copyrighted. In 1959, the patent would have provided protection for only 17 years, but the copyright would have been in effect for a term of 28 years, renewable for one second term of 28 years. (The new law has a single term of 75 years for works for hire or life of the author plus 50 years.) Thus the patent, which provided the better protection, expired first and left only the copyrightable aspects of the game (i.e. the visual expression) protected.

In Midway's Galaxian game, there apparently is no patent, only a copyright notice on the console and a deposited videotape. Obviously Midway does not sell videotapes and presumably could care less if anyone made a copy of the videotape. They want to protect the "game" so that if someone else makes and sells one, they can be stopped.

In order to stop one from infringing a copyright, the law requires that the claim for copyright be registered before the suit is brought. Therefore the question of whether Midway has a valid copyright in the game based on the deposited videotape is not academic. The answer to this question is tied in with the answer to whether the Galaxian copyrighted work was copied.

In the Midway case, it is obvious that the alleged infringers did not copy the videotape. They probably never saw the videotape. Furthermore, because in copyright cases it is usually impossible to get a witness to testify as to the actual making of the copy, the circumstantial evidence of substantial similarity and access to the copyrighted work is proven as an alternative.

In the preliminary decision in the Midway action, the Administrative Law Judge hearing the case held that the "games" of 14 of the 24 alleged infringers were substantially similar to Midway's Galaxian "game" and that these fourteen had access to the Galaxian game. If the game were the copyrighted work, there would be no problem. In this case the problem is that there is no practical possibility that any game being played will be identical to the game that was videotaped and filed with the application. The question then becomes, does the videotape of one game offer copyright protection to every other game?

If the video game being played were the game of "Life," then the answer to the above question is probably no. On the other hand, if the videotape were of a constantly repeating and repeatable design (e.g. of a kaleidoscope design), then access to and substantial similarity with the game being played would probably be all that is necessary. The "performance" of the game at any time would always produce the same sequence of video images. Clearly the Galaxian game is somewhere in between. Where the line should be drawn as to when the "game" is effectively protected by a copyright of only the individual performance of one game is a question that has never been asked before let alone ever answered.

It seems that the better course for Midway to have taken would have been to also register their claim in the computer program. They did not choose to do so, and therefore if they lose the present round because they dropped into a crack in the present law, they have only themselves to blame. □



"Computer & Games? Is the idea of Midway's Galaxian game in a Midway's Galaxian game? Is the idea of Midway's Galaxian game in a Midway's Galaxian game?"

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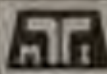
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CIRCLE 174 ON READER SERVICE CARD

ns...puzzles & problems...pu

It's time to acknowledge some of the "better" solutions that Merlin receives to the "change-the-word" puzzles he presents from time to time. The first is overdue recognition to Mr. James Fletcher Meis of Pleasanton, California, for his solution to the "PLAY" to "WORK" puzzle that appeared in the July, 1980 issue: "PLAY, FLAY, FLAM, FOAM, FORM, FORK, WORK". Mr. Meis's solution was two less moves than our answer. Great puzzling! The following readers came up with the following solutions to the "APE" to "MAN" problem in the January, 1981 issue: "APE, APT, OPT, OAT, MAY, MAN". They are: Barbara Barre-Hanning, Gary Schuman, Lake Success, N.Y.; Paul A. Kirschner, Goringham, The Netherlands; Victor G. Fourn, Rossmore, N.D.; Richard F. Salkow, Mt. Pleasant, S.C.; Timothy, in the May, 1981 issue we presented "LEAD" to "GOLD" giving an answer in four moves. The following solution, "LEAD, LOAD, GOAD, GOLD", was sent in by Christopher K. Johnson, Hot Springs, N.C.; Bruce Bealer, Schenectady, N.Y.; Bill Foster, Norley, N.J.; Larry L. Taylor, Tulsa, Oklahoma; George Kramer, Danbury, Ct.; Virginia L. Theonika, Oxford, N.H.; Edward Wefen, New Rochelle, N.Y.; Willard Hall, Washington, N.C.; Edward Scher, N.Y., N.Y.; Dr. Morris Baden, Bethlehem, Pa.; Robert Hink, Norwood, Ill.; Raymond Pittman, Las Vegas, Nev.; Albert Walters, Portland, Or.; and Neil Keri, Chicago, Ill. Thank you for taking the time to write. Your answers were great.

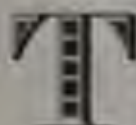


A Wild West Problem



Here's a new "change-the-word" puzzle to start the letters coming in again. In the old American West, if a card player was caught in an attempt to tin the odds of poker in his favor during his DEAL with the postboards, it often came to pass that he would end up being SHOT on run out of town on a rail. Our first puzzle gives you the opportunity to take the problem of changing DEAL to SHOT without getting caught along the way. (During each step the puzzle must change one letter in the previous word so that a new word is formed.) (This puzzle is from *Merlin's Puzzles 2* by Charles Barry Townsend, and published by Hammond, Inc.)

A Money Problem



The following "Golden Oldie" was sent in by Mr. George Kramer of Danbury, Ct. Merlin will be sending him something better than money, namely a copy of one of his famous books. Mr. Kramer writes:

"An impoverished college student sent the telegram pictured here to his father. The son was so short of cash that he could not include the sum he needed in the telegram so the father had to figure it out himself. Each letter of the message represents a digit (zero through nine). How much, in dollars and cents, does the son need?"

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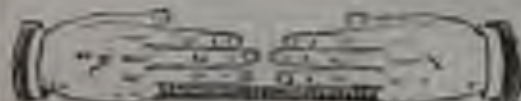


From Sweden comes this interesting test in deterring. Our thanks go out to Mr. Peter Lagerberg of Stockholm, Sweden. A copy of *Merlin's Puzzles* is winging post now.

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1. The truckdriver lived with the golfer's wife.
2. The transporter and the computer technician used to go horseback riding with John.
3. The truckdriver laughed at the transporter because of his long beard.
4. Dick received a box of chocolates from the transporter's ex-wife.
5. The golfer's brother is a boat captain from the smuggler.
6. Roger was faster than both Dick and the golfer at eating pizza.





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reviews...book

Steve Gray, et al.

Business Programming in Fortran IV and ANSI Fortran 77: A Structured Approach, by Asad Khailany, Prentice-Hall, Inc., Englewood Cliffs, NJ, 456 pages, paperback \$13.95, 1981.

This book is "primarily designed for students in business schools taking an introductory programming course in the Fortran language." The text orientation also makes it appropriate for students in humanities, social sciences, and education," according to the preface.

The author claims his textbook is different from "others in the field" because it combines a data-processing textbook and a Fortran textbook, covers both Fortran IV and ANSI Fortran 77, gives extensive examples and exercises, emphasizes structured programming, etc. Last on the list of features is, "All programs are written on the DEC SYSTEM-10. Inquire about them from the author to get all programs on a DEC 1010."

The first chapter discusses computers (hardware, software, industry, careers, the second, problem-solving tools (algorithms, pseudocode, flowcharts). The remaining 14 chapters are on Fortran. These appendices cover number systems and provide summaries of the two Fortrans.

Almost all programming examples are of business programs. The first algorithm in the chapter on tools is for a car rental problem; the second, on stock transaction service charges. Others in later chapters are on sales forecasting, payroll sales commissions, etc.

A separate instruction manual contains the solutions and programs for all exercises in the text, plus samples of exams and course syllabi.

None of the programs is very long; the author is more interested in providing a solid grounding in the principles of Fortran, and continually improves on the payroll program, among others, as new statements are introduced. Throughout the book, the differences between the two Fortran are explained in detail.

The Computer in the Schools: Tutor, Tool, Tutor, edited by Robert P. Taylor, Teacher's College Press, Teacher's College, Columbia University, New York, 262 pages, paperback \$14.95, 1980.

This book is meant to help educators and parents who are "beginning to seriously ponder what the role of computing will be in human learning and what action they can and should take to affect it," according to the introduction to 14 essays by "two pioneers in the field of computers in education": Alfred Bork, Thomas Dwyer, Arthur Lieberman, Seymour Papert, and Patrick Suppes.

The essays cover a wide area of teaching and learning, intended "to build a good foundation for understanding the basic issues involved in using computers of any kind in schools, the teacher's role in helping the student to make full use of computing, and the general limitations of computer use," as the back cover puts it.

The essays are on subjects such as Preparing Student-Computer Dialogs (Bork), Learning through Graphics (Bork), Some Thoughts on Computers and Creativity in Teaching (Dwyer), The Fundamental Problem of Computer-Enhanced Education and Some Ideas about a Solution (Dwyer), Should

views...book re

the Computer Teach the Student, or Vice-Versa? (Ludtman), Technology in Science Education (Ludtman), Teaching Children Thinking (Papert), Personal Computers and Its Impact on Education (Papert), Computer-based Mathematics Instruction (Sugrue), The Future of Computers in Education (Sugrue).

Most of the essays are quite helpful, presenting useful examples, system thoughts, and useful references. Some of the writing reads a writer's pet theory, or fails his special pet name, but fortunately there isn't much of this in a book whose ultimate purpose is apparently to show parents, teachers, school boards and administrators why computers should be used in every classroom.

Microprogrammed Control and Reliable Design of Small Computers, by George D. Kraft and Wing N. Toy. Prentice-Hall Inc., Englewood Cliffs, NJ, 442 pages. Hardcover \$21.95. 1981.

Page iv carries a 1981 copyright by Bell Telephone Laboratories, which seems odd until you find that the system selected to provide examples of modern microprogramming is the Bell System 5A CC, a small computer designed to control the No. 5 EMS, or Electronic Switching System, which can handle from 500 to 5,000 telephone lines.

No knowledge of telephony is required to understand this book, "written as a reference volume for the practicing electrical engineer or computer scientist who has a need to develop a fault-tolerant small computer. The book could be used as a reference text in a college course taught at the junior, senior, or first-year graduate level," according to the preface.

The word "telephone" isn't even in the index of this book, whose nine chapters discuss Conventional and Microprogram Control, Internal Process Control, Microprogram Control of Main Storage Operations, Microprogram Control of Input/Output Operations, Reliability Calculations, Maintenance Design Considerations, Fault Detection, Fault Diagnosis, and Fault-Tolerant Design of ESS Processors. A brief appendix describes MTP Calculation of Systems with Repair, using integral equations, a knowledge of which is also needed to understand the chapter on reliability calculations. The other chapters use no more than Boolean algebra, and very little of that.

This book is an expansion of the 1979 Kraft-Toy book for Prentice-Hall on Mini/Microcomputer Hardware Design. It presents in detail the design philosophies and approaches used by Bell Labs to implement the 5A CC, "a small computer designed to observe the high reliability requirements of the Bell System (i.e., two hours downtime in 40 years of operation)."

The Small Computer in Small Business: A Guide to Selection and Use, by Brian R. Smith, Stephen Greene Press, Inc. (1981), Brattleboro, VT 05301, 134 pages, paperback \$12.50. 1981.

"Smith's book is geared toward the small-business manager who needs a primer in order to be able to deal intelligently with computer vendors," according to the letter accompanying this book.

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Reviews...book

Small Business Applications, Justifying a Computer for Your Business, Evaluating and Selecting a Computer System, Planning for the Computer, and Final Thoughts (alternatives to the computer, used equipment, documentation, etc.).

Four appendices cover The Future of Small Business Computing (EFT, databases, credit, etc.), A Notebook for Computer Evaluation, Bibliography, and Glossary.

Although the first two chapters aren't very well organized, and present more information in the non-ambiguity area than many readers would care about, the remaining chapters are better, and present much information of interest to the manager. It is funny some paragraphs seem skimpy, perhaps it's because the author didn't want to get too far into the murky byways that present themselves in such a book.

The issue of the book is the four chapters on software, applications, justifying a computer, and evaluation. The first looks at operating systems, computers, and languages such as Fortran, Basic, Cobol, etc. The second examines a payroll system, inventory software, general ledger, A/P, A/R, inventory control, word processing, etc. The third goes into financial analysis and cost savings, while the fourth provides several dozen questions to ask.

A Primer on Structured Program Design, by Gary L. Richardson, Charles W. Butler, and John D. Tomlinson. Prentice-Hall Books Inc., Englewood, NJ. 241 pages, hardcover \$17.50, paperback \$14. 1980.

Written as part of the HBI Series for the Computer and Data Processing Professional, this book was written for the student learning about programming, or for those who already know the mechanics of a computer language and is now concerned about the design process," according to the preface.

Because PL/I was found to "best fit the spirit" of structured design, it is used throughout in the illustrative language.

Structured programming means, among other things, eliminating GOTOs and instead using the coding structures of SEQUENCE, IF-THEN-ELSE, DOWNTO, DOWNTIL, and CASE (multibranch); top-down design; pseudocode; or the shell-programmer team-management process.

The book's ten chapters cover Background, Evaluation of Program Design Methodologies, Top-Down Design, Structured Programming, Structured Design Techniques, Pseudo-Coding, Program Style and Debugging, Data Base Considerations, Managing the Programming Process, and Final Remarks. Each chapter ends with review questions and references.

The book ends with an appendix with the solution to a debugging case-study of a faulty program, and a glossary.

Although the writing style is formal and somewhat stiff, with phrases such as "This chapter has attempted to address some of the more pragmatic issues," the text is very helpful, and the many figures and programming examples also help turn the art of system design into a science.

Personal Computers Serving People: A Guide to Human Service Applications, by Robert A. Lamm. Hawkins & Associates Inc., 404 D St. N.E., Washington, DC 20002. 146 pages, paperback \$7.95, 1980.

According to the introductory chapter, this book "is intended as an introductory guide for the person who may have little or

no background in computing and who would like to begin using a personal computer in such activities as teaching, special education, rehabilitation, recreation and leisure, and creative art.

The other seven chapters cover: the essentials of basic and computer hardware; Education with Personal Computers (5 programs: multiplication practice, reaction time, grade distribution, etc.); Education and Rehabilitation for the Handicapped (3 programs: phrase builder, word-comparison game); Creative Art (2 programs: city skyline, color graphics); recreation and leisure (3 programs: number-guess, ball-and-paddle, royal-rails tournament); selecting a computer (Apple II, Radio Shack TRS-80, Commodore PET, etc.); Sources of information and inspiration (books, magazines).

The two chapters on education, covering 56 pages, are the heart of this book, and present a good variety of examples. However, most of the programs presented in these two chapters wouldn't be understood by the readers for whom the book is supposed to be intended. They use POKE, LFN, DNM, etc., none of which are even mentioned in the chapter on Basic. On the other hand, the programs are explained at length, so the reader who really digs in, may get some idea of how they work.

The other chapters are less than outstanding, and have been written better elsewhere. However, the author must be given an A for effort, in trying to put together a variety of information that, to be adequately covered, would take three times as many pages.

Programming with Fortran/WATFOR/WATFIV, by David L. Basin and Ronald D. Schwartz. Winthrop Publishers Inc., Cambridge, MA. 445 pages, paperback \$12.95, 1981.

This is the two-hundredth book in the Winthrop Computer Systems Series, which includes works on Basic, keypunch input, and software psychology. As a primary textbook, this text "requires no knowledge of computing. The text can best be used with an IBM 360, 370, 300X, or 4300 series computer system (or PCM) with the full OS operating system" according to the back cover.

WATFOR/FIV are the University of Waterloo (Canada) versions of Fortran IV, and in most respects identical to Fortran IV. Among the significant features incorporated into WATFOR/FIV are the error messages generated when a programming error is encountered.

The ten chapters cover Introduction to Computer Problem Solving, Elements of WATFOR/FIV, WATFOR/FIV Arithmetic Operations, Format-free Input/Output, Control Statements, Looping and the DO Statement, Arrays and Subscripted Variables, Subprograms and Subroutines, and Additional Language Features and Techniques. Exercises, with spaces to fill in the answers, are provided within and at the end of chapters.

Five appendices provide additional review exercises, information about formatted input/output, supplementary programming assignments, WATFOR and WATFIV diagnostic messages, and answers to selected exercises.

The writing style is semi-conversational and somewhat stiffly formal, but the authors have done their best to provide a short, gradual buildup, short and simple programs, thorough explanations of programs, and a fair amount of detail.

The book has been made very easy to read, with extra spacing between the lines and all programs set in large sans-serif type.

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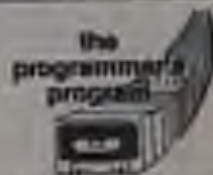
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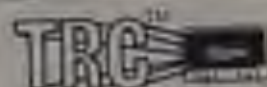
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reviews...book

Introduction to Computer Operations, by William M. Foy, Anthony D'Arco and Lawrence Orlin. Prentice-Hall, Inc., Englewood Cliffs, NJ. 638 pages, hardcover \$19. Second edition, 1981.

"This text will give students a basic understanding of what a computer is, what it can do, and what equipment is generally found in a medium- or large-scale computer complex," the preface says.

The book concentrates on hardware, with chapters on punched cards, I/O devices (with reader/punch, printer, tape, disks and drums, and terminals), computer systems (transfer systems, system components, languages), consoles. The largest chapter is on The Console and Console Typewriter, 172 pages on the console, console operation, info and microcomputer systems, scheduling and documentation, and data-center operations.

Self-study exercises are scattered throughout the text, with answers supplied. Exercises include chapter exercises and followed immediately by the answers.

Three appendices provide a glossary, two record machine operational concepts, and DP job times and descriptions. The authors have used a great many photographic drawings and charts.

The writing, although semi-formal, is very clear and detailed, explaining the many complex operations and concepts about as simply as possible.

The second edition apparently updates the portions that get out of date rapidly, mainly on terminals and main- and microcomputers.

Aside from its usefulness in the classroom, this is also a fine book for anyone wanting to know exactly what goes on, and how, in the computer system.

Computer Systems Performance Modeling, by Charles H. Sauer and K. Mani Chandy. Prentice-Hall Inc., Englewood Cliffs, NJ. 361 pages, hardcover \$18.95, 1981.

The audience for this book is divided between college seniors and first-year graduate students taking an introductory course in performance modeling, and as supplementary reading for graduate systems course and designers, developers and others to help them achieve optimum system effectiveness at the lowest lifetime cost, according to the preface and back matter.

The back matter continues, "An attractive alternative to after-the-fact modifications is the mathematical model that estimates performance early in the design and development stages and permits appropriate adjustments for the system before operational."

The authors introduce the key concepts of modeling, their practical application, and their management. Detailed chapters cover general principles, Markovian queueing models of computer systems, related queueing and open networks of systems, closed product form queueing networks, approximation, simulation, management and parameter estimation, case studies, and management modeling projects.

"It is common, but unfortunate," the authors point out, "that performance is not seriously considered until the later stages of system evolution" when corrections, such as the acquisition of additional hardware, can be costly.

This book requires familiarity with elementary calculus and linear algebra, and a thorough understanding of computing systems and programming.



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Micro-DSE/Finance is a financial modeling and planning language for the 48K Apple disk system with Pascal. It is designed to provide managers who are not computer specialists with a "private computer workbench" environment that enables them to experiment, manipulate data, redesign reports and construct presentations. \$1500. Addison-Wesley Publishing Co., Inc., Reading, MA 01867.

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Aurora Software Associates announces S-Forth for Ohio Scientific computers. S-Forth is a full implementation of fig-Forth, and includes editor, virtual memory disk sub-system, and compatibility with Q565D. The language comes on 5-1/4" or 8" disk. \$34.95. Aurora Software Associates, P.O. Box 98552, Cleveland, OH 44199.

CIRCLE 312 ON READER SERVICE CARD

Forth-79 is available on disk for the Apple. The package comes with a screen editor, macroassembler and vocabularies for strings, double precision integers and lo-res graphics. \$89.95. MicroMatrix, 12077 Wilshire Blvd., #506, Los Angeles, CA 90025. (213) 821-4340.

CIRCLE 355 ON READER SERVICE CARD

SYSTEMS

Nautilus Systems has introduced a new compiler program for the Forth language. It is available for TRS-80 Model I, II, III, Northstar and CP/M systems. \$200. Nautilus Systems, P.O. Box 1048, Santa Cruz, CA 95061. (408) 475-7461.

CIRCLE 354 ON READER SERVICE CARD

Intex Datalog announces a PC-Basic Compiler for the Commodore CBM line of computers. Written in machine code, the compiler takes a program which has been saved on disk normally and compiles it back on to the disk as a directly loadable program file. About \$600. Intex Datalog Ltd., Baginbidge, Stockton-on-Tees, Cleveland TS16 0PN, England.

The FBasic compiler runs under the Q565DD operating system and possesses standalone 6502 machine code modules. Features include user definable array locations, WHILE loops, GOTOs and GOSUBs to absolute addresses, and direct access to registers. It requires 48K of

memory and is available on 8" disks. \$150. Pegasus Software, P.O. Box 100414, Honolulu, HI 96816.

CIRCLE 355 ON READER SERVICE CARD

A Basic compiler designed for 8080 or Z-80 based systems has been introduced on 8" disk by Compiler Systems. CBRO is a native code compiler which runs under CP/M, MP/M and CP/MET. It retains the 14-digit BCD arithmetic, random and sequential disk accessing and WHILE statement of CBasic and offers improvements in speed and performance. \$300. Compiler Systems, Inc., 37 No. Autumn Ave., P.O. Box 145, Sierra Madre, CA 91024. (213) 355-4211.

CIRCLE 314 ON READER SERVICE CARD

DATA BASE MANAGEMENT SYSTEMS

Pegasus is a user-friendly database management system, which allows the user to create files, input data, query the database, print reports and select subsets. It runs on UCSD Pascal operating systems on the Apple II. Prowsoft, Inc., P.O. Box 457, Pitman, NJ 08071.

CIRCLE 317 ON READER SERVICE CARD

Filemanager 800 is a file-forging system for the Atari 800. It may be used to create mailing lists, inventory and business records, and customer lists. It requires 40K and a disk drive. \$94.50. Synapse Software, 620 Conventry Rd., Kensington, CA 94707. (800) 223-1817 ext. 277; in California, (800) 722-3545 ext. 297.

CIRCLE 318 ON READER SERVICE CARD

APPLICATIONS SOFTWARE

GAMES AND RECREATIONAL

Crush, Crusade and Champ allows the player to assume the role of his favorite number in over 100 possible scenarios. As any of six man-eating beasts, the player must satisfy his carnivorous appetite by eating his opponents while battling National Guard tanks, infantry, helicopters and a team of mad scientists. The game is available on disk for 48K Apple with AppleSoft in ROM and 32K TRS-80 or on cassette for 16K Level II TRS-80 and 32K Atari. \$29.95. Also available is the **Dragon's Eye**, a fantasy game in which the player has 21 days to find the Dragon's Eye. While searching, he sees a detailed map of the province on the screen along with his location, strength, health and other information. The game is available on cassette for 32K PET and on disk for 48K Apple with AppleSoft in ROM. \$24.95. Automated Simulations, P.O. Box 4247, Mountain View, CA 94040.

CIRCLE 349 ON READER SERVICE CARD

Empire of the Overmind is a fantasy game from Avalon Hill. The game/puzzle comes with a poem that contains the clues necessary to complete a hero's journey. It is available for TRS-80, Apple and Atari 800. Cassette: \$30; disk, \$35. Also available from Avalon Hill is **Tanktics**, a wargame which comes with a full color mapshow and counters depicting 15 different armored vehicles of the German and Russian armies. It is available on cassette for 24K Atari 400 and 800, 16K Apple, 16K PET, and 16K Level II TRS-80 for \$24, and on disk for 32K TRS-80, 32K Apple and 40K Atari 800 for \$25. The Avalon Hill Game Company, 4517 Hanford Rd., Baltimore, MD 21294, (301) 254-5700.

CIRCLE 306 ON READER SERVICE CARD

Dungeon Campaign is an Adventure program for the Atari 400 and 800 in which players explore a dungeon in search of gold. Movements are controlled by keyboard or joystick. Each package includes both **BN** and **ABC** versions on



^a You do not need to help. *Prosimian*: take a small necessary study, see section 7.

cassette, \$24.95. Also available are four games packs for TRS-80 Model III, including are such games as Wall Street Challenge, Metropolis, Withstanding and Space Ace. Each package contains two or four 16K programs. \$19.95. Image Computer Products, 615 Academy Dr., Northbrook, IL 60062. (312) 564-5080.

CIRCLE 261 ON READER SERVICE CARD

Riverbank Software announces **International Grand Prix**, a 3-D car race simulation by the author of *Three Mile Island*. The game features live race courses and eight levels of difficulty. It is available for the 48K Apple II or Apple II Plus with disk and paddle. **330, Riverbank Software, Inc., Smith's Landing Rd., P.O. Box 128, Denton, MD 21629, (301) 471-1312.**

CIRCLE 342 ON READER SERVICE CARD

CE Software announces **SwordThrust**, a fantasy, role-playing system for the Apple in which players attempt to survive different quests. The experience and treasure acquired in one adventure help to others. CE Software, 807 73rd St., Des Moines, IA 50312, (515) 224-1997.

CIRCLE 283 ON READER SERVICE CARD

Country Carnival is a shooting gallery game with multi-color flies animation and real-time carnival sound effects. Available on disk for 48K Apple II and Apple II Plus, the game features an animation-rating track and target rabbits that multiply faster and faster on the game progression. \$24.95. Progressions International, Inc., 6028 North Miami St., Burbank, CA 91504. (713) 394-0700.

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CIRCLE 129 ON READER SERVICE CARD

New Product Announcement!

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New Products, continued...

Color Invaders for the IBM TRS-80 Color Computer places the player at the controls of a space task force of stellar ships and invading critters. Invading ships burst in the air, and alien creatures march across the screen dropping bombs. The game comes in two versions, one which requires the power pack (\$19.95) and one which does not (\$24.95). Computerware, Box 668, 1512 Encinitas Blvd., Encinitas, CA 92024. (714) 436-4282.

CIRCLE 384 ON READER SERVICE CARD

Acorn Software has introduced **Terpin**, a machine language learning game for use in four players on TRS-80 Model I or III. Scoring, plotting and ball return are automatic, and players can view the scoreboard at any time. Cassette, \$14.95.



"Dear Diana: I feel that more and more my life is being influenced by computers."



disk: \$20.95. Acorn has also released the following games for the Model III: **Pythul**, **Duel to Death**, **Everest Explorer**, **Invaders from Space**, **Garrison Challenges 2.0**, **Pigskin**, **Basketball**, **Space War**, **Quid**, and **Word Wars**. Acorn Software Products, Inc., 614 North Carolina Ave., S.E., Washington, DC 20003. (202) 544-4239.

CIRCLE 385 ON READER SERVICE CARD

EDUCATIONAL

Educational Computerware offers a library of disks in 3.2 or 3.3 DOS for use on the Apple. Each memo-driven disk includes a series of programs designed to aid the teacher in the creation and implementation of lessons, which may be stored, modified,

saved, or deleted without programming skills. Prices range from \$24 to \$32. Educational Computerware, 3 Napa Lane, Westport, CT 06880.

CIRCLE 387 ON READER SERVICE CARD

Spelling Bee, designed for use in kindergarten through third grade, has three objectives: develop computer literacy, establish new vocabulary by linking words with pictures, and build basic spelling skills. The program requires a 48K Apple with AppleSoft and DOS 3.3. \$24.95. **Compu-Read 3.0** previously available only in AppleSoft, is now available for the 48K Atari with disk drive. It contains a series of instructional modules which build skills by strengthening perceptual processes. \$28.95. EdusWare Services, 22222 Sherman Way, Ste. 203, Canoga Park, CA 91303. (213) 348-6783.

CIRCLE 388 ON READER SERVICE CARD

BUSINESS

Broker I for the Apple II provides registered representatives with access to customer account information. It allows users to enter current market prices and obtain a value for the client portfolio, and includes a tickler function which displays messages and reminders on specified

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New Products, continued...

data. The Telephore Corporation, 1802 John St., Fort Lee, NJ 07024, (201) 866-2476.

CIRCLE 388 ON READER SERVICE CARD

Mail List Manager for the Apple III is a disk-based program which allows users to store, sort, edit and print mailing labels and phone lists either in their entirety or selectively by zip code, name or other identifying data. The program requires a 128K Apple III and an additional disk drive. \$150. Apple Computer, Inc., 10250 Hamley Dr., Cupertino, CA 95014.

CIRCLE 370 ON READER SERVICE CARD

Orders, written in Basic for the TRS-80 Model II, is an integrated invoicing-inventory accounts receivable system which runs under TRSDOS. The program produces invoices, inventory up-dates, price lists, inventory lists, re-order reports, customer sales histories, open items accounts receivable reports, open items aging, closed items listing, monthly statements and customer listings. \$275. National Software Marketing, Inc., Box 6195, Hollywood, FL 33021.

CIRCLE 371 ON READER SERVICE CARD

Databook II from Organic Software maintains a record of appointments for up to 27 people in nine groups of three,

for an unlimited time in the future. Written in Pascal, the program runs under CP/M and CP/M 86 as well as TCM2 Pascal systems. \$295. Organic Software, 1492 Windsor Way, Livermore, CA 94550.

CIRCLE 372 ON READER SERVICE CARD

Bruceland Software introduces a payroll program for the Apple II which has a capacity of 200 employees, 15 divisions and 30 types of deductions. Tax formulas are built-in, and the program prints checks, check register, W-2 forms and all quarterly and summary reports. It uses Apple's Run Time Module and requires two disk drives. \$395. Bruceland Software, Box 3366, Eugene, OR 97403, (503) 343-9024.

CIRCLE 373 ON READER SERVICE CARD

Taranto & Associates announces a **Sales Analysis** enhancement for its Accounts Receivable/Invoicing System for the TRS-80 Model II. The program keeps track of sales by product category and seller for month-to-date and year-to-date. Also available is a **Budgeting** facility which can be added to the company's General Ledger System. Taranto & Associates, Inc., 121 Paul Dr., P.O. Box 6216, San Rafael, CA 94903, (800) 227-2668; in California, (415) 472-2670.

CIRCLE 374 ON READER SERVICE CARD

An **Inventory-Purchasing** module has been added to the Apple Accounting Plus II software package from Systems Plus. The module supports 1000 inventory items per volume and provides details concerning on-hand quantities as well as standard reports. Systems Plus, 375 East Bayshore, Palo Alto, CA 94303, (415) 969-7047.

CIRCLE 375 ON READER SERVICE CARD

Electric Spreadsheet is designed to be used as a general-purpose tool to prepare tables of data or spreadsheets. Pre-programmed operators are used to accomplish calculations on lines, columns, cells of the sheet, and variable formatting of data and labels of columns and lines is available. Three versions are available: tape for 16K, TRS-80 Model I or III (\$54.95); tape for 32/48K Model I or III (\$64.95); and disk for 48K Model III (\$67.95). Dan B. Hany & Associates, Inc., P.O. Box 187, San Mateo, CA 94401.

CIRCLE 376 ON READER SERVICE CARD

Project Management, designed for the project manager in construction, engineering or publicly funded projects, allows the development or analysis of task preparation and updating of budget information; entry, updating and tabulation of

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The book will take you through everything programmers learn its easy to understand and the large type makes it easy to read. You'll find out how to put together a flowchart, and how to tell your computer to do what you want it to do. There's a lot to learn, but **Computers For Kids** has 12 chapters full of information. You'll even learn how to write your own games and draw pictures that move.

Just so the folks and your teachers won't feel left out, there's a special section for them. It gives detailed lesson ideas and tells them how to fix a lot of the small problems that might pop up. Hey, this book is just right for you. But you don't

have to take my word on that. Just listen to what these top educators have to say about it.

Donald T. Piele, Professor of Mathematics at the University of Wisconsin-Parkside says, **Computers For Kids** is the best material available for introducing students to their new computer. It is a perfect tool for teachers who are learning about computers and programming with their students. Highly recommended.

Robert Taylor, Director of the Program in Computing and Education at Teachers College, Columbia University states, "It's a good idea to have a book for children."

Not bad, huh? Okay, you can tell the adults back in the room. Don't forget to tell them **Computers For Kids** by Sally Greenwood-Larson cost only \$3.95. And tell them you might share it with them, if they're good. Specify edition on your order: TRS-80 (12H), Apple (123), Atari (12J).

Your local computer shop should carry **Computers For Kids**. If they don't ask them to get it or order by mail. Send \$3.95 payment plus \$2.00 for one, \$3.00 for two or more, for shipping and handling to Creative Computing Press, P.O. Box 789, M. Mantown, NJ 07060.

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CIRCLE 254 ON READER SERVICE CARD

Why would anyone spend \$59.95 for a joystick?



Star Wars. Played with paddles, it's difficult at best and frustrating at worst. But with a joystick, it becomes an entirely new experience. It's still challenging. It's also fun. And very addictive.

Have you ever used a drawing program in which one paddle controls the horizontal movement of the "brush" and the other paddle the vertical? It's slow, tedious work. But with a joystick, drawing is an absolute joy.

Exceptional Precision

The Apple high-resolution screen is divided into a matrix of 160 by 240 pixels. To do precise work on this screen, you need a precise device. Most potentiometers used in paddle controls are not quite linear. If you rotate a paddle control at a constant speed, you'll notice that the cursor speeds up slightly at the beginning and end of the paddle rotation.

The Super Joystick has a pure resistive circuit which is absolutely linear within one tenth of one percent. In other words it would give you precise control over an image of 1000 by 1000 pixels, were such resolution available. Thus it is suitable for high precision professional applications as well as educational and hobbyist uses.

Matched to your application

The Super Joystick also has two external trim adjustments, one for each direction. This allows you to perfectly match the unit to your application and computer. Say you want to work in a square area instead of the rectangular screen. Just reduce the horizontal size with the trim control.

How many times have you played Snake Invader and had your thumbache for hours from the repeated button pressing? This won't happen with the Super Joystick. Its two pushbuttons are big. Moreover, they use massive contact surfaces with a life of well over 1,000,000 contacts. A few games of Super Invader using these big buttons will justify the purchase of the Super Joystick.

The Super Joystick is self-centering in both directions. That means when you take your hand off it, the control will return to the center. However, if you want it to stay where you leave it, self-centering may be easily disabled.

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CATALOG OF CP/M SOFTWARE

A reference catalog describing CP/M compatible application software and the companies who write and distribute it is now available from Digital Research, Inc.

The catalog lists more than 100 companies that write CP/M compatible software. Application programs are cross-referenced by application type, including programs for word processing, accounting, utilities, languages and vertical markets.

Digital Research, P.O. Box 570, 801 Lighthouse Ave., Pacific Grove, CA 93950. (415) 691-3000.

MICROSOFT CATALOGS

Microsoft Consumer Products introduces two new catalogs.

One catalog provides detailed information about software packages, their applications and system requirements.

The other is designed as a handy guide with condensed descriptions of each Microsoft product and its specifications.

Both books are available through Microsoft dealers or directly from Microsoft Consumer Products, 400 118th Ave. NE, Suite 200, Bellevue, WA 98004.

MONUMENT SOFTWARE CATALOG

Monument Computer Service has introduced the release of its free Summer-Fall Software Catalog, which features products for the Apple III computer.

The catalog provides detailed descriptions of more than 50 business, word processing, educational, and personal applications for the Apple Computer family.

Monument Computer Service, Village Data Center, P.O. Box 803, Irvine Tree, CA 92652. (800) 854-0561, ext. 803. In California, (800) 433-7257.

MAGAZINES, NEWSLETTERS**GRAPHICS NEWSLETTER**

"The Computer Graphics Software News" is a newsletter which will review computer programs in both the public and industrial domains which specifically deal with computer generated graphics.

Areas of coverage include CAD/CAM, animation, business graphics, image processing and petrophysical related software.

"The Computer Graphics Software News" will be published six times per year at a subscription rate of \$50 per year.

"The Computer Graphics Software News," 5857 S. Gower, Suite 401, Houston, TX 77036. (713) 975-8509.

NEWSLETTER FOR PHYSICIANS

A new publication from Information Research, the "Physician's Desktop Computer Letter" provides the physician and his staff with up-to-date information on the applications of desktop computer hardware and software, plus tutorials and check lists for use in the clinic and general practice.

A subscription is \$6 per year for eleven issues.

Information Research, 10367 Paw Paw Lake Dr., Menomonee, WI 48071.

GENEALOGY NEWSLETTER

"Genealogical Computing" is a newsletter for genealogists and home computerists.

The newsletter features a directory of genealogy-oriented programs for personal computers, citations on how to computerize your family research records, program reviews, and interchanges among those using their computers for genealogical purposes.

"Genealogical Computing" is edited by Paul and Susan Anderson, operators of the Family Historian Forum, a computerized genealogical message system. A subscription is \$12 for six issues.

Data Transfer Associates, 5102 Potomac Dr., Fairfax, VA 22032.

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New Products, continued...

EDUCATIONAL SOFTWARE LIBRARY

Educational Software Library Inc. is a nonprofit organization which offers a mail order library of educational programs for the TRS-80 Models I and III.

ESL publishes a bi-monthly newsletter giving descriptions of available software, ranging from preschool to high school level.

A \$20 one-year membership entitles the member to the newsletter, two free educational tapes, the opportunity to borrow programs for two week periods for \$2 per tape, and the opportunity to purchase software at discount prices.

Educational Software Library, 262 Park Lane, King of Prussia, PA 19406

SCHOOL MICROWARE REVIEWS

The first issue of *School Microware Reviews* will contain user evaluations of over 100 instructional programs and packages for the Apple, PET, and TRS-80, as



well as an index, in evaluations in many other publications.

The book will be organized by subject within school departments. Each evaluation includes a summary rating which is backed up with extensive comments (both positive and negative) about the quality of the program. \$30 per edition.

Dynadyn Associates, P.O. Box 246, Dept. CCNR, Presford, ME 04342. (207) 737-4466.

COMPUTERS IN SCIENCE TEACHING

The Journal of Computers in Science Teaching is published quarterly by the Association for Computers in Science Teaching.

It includes descriptions of uses of computers in science instruction, tutorials, reports of research studies, lists and reviews of software, announcements of conferences and events, bibliographies of articles in the field, and book reviews. A one-year subscription is \$7.

Association for Computers in Science Teaching, P.O. Box 4825, Austin, TX 78768.

BOARD GAMES MAGAZINE

Schema is a new magazine devoted to the diversity of board games.

The bi-monthly magazine is published by Michael Weissman, and a one-year subscription is \$15.

Schema, 100 E. Ohio St., Ste. 226, Chicago, IL 60611.

MISCELLANEOUS

PMC-80 NETWORK SYSTEM



Personal Micro Computer, Inc., has introduced a system for local network distribution of data or programs. Principal applications for the Downloader System are for teaching and distributing information to local displays.

The system is comprised of a master disk-based PMC-80 with 48K byte memory and several slave PMC-80s. The slaves are 16K byte memory units equipped with the company's Fastload modification which accepts data serially from the master at 10,000 bits per second.

The master PMC-80 has a Downloader interface (Model DLB-50) on an S-100 bus card which plugs into the Expander chassis.

The master with 48K memory and two disk drives is priced under \$3000. Each slave with 16K memory is priced under \$1000.

Personal Micro Computers, Inc., 475 Ellis St., Mountain View, CA 94043. (415) 962-0220.

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CIRCLE 223 ON READER SERVICE CARD

computer store of the month



Computerland of Nassau

Numerous computer stores sell Creative Computing Magazine, Press, and Software. In this issue we are spotlighting Computerland of Nassau. We would like to recognize their salesmanship, success, and service to the community.

Computerland of Nassau does not nestle comfortably on an island in the Bahamas as many expect, but is on Long Island in the heart of Nassau County just 20 miles east of Manhattan. It boasts an in-stock product inventory of over 7000 items of which more than 50% are programs, books and magazines. The store carries a full line of Creative Computing products. Computerland of Nassau is a supermarket for businessmen, educators, professionals, and hobbyists alike. The store is alive with displays of Apple, Atari, Commodore, Dynabyte, Ithaca Intersystems, Osborne, Vector Graphics equipment.

Computerland of Nassau, a franchise of Computerland Corp. of San Leandro, California, opened for business in late 1978 and was staffed with the owner, Elliot Greene, his wife Sybil, and their soon-to-be son-in-law, Keith Blau. The store's 2400 square feet of retail space is a veritable Grand Central Station of activity. Four full-time technicians cater to customer's servicing needs both in the store and in the field. Eight salespeople assure customers of prompt and courteous service. Behind the scenes, two administrative people utilize their own computers to control the accounting and management information needs.

The store is located at 78 Westbury Ave. in Cami Place, L.I., N.Y. 11514. Their phone number is 516-742-2262. If you are ever in the area, stop in and see them.

New Products, continued...

HOME CONTROL FOR TRS-80



Radio Shack has introduced a device that permits direct computer control of up to 256 low-powered lights and appliances: the TRS-80 Plug 'n Power Controller (26-1182).

The TRS-80 Plug 'n Power Controller connects to the common output of any TRS-80 Model I, Model III or Color Computer. It translates instructions from the host TRS-80 computer into controlling signals, which are coupled through normal AC power wiring to remote appliance and lamp dimmer modules (sold separately).

Any one of up to 256 remote modules can be reached with a command to turn on, turn off, brighten or dim a light, or to turn an appliance off. Alternatively, a group of up to 16 remote modules can be turned on or off together, and up to sixteen such groups are accessible. \$39.95.

Available at Radio Shack stores and Computer Centers.

CIRCLE 388 ON READER SERVICE CARD

TV LOCKING SYSTEM



Perno announces Video Lock, selective locking system that permits parental control over either standard, pay television, or video cassette recorder viewing.

The Perno Video Lock is an A/B locking switch made of coated-cast metal. It has specially created contact points for long wear. It comes complete with cable and security shields so that the connecting ends of the cable cannot be removed and the lock bypassed. \$24.95.

Perno, 3001 Malmo Rd., Arlington Heights, IL 60005 (312) 640-2472.

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Retail Roster



Advance Data Concepts—2250 Diamond Blvd., Concord, 94520; (415) 671-9816. 9-5 Mon-Fri. Vector-Graphic, CP/M Software Headquarters-User's Group.

D.E.S. Data Equipment Supply—8115 Firestone, Downey 90241. (213) 923-9361 7 days. Commodore PET specialists. Hardware Software, Books, Maps, Supplies, In House Maintenance.

CONNECTICUT

Computerworks—1436 Post Rd., East Westport 06880; (203) 255-9096. 12-6 Tues-Fri, 12-9 Thu, 10-5 Sat.

GEORGIA

Atlanta Computer Mart—5091 Buford Hwy., Atlanta 30340; (404) 455-0647. 10-6 Mon-Sat.

ILLINOIS

Computer Land/Downers Grove—136 Ogden Ave., Downers Plaza 60515; (312) 964-7762. 10-6 Mon-Sat., 10-8 Tue., Thurs. Apple, Atari, Osborne, Zenith, Vector.

Data Domain of Schaumburg—1612 E. Algonquin Rd., Schaumburg 60195; (312) 397-8700. 12-9 Tues-Fri, 11-5 Sat. Apple, Alpha Micro, Hewlett-Packard Calculators. Largest book and magazine selection.

Farnsworth Computer Center—1891 N. Farnsworth Ave., Aurora, IL 60005; (312) 651-3886. 10-6 Mon-Fri, 10-5 Sat. Apple, Hewlett-Packard series 80 systems, HP Calculators, IDS Printers.

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To include your store in Creative Computing's Retail Roster, call the Advertising Department at (201) 540-1189.

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The Video Station—872 So. Milwaukee Ave., Libertyville; (312) 367-8600. Open 7 days. Atari Computers, Hardware and Software.

MASSACHUSETTS

Nesco—679 Highland Ave., Needham 02194; (617) 449-1760. 9-5:30 Mon-Fri. Commodore, Apple, Superbrain, Atari.

Science Fantasy Bookstore—18 Elliot St., Harvard Sq., Cambridge 02138; (617) 547-5917. 11-5 Mon-Sat, 11-8 Thur. Apple & TRS-80 games, Epyx, Microsoft, Creative Computing.

MICHIGAN

Uptate Computer Shop—629 French Rd., Campus Plaza, New Hartford 13413; (315) 731-9139. Mon-Fri 10-6, Sat 11-5. Apple-Commodore-Data General.

Computer Center—Garden City; (313) 425-2470 & West Bloomfield; (313) 855-4220. Books, Magazines, Hardware and Software for Apple, Northstar, TRS-80 & PET.

NEVADA

Home Computers—1775 E. Tropicana 86, Las Vegas 89109 (702) 796-3022. 10-7 Mon-Sat. Apple, Commodore, Atari, AIM 65. (Books) Sales & Service.

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Silent Partner—2050 Center Ave., Fort Lee 07024; (201) 947-9400. Mon-Sat 10-6. Apple/Atari/Commodore/Vector/Malibu.

Stonehenge Computer Shop—89 Summit Avenue, Summit 07901; (201) 277-3020. 10 am-6:30 pm Mon-Sat. Apple/Bell & Howell/Commodore Authorized Dealer, Sales and Service.

Software City—111 Grand Ave., Rye/Edge 07661; (201) 342-8788. Bus/Rec./Utility Home programs for TRS-80, Atari, Apple and PET. 10-25% off list.

NEW YORK

Programs Unlimited—20 Jericho Turnpike, Jericho, NY 11753; (516) 333-2266. 10-8 Mon-Sat. The largest microcomputer software selection available.

The Computer Center—31 EAM 37th St., New York 10018; (212) 689-8130. 10-7 Mon-Fri, 11-6 Sat, 10-8 Thur.

Uptate Computer Shop—629 French Rd., Campus Plaza, New Hartford 13413; (315) 731-9139. 10-6 Mon-Fri, 11-5 Sat. Apple-Commodore-Data General.

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Abacus II—1417 Bernath Pkwy., Toledo 43615; (419) 865-1009.

Micro Mini Computer World—74 Robinwood Ave., Columbus 43213; (614) 235-5013/6058. 11-7 Tues-Sat. Authorized Apple/Commodore dealer. Sales, Service, Business Software.

North Coast Computers—626 Dwyer Center, Bay Village 44140; (216) 835-4345. 10-6 Mon-Sat, 10-8 Tue. Thur. Apple/Atari/Vector Graphic/Data General.

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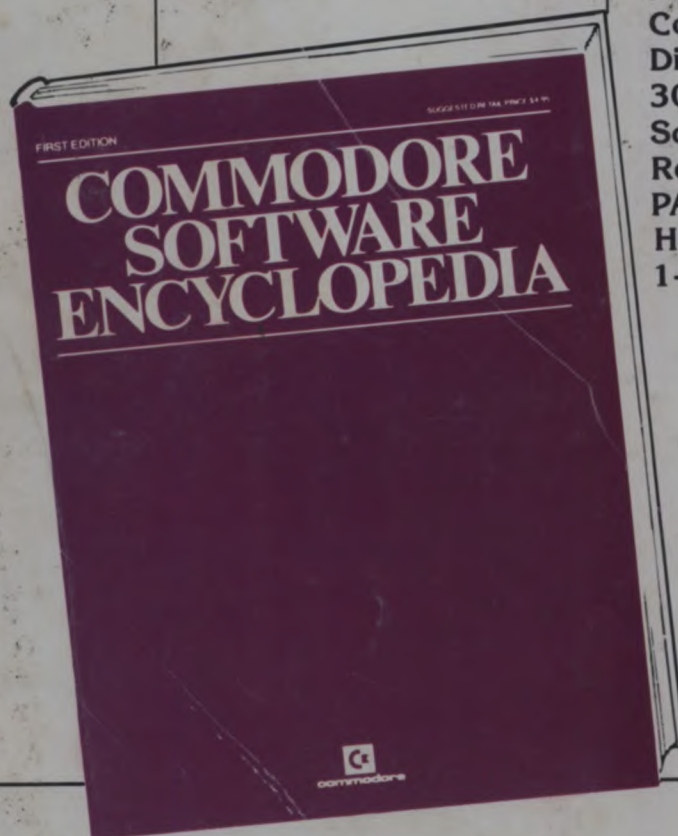
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