

# edu



## GAMES COMPUTERS PLAY

The Education Products Group is currently in the process of collecting for publication the most comprehensive, all-embracing collection (conglomeration?, bunch?, herd?) of computer games known to BASIC-speaking man.

### WE NEED HELP!!

Namely, more games. Please submit games as follows:

1. A complete listing (on *white* TTY paper with a reasonably good ribbon).
2. One or two sample runs.
3. Paper tape of program (tape not absolutely vital—if possible, submit on fanfold tape).
4. BASIC language requirements or limitations (or machine).
5. Your name, address and phone number.
6. Original source of program (if known).

Authors and submitters will be given full credit in the book.

Send your programs to:

GAMES  
Education Products Group (5-5)  
Digital Equipment Corporation  
Maynard, Massachusetts 01754

Anyone submitting an original game will receive a FREE copy of the entire GAMES booklet.

The man who follows the crowd will usually get no further than the crowd. The man who walks alone is likely to find himself in places no one has ever been.

Creativity in living is not without its attendant difficulties, for peculiarity breeds contempt. And the unfortunate thing about being ahead of your time when people finally realize you were right, they'll say it was obvious all along.

You have two choices in life: you can dissolve into the mainstream, or you can be distinct. To be distinct, you must be different. To be different, you must strive to be what no one else but you can be.

Alan Ashley-Pitt

*This issue features*  
**VALUES**  
*and*  
**VALUE CLARIFICATION**

*See articles pages 6,7 and 8.*

## NEW MATERIALS FROM DIGITAL

*Advanced Problems for Computer Mathematics*,  
DEC, \$2.00.

This volume is another in the continuing series of curriculum materials published for use with EduSystems and RSTS. *Advanced Problems for Computer Mathematics* is a 75-page booklet packed full of fascinating problems designed to challenge the average, as well as the most accomplished, students. The booklet contains problems from a variety of subject areas including general math, intermediate and advanced algebra, geometry, statistics, and mathematical analysis.

*Introducing BASIC*, by Theodore R. Blakeslee II, Trinity College (published by EduComp Corporation) \$4.95.

This text, based on EduSystem BASIC, is an outstanding volume designed specifically for teaching BASIC at the secondary school or college level. It provides thorough coverage of elementary language concepts, which makes the text ideal for teachers and students with little or no computer experience. Each section is clearly developed and contains a wealth of classroom examples, descriptions, and suggested exercises. Emphasis is placed on random numbers and teletype graphics. Additional topics include debugging, program documentation, and teletype usage. *Introducing BASIC* is an excellent text for use as a sequel to *POPULATION* or as the central student text for learning BASIC.

Both *Advanced Problems for Computer Mathematics* and *Introducing BASIC* may be ordered from:

Software Distribution Center  
Digital Equipment Corporation  
Maynard, Massachusetts 01754

Inquire directly for prices on classroom quantities.

## THE USERS' VIEW

Our users have been keeping the mailman on his toes recently—and we're pretty proud of the users' view! Here are two samples we'd like to share with you . . . they speak for themselves.

The first was sent to DEC's president, Mr. Kenneth Olsen, from John G. Boyce of William Tennent High School, Warminster, Pennsylvania.

Dear Mr. Olsen:

On behalf of the School Directors, Administration, and Teachers at William Tennent High School, I would like to thank your company for the courteous service and delivery of the four PDP-8/L machines.

Mr. Paul Derdul, of your Fort Washington, Pa. office, is a superior person to deal with. We, at school, had a lot of red tape to cut through in order to get the purchase order and as time went by it was apparent that it was increasingly difficult for Mr. Derdul to maintain the original conditions of the sale. He did so, and more!

Your company is to be congratulated for its personnel and equipment. Each day when I come to school I cannot believe that we have 5 DIGITAL computers and 6 TTY's in our C-17 classroom.

We plan to do quite a lot with them in education. We see them as a marvelous instructional aid. One area of concentration will be to try to help those 11th and 12th grade students who are two or more years behind in their arithmetic ability level. We practiced, last year and the year before, with some programs that helped restore the student's confidence in his math ability and we were pleased with the results (we only had one machine at that time).

We will keep you informed on our progress and we look forward to an exchange of ideas.

Yours truly,

John G. Boyce, Dept. Chmn.

"Educated men are as much superior to uneducated men as the living are to the dead."

Aristotle

## BACK ISSUES BECOME COLLECTORS ITEMS!

Yes, indeed, the 1901 issues of National Geographic and 1937 issues of Superman Comics are becoming priceless collectors' items. We also receive many requests for back issues of EDU. Some of you old timers will recall the plans for building a nifty roll-around cart for your EduSystem 10 in EDU #3 or the EduSystem software announcement in EDU #1. Double WOW!

If you want the back issues of a publication that's sure to be a collectors' item in 2070, subscribe to MAD. But if you want some back issues of EDU, we have a couple of hundred of EDU #6, #5, #4, a handful of #3 and #2. Sorry, #1 is all out.

The R.E.S.I.S.T.O.R.S. (Radically Emphatic Students Interested in Science, Technology, and Other Research Subjects) reside at Princeton University, Princeton, N.J. The group's president, Steve Emmerick, recently wrote the following letter to Paul Derdul, Philadelphia Area Educational Specialist:

Dear Paul:

The show in Atlantic City went very well, and the RESISTORS are all grateful to you and to DIGITAL for lending us the PDP-11. I would especially like to thank you for putting up with Nat's and my annoyance calls during the weeks preceeding the conference.

Our exhibit was one of the best on the floor (which this year isn't saying too much) and there were no serious mishaps. There was only one hardware problem. . . . The DE-11 we got had a lower output voltage (7 volts) than the TEKTRONIX needed (about 20) to be driven. Our solution was to get a heavy-duty-any-plug-to-any-plug-compatible-all-purpose Livermore modem, which we used to amplify the signal.

The group got a lot of good publicity, and I think DIGITAL did too. Many people asked what central computer we were time-sharing BASIC on, and their eyes boggled when we pointed to the 11. "And only 8 K?"

Thanks again for putting up with us and for being so helpful. Enclosed is the Basic tape which you lent us.

Sincerely,

Steve Emmerick  
President, R.E.S.I.S.T.O.R.S.



## SPEAK OUT!

We'd like to give all of you out there in the educational world a chance to express your views, communicate ideas, and blow your own horns! That's why we'll be reserving a page (or more if we need to) just for you in every future issue of EDU. SPEAK OUT is for you, by you . . . but it won't speak without you.

We do need your help, your suggestions, your ideas. Send us any information you'd like to share with other educators who are using computers at any academic level, in any application or discipline. Your input can be any length, edited or unedited.

We'll publish editorials, project descriptions, and suggestions for the classroom, the lab, or the comp center. Use SPEAK OUT to air your views, make a connection, or tell your story.

Come on! SPEAK OUT—Teachers, Administrators, Deans, Comp-Center Directors, and Students, too. Let the educational community hear your voice! Send your input to:

Educational Products Group (5-5)  
Digital Equipment Corp.  
Maynard, Mass. 01754

## PUBLISHER'S STATEMENT

EDU—ISSUE #7. Editors of this issue: David Ahl and Sally Richards Bower.

EDU is published 5 times per school year by the Educational Products Group, Digital Equipment Corporation, Maynard, Mass. 01754.

EDU is distributed free to educators, teachers, and others involved in the use of computers in education. Circulation of this issue is 22,000 distributed as follows:

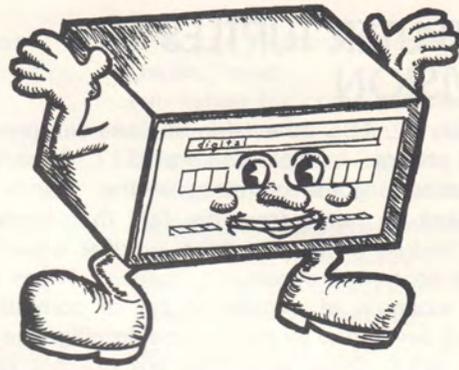
Mailed Directly	18,000
Conferences and Shows	1,500
DIGITAL Sales Offices	2,000
Miscellaneous	500

EDU welcomes contributions and commentary from its readers; simply send to: Editor, EDU, at the above address.

## DROP IT

Cut out a cardboard rectangle 1-1/2" x 3". Drop it from a height of about 2 feet onto an 8-1/2" x 11" sheet of paper laid flat on a table. Outline the rectangle where it falls with a "Flair" type pen. Repeat 15 times.

Write a program to determine the probability of one rectangle touching one other, two others, and so on. How do the results from your program compare to your drawing? Try it for 30 drops. Any improvement?



Be sure to meet Petey P. Eight and his friends on pages 22 and 23.

## NEW YEAR \$PECIAL

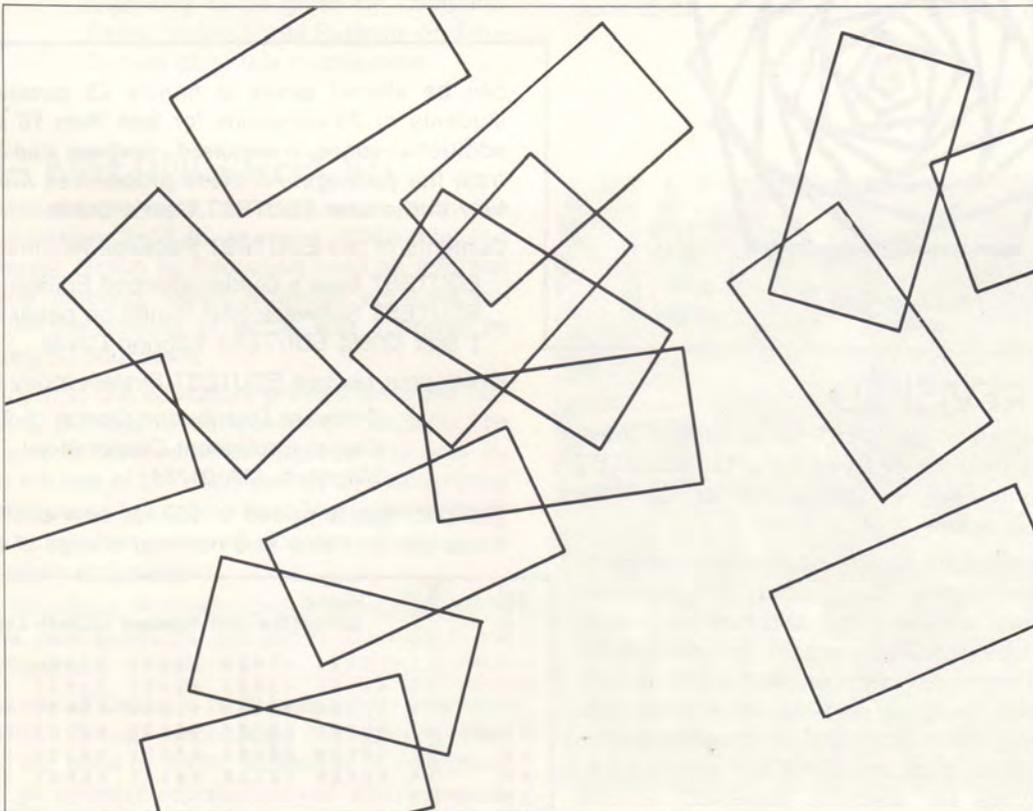
*Save \$1*

While they last . . . EduSystem BASIC Reference Booklets are available at a 50% discount! Normally a 25-cent item, these handy-dandy pocket-size booklets may be purchased in quantities of 8 for \$1.00.

Order yours today. . . . Stock your supply closet with BASIC-Edu-knowledge-in-a-nutshell!

Minimum order: 8 booklets. Payment must be enclosed:

EDUCATION PRODUCTS GROUP (5-5)  
Digital Equipment Corporation  
Maynard, Massachusetts 01754





## SPRING CONVENTION AND CONFERENCES

Be sure to visit us at the following conventions and conferences this spring.

- Feb. 15-17 Nat'l Council of Teachers of Math  
Pioneer International Hotel, Tucson, Arizona
- Feb. 24-28 Amer. Assn. of School Administrators  
Convention Hall, Atlantic City, N.J.  
(see EduSystem EDP at the DIGITAL Booth and the Project LOGO computer-controlled turtle, plotter and music box at the General Turtle booth).
- Feb. 26-28 Amer. Assn. of Junior Colleges  
Disneyland Hotel, Anaheim, Calif.
- Mar. 15-17 Nat'l Council of Teachers of Math  
Sheraton Hotel, Philadelphia, Pa.  
(DIGITAL Educational User Group meeting to be held at this conference)
- Mar. 17-21 Amer. Assn. of School Administrators  
Civic Center, San Francisco, Calif.
- Mar. 22-24 Nat'l Council of Teachers of Math  
Hilton Hotel, San Francisco, Calif.
- Mar. 30-Apr. 1 Nat'l Science Teachers Assn.  
Cobo Hall, Detroit, Michigan  
(Workshop for computer teaching in chemistry to be given by Computer Based Instructional Systems on EduSystem 25 at this conference)

- Apr. 8-11 American Chemical Society  
Dallas, Texas  
(workshop for computer teaching in chemistry to be given by Computer Based Instructional Systems on EduSystem 25 at this conference)
- Apr. 18-20 Federation of Medical Societies  
Atlantic City, New Jersey  
(Workshop on EduSystem 15 to be given at this conference)
- Apr. 25-28 Nat'l Council of Teachers of Math  
Albert Thomas Convention Center, Houston, Texas  
(Sally Bower of DIGITAL to give workshop on computer usage in geometry using Project LOGO turtle plotter)  
(DIGITAL Educational User Group meeting to be held at this conference)
- May 2-5 Digital Equipment Computer Users Society, Holiday Inn, Philadelphia, PA  
(DIGITAL Educational User Group meeting to be held at this conference)
- May Pacific Education Showplace  
Vancouver, B.C.
- June 18-20 Conference on Computers in the Undergraduate Curricula  
Claremont Colleges  
Claremont, Calif.  
(DIGITAL Educational User Group meeting to be held at this conference)
- June 25-28 American Society of Engineering Education  
Ames, Iowa.

## EDUSIG MEETING REPORT

On Saturday, December 2, in conjunction with the DECUS Symposium held in Anaheim, California, the Special Interest Group in Education held an informal meeting. The meeting, which provided an ideal environment for the sharing of ideas, was attended by approximately 50 educators.

Of key concern to the educators present were the factors inhibiting the use of computers by schools. The methods used to involve other departments and instructors in the use of the computer as an instructional tool were discussed in some detail. The need for comprehensive curriculum materials, for use with the computer, was again emphasized.

David Ahl, Education Products Group Manager, briefly outlined the new products and future plans that are under development.

Dr. Don Harmer of Georgia Tech (and acting president of the EDUSIG Group) emphasized the need for user concern on the issue of BASIC standards. A committee comprised of industry representatives and computer users is currently attempting to set standards for the BASIC Language. Representatives for the committee are being sought from the user community.



Sally Bower demonstrates EduSystem 40 at NSTA Conference in San Diego.

# VALUES—A “V” WORD

There's a great deal of talk (and action, too) these days about values; value clarification, strategies, the processes involved in “valuing,” and about the reevaluation of values. Based on the premise that our lives, our surroundings, and our roles are constantly shifting and changing, it becomes critically important that each of us knows what we value. That is, we must know who we are, what we want and where we're going.

Values have become a central issue in school, home, church, and business. Value clarification is being sought extensively as a vehicle for achieving personal growth and fulfillment, as well as a basis for decision making and problem solving.

The source for many of the ideas in this feature article come from the Spring-Summer 1972 issue of *FORUM*, a semi-annual periodical published for educators by the J. C. Penney Company. Copies of this and future issues are available on request to interested educators from all J. C. Penney Store managers. We thank *FORUM* for its permission to bring this enlightened view to our readership.

“What Do You Value?” by Sid Simon, (edited by Education Products Group)

How does one know what to value? How do you know what you are for or against?

In these troubled, confused, but also exciting times, we need people who know who they are, who know what they want out of life, and who can name their names when controversy rages. People who are not so vulnerable to a demagogue, or to blandness, or to safety. Values are the basis upon which people decide what they are for and against, or where they are going and why. In other words, they give direction to life. But, with the many divergent values viable today, it is oftentimes difficult to know where you stand.

The following exercises (sometimes called strategies) can be used to help you determine what is important to you? What do you value? After doing these yourself, you can perhaps try them on friends, family, or students and compare some of their ideas and alternatives to your own.

**THERE'S ALWAYS  
AN EASY SOLUTION  
TO EVERY PROBLEM**

**NEAT . . . PLAUSIBLE . . . AND WRONG**

117

## 20 THINGS I LOVE TO DO

1.					
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20.					

As quickly as you can, list 20 things in life which you really, really love to do. There are no right or wrong answers about what you should like.

Using the suggested code below, the next step is to code the 20 items listed above.

1. Place the number 1 by any item which costs more than \$5 each time you do it.

2. Put a 2 by any item which involves some RISK. The risk might be physical, intellectual, or emotional. (Which things in your own life, that you love to do, require some risk?)

3. Using a 3, record any of the items on your list you think your FATHER and MOTHER might have had on their list if they had been asked to make such a list at your age.

4. Place either a 4 or a 5 next to each item; the 4 is for items you prefer doing with PEOPLE, the 5 for items you prefer doing ALONE.

5. Place a number 6 by any item that would not have been on your list 5 years ago.

6. Place a number 7 by any item you think will not be on your list 5 years from now.

7. Finally, go down through your list and indicate the date when you last did each item. Use an 8 for things you have done today, a 9 for those done within the last month, and a 10 for things you haven't done in more than a month.

Now . . . how about writing a program that will analyze the responses that you and your class have made. The following sample is an analysis of the strategy responses of an EDU Editor.

RUN  
VALUE

THIS IS A COMPUTERIZED ANALYSIS OF YOUR RESPONSES TO THE VALUE STRATEGY GAME '20 THINGS I LOVE TO DO'.

THIS ANALYSIS WILL PASS NO FINAL JUDGMENTS ON YOUR RESPONSES. IT WILL, HOWEVER, COMPILE THE NECESSARY STATISTICS THAT WILL AID YOU IN MAKING YOUR OWN EVALUATION OF THE THINGS YOU VALUE IN YOUR LIFE.

HOW MANY THINGS ARE CONTAINED IN YOUR LIST (FROM 1 TO 20)? 20

ENTER THE CODE NUMBERS THAT YOU HAVE PLACED NEXT TO ITEM# 1 . TYPE A 99 AFTER ALL OF YOUR NUMBERS HAVE BEEN ENTERED.

? 5  
? 10  
? 99

ENTER THE CODE NUMBERS THAT YOU HAVE PLACED NEXT TO ITEM# 2 . TYPE A 99 AFTER ALL YOUR NUMBERS HAVE BEEN ENTERED.

? 1  
? 4  
? 10  
? 99

:  
:

YOUR COMPUTERIZED ANALYSIS . . . . .

YOU ARE FORTUNATE. IN THESE INFLATIONARY DAYS ONLY 30 PERCENT OF THE THINGS YOU LOVE REQUIRE MONEY.

YOU MUST BE CAUTIOUS!  
ONLY 15 PERCENT OF YOUR VALUED ACTIVITIES INVOLVE PERSONAL RISK.

YOU AND YOUR PARENTS VALUE LESS THAN HALF OF THE SAME THINGS.

PEOPLE ARE INVOLVED IN LESS THAN 50 PERCENT OF YOUR FAVORITE ACTIVITIES.

YOU ENJOY DOING THINGS THAT INVOLVE YOU ALONE MOST OF THE TIME.

2 OUT OF 10 TIMES YOUR ITEMS WOULD NOT HAVE APPEARED ON YOUR LIST FIVE YEARS AGO.

YOU KNOW WHAT YOU VALUE. 0 PERCENT OF YOUR ITEMS WILL NOT BE ON YOUR LIST IN 1978.

35 PERCENT OF YOUR VALUED ACTIVITIES HAVE BEEN ENJOYED WITHIN THE LAST 24 HOURS.

WITHIN THE LAST MONTH YOU HAVE DONE 60 PERCENT OF THE THINGS YOU LOVE TO DO.

AND IN 4 OUT OF 10 CASES YOU HAVE NOT BEEN INVOLVED IN YOUR VALUED ACTIVITIES FOR MORE THAN A MONTH.

YOUR COMPUTER ANALYSIS OF THE THINGS THAT YOU VALUE IS COMPLETE. WE HOPE THAT YOU ARE HAPPY WITH THE RESULTS. PERHAPS THERE ARE SOME CHANGES YOU WOULD LIKE TO MAKE OR PERHAPS YOU HAVE LEARNED SOMETHING ABOUT YOURSELF BY PLAYING '20 THINGS'. ONLY YOU CAN EVALUATE THE STATISTICS OF THIS ANALYSIS.

IT MIGHT BE INTERESTING TO GO BACK OVER YOUR LIST AND ASSIGN PRIORITIES TO YOUR ITEMS. IT MIGHT GIVE YOU SOME ADDITIONAL INSIGHT TOWARD THE THINGS THAT YOU VALUE.

READY

After you have written your analysis program and your EduSystem has compiled the statistics for you, look back over the results.

- Can you identify any patterns in the things that you value?
- Did you learn something new about yourself?
- Are there things you are pleased with?
- Is there anything you would change?
- How might you go about it?
- Are there some things you like to do that you haven't done lately? Why? What can you do about it?
- Does establishing priorities for your entries give you additional insight about you and your values?

Try playing "20 Things" several times this year. Maybe you'll learn something new about yourself each time!

## IDEA DEPARTMENT

The Fall/Winter, 1972, issue of *FORUM* is now available (see "Values—a 'V'-word" article). It is based on the topic of consumerism and contains lots of good articles and creative ideas for classroom use. On pages 21-23 there is a consumer survey designed to determine local consumer attitudes and concerns. So why not call or write to J. C. Penney today? Have your social-studies or business students conduct this survey in the school or in the community and use your EduSystem to tabulate and analyze the findings. Let us know how you do!!



# GAMES . . . FOR LEARNING BASIC

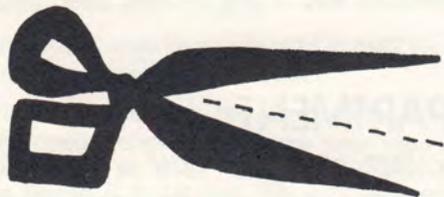
In the math lab or in the classroom, activity-centered learning has been used successfully by teachers and students in a variety of subject areas. So why not teach BASIC using a similar approach??

Here's an idea that we've cooked up that will get you started.

Write a BASIC program on a large piece of cardboard. Choose programs that illustrate a programming idea that you're teaching today. (The sample that we've used here illustrates a simple looping technique).

Now. Go crazy with a pair of scissors. Cut off all the statement numbers, first. Then separate each statement into one or more parts. Remember not to make the "puzzle" too complex, especially for beginners.

```
10 PRINT "TYPE ANY NUMBER";
15 INPUT A
20 LET X=A/2
25 LET Y=INT(X)
30 IF X=Y GOTO 45
35 PRINT A; "IS ODD"
40 GOTO 10
45 PRINT A; "IS EVEN"
50 GOTO 10
99 END
```



10 PRINT "TYPE AND NUMBER";  
15 INPUT A  
20 LET X=A/2  
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30 IF X=Y GOTO 45  
35 PRINT A; "IS ODD"  
40 GOTO 10  
45 PRINT A; "IS EVEN"  
50 GOTO 10  
99 END

The program puzzle can be used by single students or by groups. Once it's back in one piece, students can "hand-execute" the problem, calculate a result, and then check their answer by letting an EduSystem solve the problem.

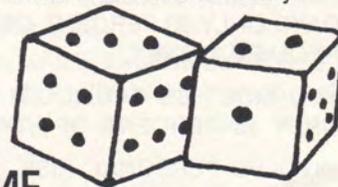
Make a whole set of BASIC program puzzles. The kids will love them!

# SO YOU THINK YOU KNOW BASIC?

1 \_\_\_\_\_ 7 \_\_\_\_\_ 13 \_\_\_\_\_  
2 \_\_\_\_\_ 8 \_\_\_\_\_ 14 \_\_\_\_\_  
3 \_\_\_\_\_ 9 \_\_\_\_\_ 15 \_\_\_\_\_  
4 \_\_\_\_\_ 10 \_\_\_\_\_ 16 \_\_\_\_\_  
5 \_\_\_\_\_ 11 \_\_\_\_\_ 17 \_\_\_\_\_  
6 \_\_\_\_\_ 12 \_\_\_\_\_

List the seventeen fundamental statements in the BASIC language (need help?—see the EduSystem 5 and 10 User's Guide).

- If there were a decree that said you had to use fewer statements, draw a line through the 5 statements you could easily do without. Are there 5 others that you could get along without?
  - Circle the four that really do the most for you and which you would hold on to until the very end.
- Look back over your list and your decisions and consider:
- After getting rid of all 10 statements asked for in A., is there anything you really cannot do? If there is, you ought to think about changing some of your decisions.
  - Which statements are necessary, and which just make programming easier? What value do you place on these latter statements?
  - Consider other items in life similarly. What possessions do you enjoy (make a list of 12)? Which ones could you give up if you had to? How important to you are things that are nice but not necessary?



## NUMBER GAME

Write a BASIC program to simulate this Number Game that appeared in the latest issue of *Zephyrus: De-Schooler Primer*.

Equipment: 2 dice and a score sheet. Each die numbered from 1 to 6.

Score sheet numbered from 1 to 100 with a blank beside each number.

Rules: Each player (you vs. the Computer?) rolls the dice. The object is to fill the blanks on the score sheet using the numbers on each die in any arithmetic operation. Only one operation may be used.

Strategy: With a roll of 2 and 6 the player could elect to fill in either the 2, the 6, the 4 (6-2), the 8 (6+2), the 12 (6×2), the 3 (6/2), the 36 (6<sup>2</sup>), or the 64 (2<sup>6</sup>).

The winner? The player that fills the most blanks!

# GAMES COMPUTER BUMS PLAY

## 1. Illegal cancellation

The equation  $16/64 = 1/4$  is a result obtained by the cancellation of the 6 in the numerator and denominator. Find all the cases in which  $AB/BC = A/C$  for A, B, and C integers between 1 and 9 inclusive. Do not consider obvious special cases such as 22/22, 33/33, etc.

## 2. Four digit numbers

The four digit number 3025 has the following property: if the number formed by considering only the first two digits (30) is added to the number formed by considering only the last two digits (25) (the total will be 55), and if this number (55) is squared, the result will be the original number:

$$(55)^2 = 3025$$

Find all 4 digit numbers having this property. Do *not* check numbers beyond 9900 since 9901 would be arranged as

$$99 + 01 = 100 \text{ and } (100)^2 = 10000$$

which is a 5 digit number.

## 3. Monkey problem

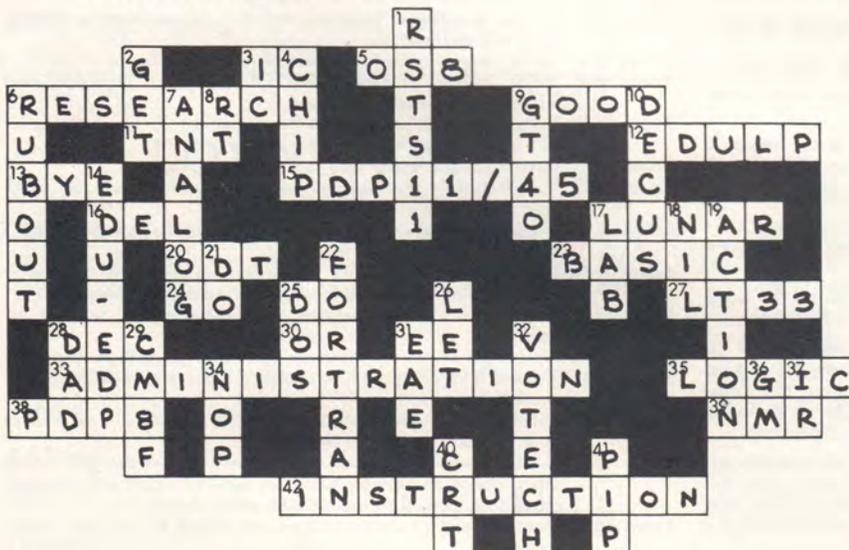
There are 3 pirates and a monkey on a desert island who have gathered a pile of coconuts to be divided the next day. During the night one pirate arises, divides the pile into 3 equal parts and finds one coconut left over, which he gives to the monkey. He then hides his share away from the pile. Later during the same night, each of the other two pirates, in turn, arise and repeat the performance of the first pirate. In the morning all 3 pirates arise, divide the pile into 3 equal shares and find one left over which is given to the monkey. How many coconuts were in the original pile? Since the result is not unique, find all values from 1 to 1000 that satisfy the conditions.

# VERBAL VOYAGE

There are 29 words embedded in this puzzle... words that relate to computers and computer applications. Some words are horizontal, some are vertical. The rest are zig-zag (not diagonal)... challenge yourself for 10 minutes a day. Take our journey into computer-jargon-land. (solution will appear in EDU #8.)

a	l	m	b	p	r	o	c	e	s	s	o	r
z	t	e	s	r	m	g	d	a	r	i	f	c
d	e	m	b	k	j	r	r	e	g	m	e	o
f	l	o	w	c	h	a	r	t	p	u	l	d
e	e	r	s	v	w	m	x	d	a	t	a	t
f	t	y	o	u	q	o	n	e	y	f	s	i
b	y	t	e	s	t	h	d	i	s	c	s	o
r	p	i	t	e	d	j	i	l	v	t	e	n
e	e	u	t	r	u	s	y	s	t	e	m	s
m	s	m	d	m	p	o	n	o	i	r	b	w
d	g	y	r	i	n	f	s	a	m	n	l	o
p	x	c	c	n	x	t	i	e	e	s	y	o
e	z	o	a	a	b	w	n	i	t	h	c	p
r	b	m	o	l	m	a	t	r	i	a	l	t
i	k	p	u	t	e	r	e	i	h	r	m	e
p	m	r	c	p	m	e	f	x	g	i	z	a
h	z	s	d	u	c	n	b	r	f	n	g	r
e	e	h	r	t	n	t	z	d	c	e	o	i
r	i	a	c	c	u	l	o	a	m	p	r	x
a	p	r	t	k	m	p	t	u	d	a	b	c
l	o	d	g	i	u	l	a	t	o	r	y	d
w	n	w	x	j	o	y	b	n	m	i	n	p
m	b	a	t	c	h	q	m	h	c	t	c	u
v	a	r	i	a	b	l	e	v	e	y	w	t
j	s	e	h	i	o	a	t	n	r	t	v	m
p	i	a	h	p	t	n	g	u	a	g	e	o
a	c	o	n	s	t	a	n	t	w	s	b	c

# CROSSWORD PUZZLE ANSWERS FROM EDU #6



# TWA KANSAS CITY SURPLUS STORE

In the market for a TWA 707 nose cone? Maybe a set of 747 lounge chairs?

At TWA's "shopping center" at 1229 Charlotte Avenue in downtown Kansas City, Missouri, thousands of such surplus items are sold at a fraction of their original cost - everything from silver coffee pots to 727 QC cargo pallets.

The shop is open Wednesdays from 9 a.m. to 6 p.m., catering to bargain hunters who snap up dinner glasses, pots and pans, used carpeting and flight deck instruments, including mach meters, compasses and horizon indicators.

You can get a set of three 707 or 727 coach chairs for as little as \$10 each. Winter hostess coats go for \$9.95, knit suits - jackets and dresses - for \$15. There's even a few evacuation slides for \$12.95 each - they make great water floats.

Sorry, no mail orders accepted.

# PROGRAMMING APTITUDE TEST

If you've been a computer bum for some time, or if you're thinking about joining the ranks of the buffs that spend every free waking moment with the computer. . . . we think it's time you stop playing computer-bum games for a moment and evaluate your true programming aptitude. This programming aptitude test is an official short version designed by MEDPA (Mass. Educational Data Processing Assn). Take 30 minutes to decide your future!

## Directions:

This test contains thirty questions. Each question has been thoroughly tested and found completely valid and reliable. Extensive field testing has proven beyond a doubting shadow that a high score on the Short Form is a positive indication of a high score.

Do not write in the test booklet. Answers may be listed on lined composition paper.

Questions requiring numerical calculations must be performed mentally.

Total allotted time for test: 30 minutes.

Answers and response evaluations appear at the end of the test.

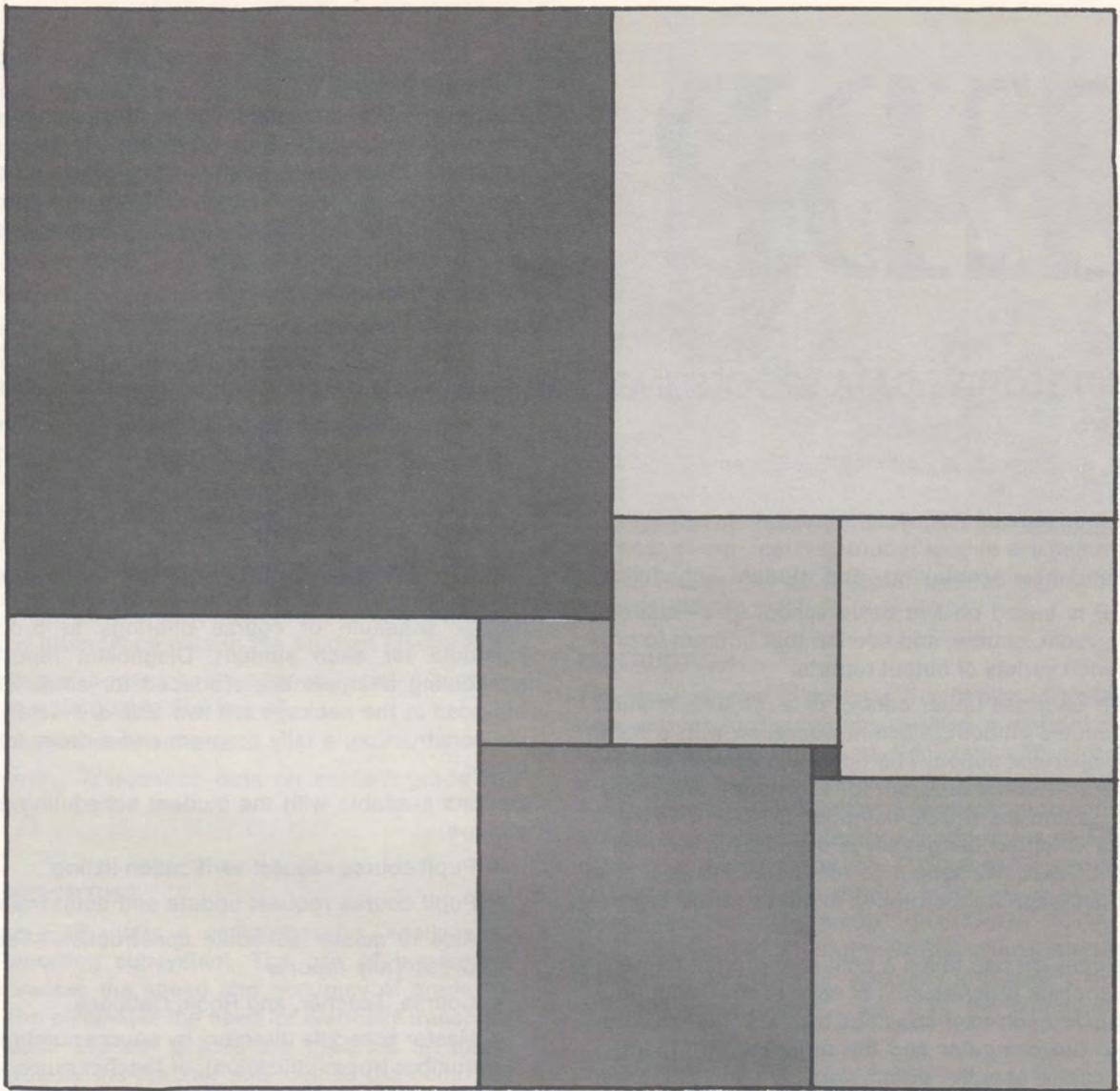
1. If you went to bed at 8:00 PM and set the alarm to get up at 9:00 AM, how many hours sleep would this permit you to have?
2. Do they have a 4th of July in England?
3. Why can't a man living in Winston-Salem, N. C., be buried west of the Mississippi River?
4. How many birthdays does the average man have?
5. If you had only one match and entered a room in which there was a kerosene lamp, an oil burner, and a wood-burning stove, which would you light first?
6. Some months have 30 days, some have 31 days, how many have 28 days?
7. If a doctor gave you 3 pills and told you to take one every half hour, how long would they last you?
8. A man builds a house with four sides to it and it is rectangular in shape. Each side has a southern exposure. A big bear came wandering by. What color is the bear?
9. How far can a dog run into the woods?
10. What is the minimum number of active players on a baseball field during any part of an inning? How many outs in each inning?
11. I have two United States coins in my pocket and together they total 55¢ in value. But one is *not* a nickel. What are the two coins?
12. A farmer had 17 sheep. All but 9 died. How many did he have left?
13. (Mentally) Divide 30 by a half and add 10. What is the answer?
14. Take two apples from three apples and what do you have?
15. An archaeologist claimed that he found some gold coins dated 46 BC. Do you think he did?
16. A woman gives a beggar 50 cents. The woman is the beggar's sister, but the beggar is not the woman's brother. How come?
17. How many animals of each species did Moses take aboard the ark with him?
18. Is it legal in Massachusetts for a man to marry his widow's sister?
19. What word is definitely misspelled in this test? (Note: the word misspelled is spelled correctly.)
20. An electric locomotive is travelling north at the rate of 40 miles an hour. It is being chased from the south by a wind blowing at 80 miles an hour. Will the smoke from the locomotive be blown ahead of the train at the rate of 40 miles an hour?
21. There is a ten-foot steel ladder attached to the side of a boat. The rungs on the ladder are exactly one foot apart with the bottom rung resting exactly on the top of the water. If the tide rises one foot every half hour, how long will it take to cover the first three rungs of the ladder?

22. You are completely blindfolded. Placed in front of you is a box of stockings, all the same size. 25 of the stockings are white; 25 are black. What is the minimum number of stockings that you can remove and be absolutely sure of a matching pair?
23. There is a solidly walled enclosure with a solid 8<sup>1</sup>/<sub>2</sub>-foot wall dividing it in half. In one half is a baby bull; in the other half is the papa bull and the mama bull. How can the mama bull feed the baby bull?
24. What four words appear on every U. S. coin besides "In God We Trust"?
25. How near is the U. S. to Russia? (3000, 1000, 500, or 50 miles)
26. You have a baseball. You throw it away from you as hard as you can. It does not hit anything, nor does anyone catch it, but it comes back to you. There are no strings or elastics involved. Why does the ball come back?
27. Are there more doorknobs on the right side of doors or on the left side?
28. You have 4-1/4, 5-1/2, and 3-2/8 haystacks and you put them all together. How many haystacks do you then have?
29. If you flew due south from Atlanta, Georgia, which South American country would you pass over first?
30. A small planeload of Americans flying over Canadian territory meet with a fatal accident. None of the remains can be identified. In which country will the survivors be buried?

Answers on page 34.

# A COMPILATION OF FINAGLE'S UNIVERSAL LAWS FOR SYSTEMS ENGINEERS

- Axiom #1* In any calculation, any error which can creep in will do so.  
*Axiom #2* Any error will be in the direction of most harm.  
*Axiom #3* In any formula, constants (especially from engineering handbooks) are to be treated as variables.  
*Axiom #4* The best approximation of service conditions in the laboratory will not begin to meet those conditions encountered in actual service.  
*Axiom #5* The most vital dimension on any plan or drawing stands the greatest chance of being omitted.  
*Axiom #6* If only one bid can be secured on any project, the price will be unreasonable.  
*Axiom #7* If a test installation functions perfectly, all subsequent production units will malfunction.  
*Axiom #8* All delivery promises must be multiplied by a factor of 5.0.  
*Axiom #9* Major changes in construction will always be requested after fabrication is nearly completed.  
*Axiom #10* Parts that positively cannot be assembled in improper order will be.  
*Axiom #11* Interchangeable parts won't.  
*Axiom #12* Manufacturer's specifications of performance should be multiplied by a factor of 0.5.  
*Axiom #13* Salesmen's claims for performance should be multiplied by a factor of 0.25.  
*Axiom #14* Installation and Operating Instructions shipped with any device will be promptly discarded by the Receiving Department.  
*Axiom #15* Any device requiring service or adjustment will be least accessible.  
*Axiom #16* Service conditions as given on specifications will be exceeded.  
*Axiom #17* If more than one person is responsible for a miscalculation, no one will be at fault.  
*Axiom #18* Identical units which test in an identical fashion will not behave in an identical fashion in the field.  
*Axiom #19* If, in engineering practice, a safety factor is set through service experience at an ultimate value, an ingenious idiot will promptly calculate a method to exceed said safety factor.  
*Axiom #20* Warranty and guarantee clauses are voided by payment of the invoice.



## “PERFECT” RECTANGLE

The reproduction is of a painting titled “Perfect Rectangle” by Mary Russell. The underlying idea is mathematical. A not-quite-square rectangle has been divided into the minimum number of squares that will fill its entire area, making it a “perfect” rectangle.

Write a program to determine for any rectangle with dimension  $L$  and  $W$  the minimum number of squares that will fill its area.

CAUTION! This rather innocent problem is not that easy to solve!

## DO YOU KNOW ?

We’re looking for information regarding the use of Digital EduSystems in the following curriculum applications. If you have information about any of the following, please fill out this coupon and mail it TODAY!

Name \_\_\_\_\_ Title \_\_\_\_\_  
 School \_\_\_\_\_ Dept. \_\_\_\_\_  
 Address \_\_\_\_\_  
 City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_  
 Telephone \_\_\_\_\_

	H.S.	Comm. College	Jr. College
<input type="checkbox"/> Physics Lab/ Classroom	_____	_____	_____
<input type="checkbox"/> Chemistry Lab/ Classroom	_____	_____	_____
<input type="checkbox"/> Geometry	_____	_____	_____
<input type="checkbox"/> Mathematical Analysis	_____	_____	_____
<input type="checkbox"/> Statistics/ Probability	_____	_____	_____
<input type="checkbox"/> General Mathematics	_____	_____	_____
<input type="checkbox"/> Business Education	_____	_____	_____

# EDP

## ADMINISTRATIVE DATA-PROCESSING IS HERE

DIGITAL has recently announced EduSystem-EDP (Educational Data Processing), an administrative data processing system. The system includes programs for a comprehensive school records system, grade reporting, attendance accounting, and student scheduling.

Edu-EDP is based on five basic school files—student, teacher, room, course, and section that interact to produce a wide variety of output reports.

Edu-EDP operates under control of a run-time monitor that promotes smooth, efficient operation with a minimum of operator action. The operating system also includes a sort utility program for reordering and merging of files and the DIBOL compiler. DIBOL (DIGITAL's Business Oriented Language) is a powerful, yet easily learned COBOL-like language for the PDP-8 and is a perfect language for instruction in the business department.

EduSystem-EDP has taken a unique approach to meeting the specific requirements of each school. With EduSystem-EDP each user specifies his particular requirements to the computer and the programs are tailored to that user's specific parameters. A user has great flexibility in defining not only the data items stored in his files but also their size and characteristics. Each user selects from a list of processing options—such as daily or monthly attendance procedures and alphabetic or numeric grade reporting—and also defines the content and format of desired output reports to EduSystem-EDP.



EduSystem 50/EDP at Melrose High School, Melrose, Mass.

## SCHOOL RECORDS SYSTEM

EduSystem-EDP provides facilities for easily recording, updating, and reporting the five basic system files—student, teacher, room, course, and section. A powerful inquiry language is also available to the user to selectively retrieve and display records. Six logical operators are implemented, = ≠ < > ≤ ≥.

### Program Capabilities Include:

- Create and update the five basic system files
- Enroll new students and delete dropped or transferred students
- Retrieve and display individual records
- Inquiry language to retrieve and display records on selected data elements.

## STUDENT SCHEDULING

The EduSystem-EDP Student Scheduling program processes student course requests against a school's master schedule of course offerings to produce a schedule for each student. Diagnostic reports and scheduling analyses are produced for administrators. Included in the package are two aids to master schedule construction, a tally program and a cross-tally program.

Options available with the student scheduling subsystem are:

- Pupil course request verification listing
- Pupil course request update and audit trails
- Aids to master schedule construction—Tally and Cross-Tally reports
- Course, Teacher, and Room Catalogs
- Master schedule directory by course number, room number (room utilization), or teacher number
- Up to 24 modules per school day
- Up to 10 days per cycle
- Up to 5 semesters per school year
- A subset of students may be automatically selected for scheduling, e.g., by year of graduation
- Up to 2047 courses in relevant master schedule subset
- Up to 2047 sections in relevant master schedule subset, with maximum of 99 sections for one course
- Up to 25 course requests per student
- Split week and split semester course scheduling
- Class size balancing
- Study hall assignment
- Optional partial scheduling for students with irresolvable conflicts
- Diagnostic information for students who cannot be scheduled without conflict
- Student schedules
- Updated master schedule, including daily study hall seat counts
- Class lists, homeroom lists, and daily study hall lists

## ATTENDANCE ACCOUNTING

Attendance Accounting programs provide for the collection of attendance data for each student for each day of the school year. The data is stored in the student's master record where it is accessed for various user-defined attendance reports such as legally required periodic attendance registers and summaries to claim state aid funds.

The EDP-Attendance subsystem is based on mark-sense cards. These turnaround cards facilitate the recording of attendance data and minimize reporting errors.

Attendance accounting software capabilities include:

- Retention of full or half-day attendance data, including optional tardy and dismissal data for a full school year.
- Daily school list of absences, tardies, and dismissals.
- Daily or monthly attendance reporting.
- Retention of monthly, year-to-date, and marking period attendance data in the Student Master File.
- Printing of a monthly attendance register according to a state-specified format.
- Support for state aid claims.
- Reporting attendance data on student grade reports.

## GRADE REPORTING

EduSystem-EDP offers a comprehensive, easily used Grade Reporting subsystem. The use of turnaround cards increases the speed and accuracy of grade recording and eliminates the need for clerically transcribing the data. Student grades are reported on mark-sense cards by the teacher and sent to the computer for processing.

The EDP Grade Reporting System:

- Produces verification lists of marks before report card preparation.
- Handles customer-designated grading conventions, e.g., numeric, alphabetic, and alphabetic with plus and minus marks.
- Formats report cards in accordance with user specifications, including any data in the Student, Teacher, Room, Course, or Section Files.
- Produces lists for specified grades, e.g., I (incomplete), W (withdrawn), F (failure)
- Prints report cards for a maximum of 5 marking periods in the school year and updates the Student Master File with the current grades
- Optionally totals course credits and updates the career-to-date credit total
- Optionally computes current, year-to-date, and career-to-date grade point averages (GPA) for simple or weighted curricula
- Produces GPA reports by year of graduation
- Assigns rank in class



Debbie Russell and Ed Sousa of Melrose High School examine attendance report.

## INSTRUCTION

The same system that meets a school's administrative data processing requirements also supports instructional timesharing (such as EduSystem 25 or EduSystem 50) or a batch instructional capability (such as EduSystem 30). EduSystem 25 services up to eight teleprinter terminals simultaneously and offers on-line program and file storage on DECTape. EduSystem 50 services up to 16 time-sharing terminals in a variety of languages including BASIC, FORTRAN, FOCAL and PAL. EduSystem 30 Batch BASIC allows students to mark their programs on specially formatted cards that are then processed in a batch by the computer.

## CONFIGURATIONS

EduSystem-EDP configurations include a 132-column, 165 character-per-second line printer and a new card reader that reads only under control of timing marks. The reader can process 40-column mark-sense cards, 80-column punched cards, or interspersed mark-sense and punched data, all under timing-mark control.

Three EduSystem-EDP configurations are available.

### *EduSystem/40-EDP:*

PDP-8/E rack mountable computer with 12K words of core memory, power restart, bootstrap, two dual DECTape transports and controller, optical mark card reader, console teletype, and line printer.

### *EduSystem/45-EDP:*

PDP-8/E rack mountable computer with 12K words of core memory, power restart, bootstrap, cartridge disk, DECTape, optical mark card reader, console teletype, and line printer.

### *EduSystem/50-EDP:*

PDP-8/E rack mountable computer with 12K words of core memory, power restart, bootstrap, disk unit and control, dual DECTape transport and controller, optical mark card reader, high-speed paper tape reader, and DECwriter line printer.

## USING COMPUTERS TO AUTOMATE COMPUTER DESIGN

The concept of using computers to build other computers might be the theme of a science fiction fantasy. It also happens to be a fairly accurate description of the activities in Maynard's Automated Drafting Department, where various time consuming computer design tasks are being performed more quickly and easily with the aid of PDP-8's, a PDP-15, and a DECsystem-10.

The bulk of the electronic circuitry in any computer is contained on printed circuit boards, which, in the past, have all been hand-designed. As the race for computer miniaturization has progressed, however, increasing requirements for density (compactness of circuitry) have prompted the automation of the design process for certain kinds of boards. The REDAC group (named for a purchased software package), one of the areas of DIGITAL's Automated Drafting Department, is engaged in automated board design, utilizing a PDP-15 computer.

The function of REDAC is to take the design engineer's schematic diagram of the board's circuitry and components and to arrange those circuits and components into a pattern with no crossed circuits, and with sufficient space between components to allow for insertion and to avoid heat build-up. Instead of doing all the figuring and drawing by hand, however, REDAC staff members enter all necessary information from the engineer's drawing into a PDP-15 computer, which processes the information, and then displays a completed or nearly completed board-layout on a Graphic-15 display screen. Any circuits the computer was unable to route can be readily hand drawn on the screen by use of a light pen. Using the computer interactively, the staff member can check on the feasibility of any hand-drawn circuit until he finds an optimal solution. When the design is completed, the PDP-15 enters the proper information on DECTape to enable a highly accurate, automated plotting device to prepare a diagram of the board on photographic film (the last step before production). The PDP-15 also prepares a computer tape to control the automated drilling of holes for components in the manufactured boards. Preparing a board layout using the REDAC system takes approximately one third the time it would take to prepare the layout manually.



Ed DeJesus (left) checks the tape-drive of the REDAC PDP-15 computer system as Al Ackerman, group leader, inputs data on a Teletype.



Dora Bacener logs the X/Y axis of components on a GEMS digitizer interfaced with a PDP-8/e.



Gems Group Leader Al Brown examines a printed circuit board layout. This film was produced by the plotter and is the end result of the GEMS effort.

The GEMS group, another area of the Automated Drafting Department, provides a related engineering service. Certain manually designed printed circuit boards require the precision of automated plotting, rather than the traditional method of hand-taping the circuits on clear film. To prepare for automated plotting, the placement of circuits and components must be logged on an x/y axis by means of a PDP-8-controlled device called a digitizer. A computer tape prepared by the PDP-8 then controls the plotter as it prepares a film diagram of the board. The PDP-8 also prepares a computer tape for drilling the manufactured boards by numerical control.

The Wirelisting group, the third area of the Automated Drafting Department, provides a computerized design service for a different part of the computer—the logic panel into which all the printed circuit boards are plugged. The side of the logic panel opposite the boards consists of hundreds of steel pins that must be interconnected by wires in a pattern determined by the configuration of the boards inserted. For each computer to be wirewrapped, the Wirelisting group codes information about each of the printed circuit boards and feeds it into a DECsystem-10 computer. The DECsystem-10 then processes this information about the length and route of each required wire. This tape is used then to operate either a semi-automated wire-wrap station or a Gardner-Denver automatic wire-wrap machine at which the logic panel is actually wired.

## PUPIL ACHIEVEMENT AND ATTITUDES USING COMPUTER-SUPPORTED INSTRUCTION

A doctoral dissertation, by Gerard Akkerhuis of USC, examines pupil achievement and attitudes using BATCH-processing computer instruction. Hence, most of the paper is not directly applicable to those schools using or considering use of interactive systems. However, some of the report is general, and rather disturbing, in its conclusions.

"Long and Schwartz iterate the theme:

Computer-assisted instruction will have a noticeable effect on teachers' attitudes, practices, and training, and may be met with strong resistance in some educational circles. It has been said that there is no educational innovation that a teacher cannot cause to fail, either through improper use or by simply not investing the interest or time required to look into it.

Thus, individual enthusiasm for a specific change is found to be inversely proportional to how much the individual involved must change. People desire it in and for others. They praise change for others, but seldom value changes for themselves. Change means exertion and planning to make the adjustment. Usually people will stipulate that any change they are asked to make will make their work easier or they must receive additional compensation.

In the past several years David Austin has experienced highly successful pioneering in instructional technology (combining the telephone, the television set, and the computer into an educational threesome). Yet he has observed:

It was clear that the teachers were more than willing to recommend the use of technology as long as it did not interfere with their own classroom procedures. This was due to the fact that the technology was extraneous to their own learning experience, and thus did not fit into the pattern of their own classroom routine. If the technology were part of the teacher's own learning experience, then the teachers would make use of the technology in their teaching. The average teacher will teach the way he was taught. Hence it appears that college and university education departments will need to establish computer technology as part of their teacher training before that technology will be widely used by teachers in their classrooms.

This is the age of technology. Society would be totally paralyzed should electricity be withdrawn. All significant communications and other processes would be impossible. Yet few high schools and fewer elementary schools enable their students to experience the chief of our technological achievements, the computer. While the public likes to think of the computer as a cure-all for everything (the segment of the public that supports technology is much larger than the segment that does not), the majority of teachers seem reluctant to use the computer in their daily work. Effort should be made to help them take steps in this direction."



With apologies to Robert Crumb

## Students Speak

The way students view their experience with the computer in their classroom is often enlightening, thoughtful, honest, and sometimes, even amusing. Whatever the reaction to the words and ideas of these young people, we think that what they say has a good deal of merit . . . and that they deserve an attentive ear.

The following student comments are excerpts from The Dartmouth Project Interim Report (Oct. 1, 1968) entitled, "Demonstration and Experimentation in Computer Training and Use in Secondary Schools."

" . . . Previous to the computer, I had little confidence in tackling any complex mathematical operation. Since BASIC requires that a mathematical operation be broken down into its simplest parts, even a very complex mathematical operation could be expressed in BASIC. This makes the computer quite a confidence builder."

"The computer has been used for a teaching aid, as well as an enjoyable companion. Programs have been molded from serious math and science programs to chess, games, pictures, and Christmas wishes."

"I sincerely feel the computer is a valuable addition to the school academic life. Even when students think of it as just an intelligent toy, they are learning through their own curiosity and experimentation."

And from *LOCAL LINK* published by Project LOCAL, Westwood, Mass.:

" . . . The computer helps me to solve word problems that I have never been able to solve before. I enjoy working with the computer . . . "

"The boys hog the terminal."

"It helps me *think out* the problem. Before, I didn't know where to start unless I had a set method of solving problems."

"It's fun and makes a special kind of friendship and unity within our class . . ."

" . . . It makes me think."

"I learned the subject matter better by using the computer than I would have without it. The computer forced me to have a complete understanding of the subject."

"The computer is an outlet for my creative insanity!!!"

## BOCES LIRICS: A Regional Computer Network

A recent issue of THRUPUT, a NYS AEDS publication, published an interesting and informative article by Gerry Damm entitled, "BOCES LIRICS Goes on the Air—In Regional Computer Network." LIRICS, an acronym for Long Island Instructional Computer Services, is the first regional instructional computer center in New York State and also the first Digital Equipment Corp. PDP-10 system not affiliated with a university that is totally dedicated to instructional applications.

This BOCES system, housed at Wilson Tech at Dix Hills, was conceived by Dr. Ludwig Braun, formerly of Brooklyn Polytechnic Institute.

Regarding the use of the system for instruction, Mr. Damm, the LIRICS Director, breaks the applications into two broad categories: Concerning *Computer-Student Instruction*, he writes,

"The computer can instruct the student via teacher-written programs in simulations of CAI. CAI is a form of programmed instruction where the machine keeps track of the student's answers and provides excellent drill and practice.

Simulations in the sciences, economics and other areas provide the student with experiences wherein his knowledge and decisions based on that knowledge (or lack) determine success or failure with the computer model.

Computer models are actually mathematical models of systems or phenomena in the real world. The model is operated by manipulating symbols and routines that replicate the variables and components of the real system. Simulations are used in which human decision-makers act and interact within the simulation. 'Games' fall into this category. However, the definition of games here is somewhat more sophisticated than the popular conception. A game is a technical term denoting a simulation in which the results for one group depend on the actions of their competitors—competitors can be other simulation participants or the computer. Business and management games are now being used by large corporations. One of the most significant advantages of simulation is that it permits the student to study processes in ways that nature either prohibits or are impractical for hazardous or financial reasons. The student can explore hypotheses and get answers to his 'What if I . . .' queries over a wide range of situations.

The interactive nature of time-sharing, which provides immediate feedback, allows the student's decisions to interact with the computer's choices. The student not only learns from 'experience,' but he can explore other alternatives."

On the other hand, the student can instruct the computer. About *Student-Computer Instruction* Mr. Damm remarks that, "The best way to learn a subject thoroughly is to teach it. Most students from fifth grade onward, appear to absorb programming languages faster than teachers or other adults. Once the language has been learned, a magic flows. The student is con-

fronted with choices as to what to actually program. Invariably, research is required for the program, research that directly relates to some education and learning. Be it a simple game or an involved complexity, the computer requires an exactness of definitions, logic, and procedures that provide heavy impetus for the student to think.

The computer does not 'solve problems,' it only follows carefully defined logical procedures. The user is not relieved of the responsibility of planning the work carefully; in fact, the computer demands much more careful planning — which is valuable in itself. The computer is faster and more accurate than a human; but it cannot determine how to proceed, what to do with results, or do many things a human can do, such as detecting an unusual condition or seeing at a glance that a student is in a bad mood. The computer does not 'think'—there is no known record of a computer anywhere that is aware of its own existence. However, it really encourages the student to think."

By last summer more than sixty terminals, servicing thirty school districts, were involved in the LIRICS Networks, at a cost that is possibly the lowest in the country. In addition to providing a low cost computing facility, the BOCES have also undertaken a massive teacher-training program that provides more than 20 courses over a four-month period.



"Only once in every generation is there a computer that can write poetry like this."

© DATAMATION ®

## THE ASHEVILLE SCHOOL STORY

The following article was submitted by Chase Ambler of the Asheville School, Asheville, North Carolina. Asheville was one of the first secondary schools in the country to purchase a VT05 Alphanumeric Display Terminal with a standard DEC EduSystem. After more than a year of classroom experience with the VT05, Mr. Ambler evaluates its effectiveness and its role in learning.

"We were convinced of the valuable role computers could play in the educational process long before we came to the decision to bring computer power to the Asheville School. After careful consideration of the available options, we purchased an EduSystem from Digital Equipment Corporation in October, 1971. In retrospect, it is obvious to us that this decision was the right one.

Our EduSystem 30 is currently operating in an interactive mode 14 hours a day, seven days a week. Were we to compare the time-sharing service rates in an equivalent time frame, our cost would be sufficient, over a two-year period alone, to pay for our EduSystem 30!

The system consists of a PDP-8/E computer with 8K words of memory, a teletype terminal, a single DEC-tape drive, a VT05 Alphanumeric Visual Display Terminal, and a standard television monitor.

The VT05 is an exceptionally valuable part of our system. It is not only the most popular device for student use, but it has been the focal point for classroom demonstrations and instruction in computer usage. The VT05, which drives our 21" monitor, handles demonstrations for as many as 16 students without difficulty.

Student interest levels have hit an all-time high using the VT05 terminal. They enjoy using the "space age" device which operates at three times the speed of the



Chase Ambler of Asheville School uses VT05 with TV monitor to illustrate a point.



conventional teletype terminals. For the teacher, this increased speed, coupled with the demonstrative capability of this device, saves time that would ordinarily be spent performing "blackboard work." Several other advantages that we feel will benefit Asheville in the long run include reduced maintenance (there are less moving parts in a VT05) and the noise reduction. (Other teaching activities can take place in the same classroom where the VT05 is the exclusive terminal!)

In classroom instruction, the VT05 has been used effectively as a demonstration tool for teaching programming concepts. It is possible to design one large program, consisting of smaller subprograms, each displaying a different use of a single BASIC language statement. Using this technique, it is possible to print a listing of the first subprogram, discuss the concepts of the statement usage, run the first subprogram, and proceed to the second demonstration. And each step of this demonstration is initiated by the teacher, when discussion is completed, by simply pressing the VT05 space bar! This extreme flexibility is not possible with the conventional teletype; it provides ease and time-saving advantages that are unique to the VT05.

In addition to the many other advantages of the VT05 terminal, it is possible to directly address any of the 1,440 locations. Graphic displays can be "drawn" in any direction (backwards, vertically, or slanted!). Graphs are executed dot-by-dot rather than line-by-line; axes can be retained, new parameters defined, the curve erased, and a new function drawn. Multiple curves can be plotted, as well. This versatility of the VT05 makes it a valuable addition to math and science classes.

We highly recommend the VT05-monitor combination for its flexibility and demonstrative capability. For us, it's a must!"

## NEWS FROM BRITAIN

An increasing number of British schools now own their own computers. A recent article, written by David Pegg of the Bedford School for "Computer Education," discusses the advantages of owning a system vs the use of a timesharing terminal or batch facilities at a remote computer center. Mr. Pegg makes these comments about the use of minicomputers in education:

"(a) They are primarily interactive machines. I need not stress the remarkable incentive that this gives, particularly to Arts pupils. The languages they use (e.g., BASIC) are very easy to learn and yet permit sophisticated programs.

(b) They are sufficiently small and uncomplicated to allow young people to operate them, as well as communicate via a teletype. In fact, pupils readily learn the assembly language—even when it is not part of the school curriculum. It is quite feasible, as some schools have shown, for the pupils to take over most of the operation of a small-computer system.

(c) They can be introduced easily into the classroom, using a mobile teletype with closed circuit T.V. to project the printed output. Later it is hoped that cheaper visual display units will be developed for this purpose. Such classroom use will be available in subjects such as economics and geography, as well as mathematics and science.

(d) They can be used for school administration, for which the pupils themselves can provide the programs.

It may be argued that their small storage prevents elaborate programs, particularly with a lot of input data. This is true, but these machines can be expanded up to around 32K of core storage, together with disk or tape backing. With such a system a number of schools can share a single machine. Moreover, it is possible that a link to a large compatible computer can be arranged at cheap times, when large programs can be run. The small computer then acts as a front-end processor.

The outstanding advantage of interactive computers is the way in which they extend pupils, both the bright and not-so-bright. They provide a challenge, and the means of responding to it, in a way that only outstanding teachers can achieve and even then, only for a few pupils.

Admittedly, the costs are high but they are coming down. These machines offer much better value for money than a timesharing terminal. Their on-line editing facilities are most valuable, and there is no nagging worry that "think-time" costs money. You may argue that there will be bottlenecks and, that for large numbers of pupils, batch processing will be necessary. I agree, and reply that mark-sense card readers are available. Many pupils will be content to use these, particularly when the first flush of enthusiasm for on-line access has waned."

A small computer users' group has been formed by several of the local schools for the purposes of exchanging information on current activities, providing



Ferrari 312 on the curve.

## SPEED!!

The World Championship Ferrari factory racing team uses a Digital Equipment Corporation minicomputer in the pits to count laps and compute speeds.

At the heart of Ferrari's timing system is a 4K-word PDP-8/L computer with an added-on external clock. This clock "ticks" in milliseconds, so the system is capable of accuracy to within a thousandth of a second.

Using the PDP-8/L, the Ferrari team can now keep track of eight cars plus the leader, and can, at the completion of each lap, get a teleprinter printout of number of laps completed by each car, the time it took to complete the last lap, and the number of laps and time (to the millisecond) that the car is behind. This data is produced by the mini in response to the button-pushing of one person who is equipped with a 12-key button pad. He observes the race and presses the appropriate button whenever a car passes a certain point on the course, makes a pit stop, or resumes racing.

An advantage to the computerized system is its reliability. Since the system is accurate up-to-the-minute, the team need no longer rely on the often inaccurate interim reports from the race officials. "Several times during one six-hour endurance race the officials told me we were a lap behind, but the computer said we were ahead," recalls Richard E. Fritz, manager of Ferrari's North American Racing Team. "If I had listened to the officials instead of the PDP-8, I might have pushed the cars too hard and broken them down." As it is, Ferrari held back and won the race.

Besides its accuracy and reliability, the mini is also convenient. "It doesn't eat or require a motel room," Fritz notes, "and it has been great for team morale." With this system the drivers can pace themselves—they can see at a glance how their timings are progressing and look for trends in their performance.

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documented BASIC programs, and acting as consultants to schools that anticipate buying a small computer. The group will publish a regular newsletter and meet periodically to exchange ideas and experiences.

Membership is open to all schools, with or without a computer resource. Further information can be obtained by writing to Gordon Addison, National Computing Center, Audrey House, Ely Place, London, E.C.1., England.

# ON-LINE ENROLLMENT FOR A SMALL COLLEGE USING THE PDP-11

Robert A. Branton Jr.  
Department of Computer Science  
Southeastern State College  
Durant, Oklahoma

In these times of dwindling educational funds, many small colleges wage a losing battle trying to provide a system capable of handling enrollment. Expanding enrollments and wider course selection make enrollment an increasingly complex task for the small college. Previously, Southeastern's enrollment had been handled on an IBM 1130 computer, using punched cards for class enrollment. With enrollments exceeding 4000 students, this method was totally inadequate. It frequently took students hours to enroll; and it took the computer days and weeks to complete enrollment related tasks such as class lists. Enrollment was something dreaded for weeks before and regretted for weeks after.

In the spring of 1972, we remedied the situation with the development of an on-line enrollment, utilizing the PDP-11. The enrollment program is written in BASIC and operates under RSTS-11.

Southeastern's enrollment is analagous to an airline reservation system. To enroll, the student and his adviser first complete an enrollment sheet. The student takes this sheet to any one of six terminals. The operator then enters the student's name, student identification number, and the title, number, and section of each course the student proposes to take. For each course, a class availability file is checked. If all the student's classes are open, his enrollment is confirmed and the student is officially enrolled. The computer also verifies the class times for any conflicts. At

this time, one space is removed from each of the student's classes in the availability file. If a class is closed, an appropriate message is printed along with still open sections. The student may either choose another section or go back to his adviser to choose another course. The computer is equipped to handle students with special permission to enroll in a closed class.

The system is designed to handle both continuous and concentrated enrollment. During concentrated enrollment, six terminals enroll students simultaneously. In a three-day enrollment period, over 2500 students enrolled for summer school, with each individual enrollment taking less than one minute.

At the close of the enrollment period the individual files created by the terminals are merged to form one student file on disk storage. Students are sorted alphabetically and a class file is constructed from which class lists are printed. In this summer's enrollment, class lists were in instructors' mailboxes prior to the first class sessions.

Late enrollment and class changes are handled by one terminal located in the Dean of Instruction's Office. Approval for the change is obtained in this office, and the secretary enters the required information into the terminal.

The "enrollment predicament" is not peculiar to Southeastern. Colleges throughout the country are finding themselves bogged down in time consuming, inefficient enrollment procedures. Southeastern's solution to its enrollment illustrates that a small school can effectively meet its administrative duties without the expense of a medium-scale computer.

## COMPUTER ART

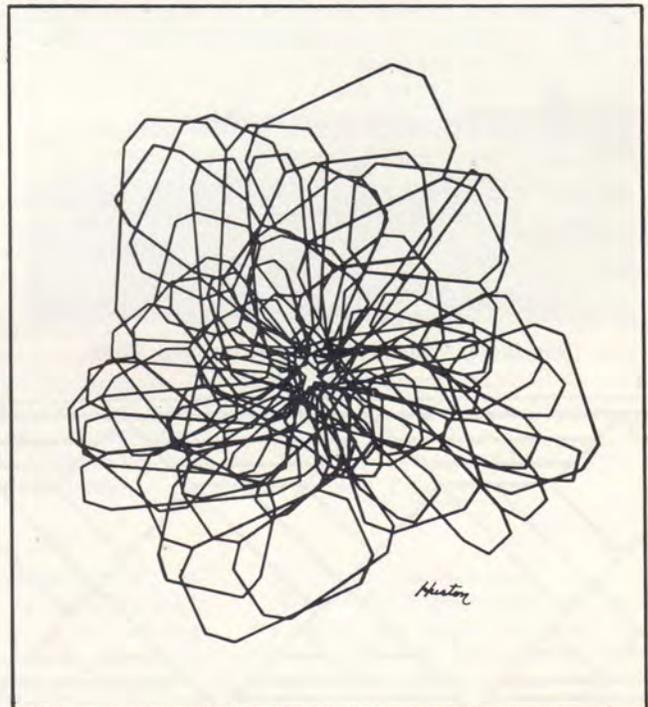
Computer art is a creative process of interaction between the artist and the computer. The artist controls originality and composition through input parameters and the skillful execution of each drawing. This control allows each computer art "original" to become literally one of a kind. In other words, each art program is a model and each "original" is one of an infinite number of different simulations of the original idea. Thus, computer art combines the rare qualities of logic, precision, and human value.

In computer art, each drawing begins with an idea that must then be analyzed for geometry, form, and aesthetic value. An idea of value is then logicized into a workable computer program. Through programmed control the computer becomes a highly versatile drawing instrument able to produce graphic art displays. However, in the final analysis, each display must be evaluated subjectively by the individual.

For a free catalog of beautiful, reasonably priced computer graphics, write to COMPUTRA. Mention EDU.

Thomas J. Huston  
COMPUTRA  
Box 608  
Upland, Indiana 46989

OCTAL CRYSTAL — 20" x 20" — one color



## DIGITAL OPENS TRAINING CENTER IN MAYNARD

Classes have begun for approximately 600 customers and employees at DIGITAL's newly constructed Training Center in Maynard. The 55,000 square foot building contains 35 classrooms, three computer laboratories, and administrative office space for DIGITAL's Educational Services and Sales Training Department. The Training Center is the second building in Digital Park, a campus-like industrial area being developed by the computer company on Maynard's Parker Street.

Constructed by The Carlson Corporation, the building was designed to provide space to meet DIGITAL's increasing involvement in training customers and employees. The building is equipped with more than 35 DIGITAL computers, ranging in size from minicomputers to large-scale computing systems, to provide students a variety of hands-on computer experiences. In addition, every classroom has been wired for closed-circuit television, and telephone lines provide each class with the ability to use a central computer via remote terminal. Room has been provided in the Training Center for a computer-science library to be opened at a later date, as well as a computer museum that will show the evolution of DIGITAL computers.

The building was designed to handle up to seven-hundred students, with a faculty of more than 100 instructors and administrators. The Education Services Department, managed by David Edwards, provides instruction in a wide variety of computer subjects for DIGITAL customers and for members of the DIGITAL Field Service Department. The Sales Training Department, managed by Jerry Witmore, provides orientation and instruction for new DIGITAL salesmen and sales managers.



New Digital Training Building in Maynard, Mass.

## GRAPHIC GAMES FOR PHYSICS INSTRUCTION

Burton N. Kendall  
University of California  
Santa Barbara, California 93106

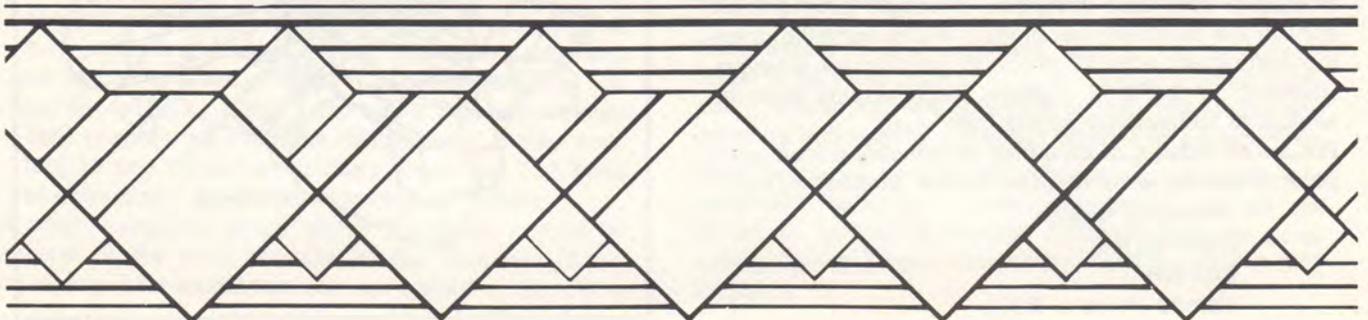
Several programs have been written to aid in instruction of undergraduate physics. These differ from most programs used for instructional purposes in several important respects.

The intent of these programs is not to "teach" a student physical concepts, but, instead, to give him a "feel" for concepts he has already encountered and to increase his learning motivation. There are many subjects in physical science that are formulated in mathematical terms and for which the student has no real-life experience. A few examples from physics are special relativity, gravitation on a planetary scale, and the dynamics of bodies with changing mass.

In order to develop and sustain a high interest level, these programs have been formulated as games. These games are played with another student or with nature (as modeled by the computer) as the opponent.

An example of one of these programs is one which combines both gravitation and special relativity. It is based upon the game of "space war," versions of which exist at a number of installations. In this game two players each operate a space ship using a "joystick" control. They can control forward and reverse acceleration of the ships, angular thrusters to rotate it, and a missile launcher. The ships, and any missiles they fire, are subject to the gravitational field of a sun. The object is to shoot down the opponent while avoiding being hit yourself or falling into the sun. This version contains several features illustrating relativistic mass increase and time dilation. It has several less competitive options for students to practice orbital mechanics and rendezvous maneuvers between the two ships.

These games put fairly stringent requirements upon the computer hardware since they are all real-time programs. The computations must be done rapidly and the display must be a fast, refresh type which makes minimal demands on central processor time. The programs described here have been implemented on a PDP-15 with floating-point hardware, a Graphic-15 display, and a special interface for the "joystick" controls. The display is changed and the program parameters updated every 50 milliseconds.



# "Will Somebody Please Deassign a DECtape?"

by Daniel S. Koch

Outstanding faculty, new equipment, and an informal working atmosphere are attracting many students to the Yale Computer Science Department.

Yale's newest department is hitting its stride in its third year. With new faculty, machines, and money, as well as breezy enthusiasm and complete informality, the Computer Science department may be heading for national prominence.

The department inherited the third and fourth floors of the Dunham Laboratory on Hillhouse Avenue when the Engineering department moved to its new quarters in Becton. On the fourth floor reposes the department's PDP-10 computer, at \$500,000 relatively inexpensive and made by the Digital Equipment Company. The PDP-10 is time-shared, which means that several users can use it simultaneously from scattered terminals; currently there are nine such terminals, all in use at least 18 hours of every day.

If it's possible for the counterculture to arrive at a computing facility, perhaps the one in Dunham Lab is it. The atmosphere there is so different from the glass-enclosed hostility of most computer centers that the PDP-10 is sometimes called, with justification, "the people's computer." In significant ways, the PDP-10 is run much more informally than computers elsewhere—and significantly cuts costs.

Access to the computer; as well as the terminals, is completely open. A computer is much less mysterious when a beginning student can go in and get his hands on it, but beyond that, open access enables whoever happens to be around—faculty, grad students, or knowledgeable undergrads—to attend to whatever snafus arise. Except for one bursary student on the late-night shift, there are no supervisory personnel. Nevertheless, it's a rare problem that holds up operation for more than a few moments.

Secondly, whereas most computer systems undertake to preserve users' data files on disk storage, a very considerable task, Yale's does not. Most students purchase a pocket-sized reel of magnetic tape called a DECtape, named after the manufacturer, and quickly learn how to save and recopy data from it. Again, students mount the tapes upon the drives themselves—no supervision is necessary, though help is available. Since there are only three DECtape drives to share among up to nine users, the cry, "Will somebody please deassign a DECtape?" frequently rises above the hum of machinery\*. Again, things work themselves out, and the DECtape procedure works so well that Yale's PDP-10 does

not even have a punched-card reader. The snows of wasted data cards are unknown in Dunham Lab.

Finally, most noticeably different at Yale is the nature of the time-sharing terminals. Elsewhere, including the "other" time-sharing system on campus (run by the Computer Center), each terminal is a teletypewriter or equivalent device which devours seemingly endless rolls of paper. Dunham uses cathode ray tube terminals, resembling TV screens with typewriter keyboards attached; CRT's are quieter, more versatile, have fewer moving parts, and are infinitely more fun to use. And eliminating all that paper makes ecological as well as economic good sense. A line printer enables students to take home printed copies of programs.

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\* The command "DEASSIGN" instructs the computer to release a DECtape drive. Ways exist to extract information about which users have assigned the drives, but it's often quicker to bellow.

That the new style is popular seems self-evident. Sign-up sheets fill up instantly upon posting, and even the wee hours of the morning can't be taken for granted—invariably a few night owls are working late. The camaraderie, always present, is strongest late at night, and especially nights before course deadlines, when tired minds battle professor and machine in a race against the dawn. And camaraderie includes help—novices or just anybody who's confused can ask the guy (or gal) at the next terminal for advice, and before all the next terminals are exhausted the answer will be found.

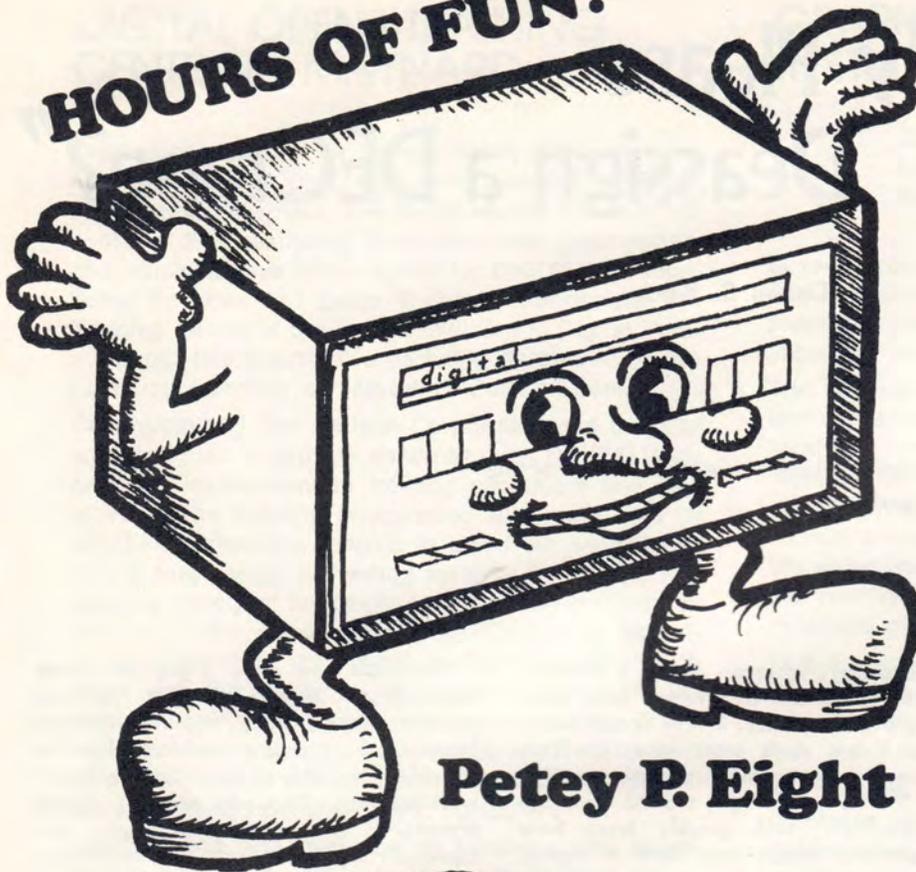
The new style does save money, too. With all the cost-cutting mentioned above, department chairman Peter Wiener reports that the cost of a terminal-hour of computing, offered free to students, is steadily being driven down. "Right now the cost [per terminal-hour] is about \$3.14, and we've proven to our own satisfaction that by adding just a few more terminals we can lower it to \$2.50. . .but our stated goal is to bring it all the way down to \$.25 an hour. At that rate we'd be really cost-effective." A half-million dollar grant from the Alfred P. Sloan Foundation has purchased three new terminals, and will eventually fund an entirely new terminal system, located on another floor in Dunham, that will drastically reduce costs."

In short, computing hasn't ever been this good at Yale.

---

Daniel Koch graduated Yale in January, 1972. An Engineering and Applied Science major, he has been intrigued by computers since high school.

**HOURS OF FUN!**



**Petey P. Eight**

# COMPUTER

Cut out these cute lil' critters along the heavy black line. Color with crayons, water colors, or "Flair-" type pens. Paste on walls, notebooks, IBM machines, etc. Or make a really keen mobile!



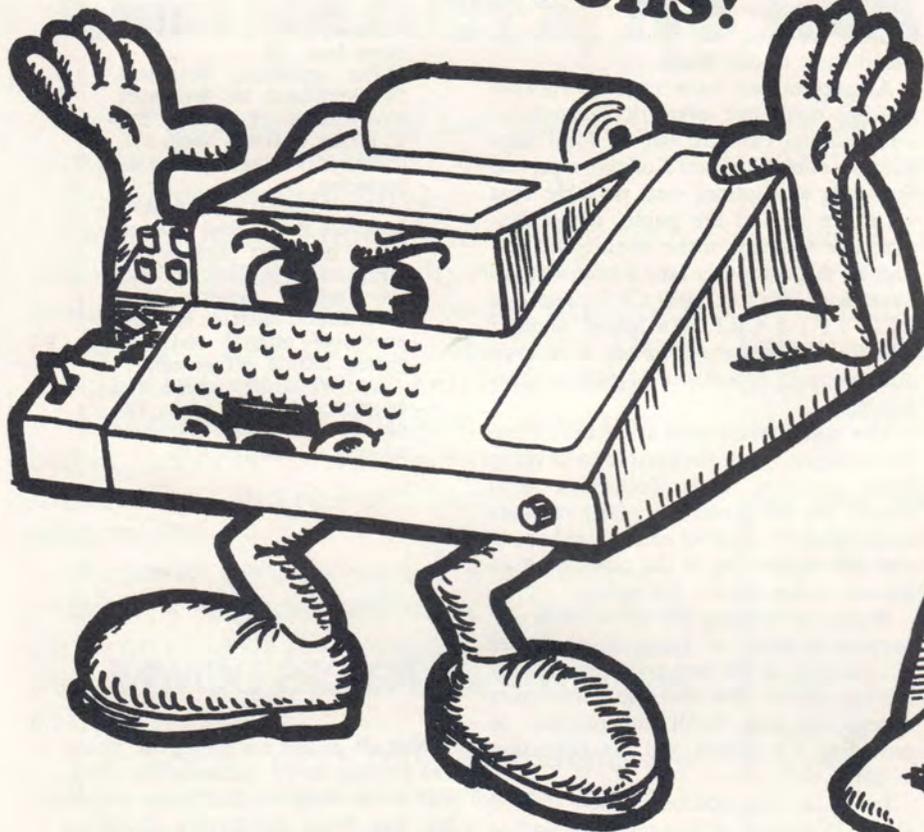
**Dancing Danny  
DECTape**



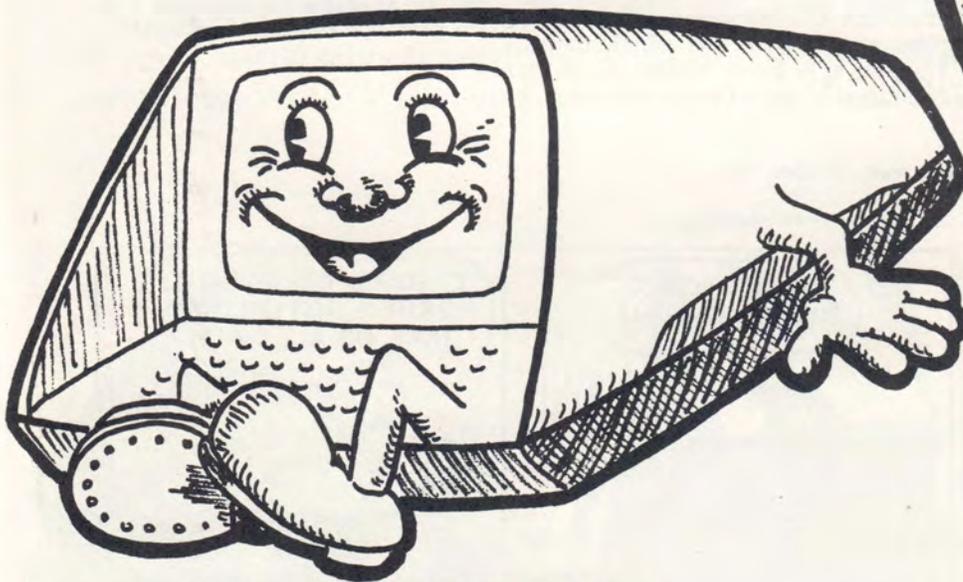
**Freaked-out  
Freddy Flip Chip**

# CRITTERS

**LOADS OF LAUGHS!**



**Terrible Tommy Teletype**

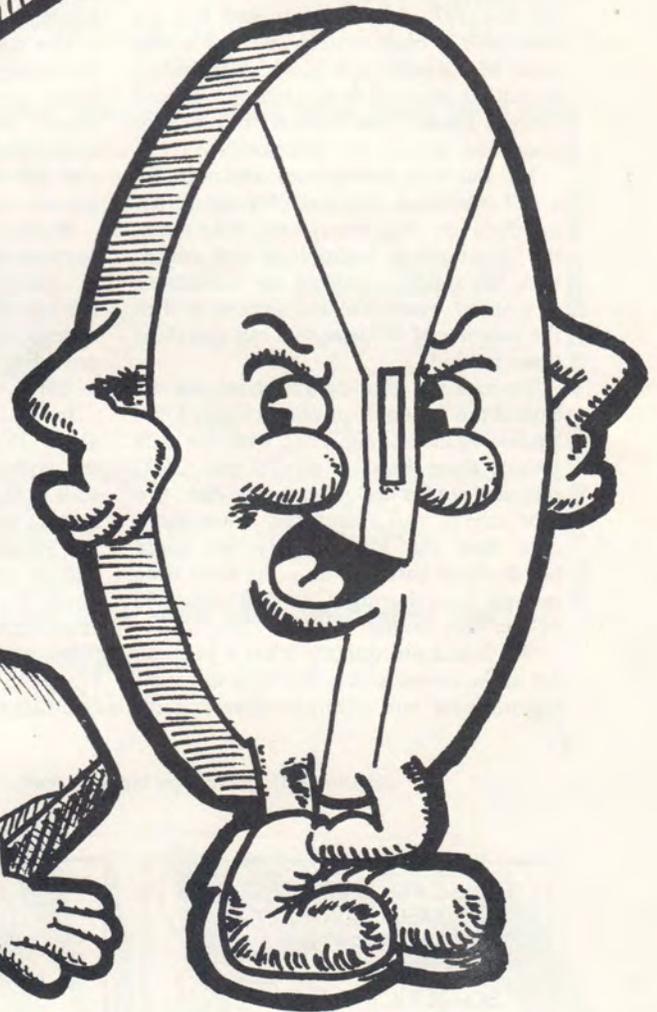


**Vic V.T.O. Five**

**COLLECT 'EM!**

Be sure to collect the whole set (more in future issues of EDU)!

**SWAP 'EM!**



**Devilish Donald Diskpack**

# A Community College That Is Computerizing the Community

By RON LENHART

Yavapai College, a member of the Arizona Community College System, is located in mile-high Prescott. The 3 R's in this area are Ranching, Retirement and Recreation. Living this easygoing life are many far-sighted people. Fortunately, many of them are educators.

The computer program at Yavapai College started in 1969 under the dedicated leadership of William Rinaldi. Without a campus or a computer, he and his classes in programming made the 200-mile round trip to Phoenix each Sunday to use the batch-oriented machine at another college.

Yavapai moved to its new campus during the 1970 fall semester and had an IBM 360/25 batch system installed at this time. Mr. Rinaldi left for work in industry with a program firmly established and Charles Baldwin left industry to return to education as our new director.

Mr. Baldwin, an engineer, and myself—a self-confessed dreamer of great things in education—had many long talks about the directions of technology and education. We quickly realized the limitations of a small batch-oriented system, and in the summer of 1971 we sent out specifications for bids.

To make a long dream short, we accepted the Digital Equipment Corp. DEC System 10 in January, 1972, with one data phone, three local teletypes, one CRT, one card reader and printer, one disk, two tape drives and about ten times more core than the 360/25. Now we could handle local batch mode at the same time we ran time-sharing. Our staff consisted of five very excited people.

We found out quickly what a juggling act in the circus is like. We were developing business and administrative systems

for the college, conducting classes in business data processing, and training any hapless teaching colleagues who wandered close to our doors.

At present, we have on our Yavapai College computer network seven local terminals on campus, two in local high schools, one at Prescott College, a private four-year institution, one portable that we move around the public school system, one teletype in the science lab and four in the computer lab, where we also have two Hazeltine 2000 CRT's and one DEC VTO 5 CRT. We added another disk file to the system, giving us storage and swapping capacity of 52 million characters.

The math department at Arizona State University is using the system to develop some graphics with Tectronics 4010 scopes. We are processing many requests at this time from other educational users, and will be phasing in the other six high schools in the county this year.

We are developing the system with one purpose in mind: to bring the computer to education at the best price possible for the tax payers. We feel the community college can best fulfill this function in providing the system and the education to use it.

In the last ten months we have trained about 35 percent of our teaching staff at the college, over half of our classified staff in the business and registrar's office, and 12 teachers and administrators from the Prescott High School. These people will be training their colleagues and students this fall; in fact, they're our best sales force. Our fall survey class is almost filled with teachers and administrators. It's going to be a very exciting year in the mountains of North Central Arizona. ■

## Hartford Campus Duel Squaring Off With Pie

HARTFORD, Nov. 10 (UPI)—The president of the University of Hartford has accepted a challenge to a duel with a student leader at high noon Monday on the campus. The weapons: custard pies at three feet.

The university president, Dr. Archibald M. Woodruff, will square off against Eric V. Litsky of Great Neck, L. I., chairman of the student association.

Dr. Woodruff said recently how nice it was that students were behaving themselves. Mr. Litsky replied through the school weekly that "frustration must be released every so often," and suggested letting off steam.

Dr. Woodruff agreed and suggested a pie duel. The parties will wear top hats ad opera capes.

## PRICES DOWN!

Not all prices are going up. Some are coming down quite significantly. For some time the computer industry has been drastically dropping prices. Now word comes through that Digital Equipment Corporation is reducing the price of the famous PDP-8 mini computer, found in many industrial applications, by as much as 27 percent. Computers today are available for about one fifth the prices of a dozen years ago.

Reprinted from College Management, October, 1972



# If you don't know who's doing what with educational computers, it's not our fault.

Sure, you realize how fast educational computers have caught on.

But do you realize why?

Do you really understand all that educational computers can do now? Do you realize the effect they have on learning? How much they motivate students? How much help they can give administration?

And do you have any idea of how many public schools, private schools, colleges, universities, and research centers are using computers?

We know because we helped it happen.

We've computerized more schools than anyone else in the business. We've had more experience in educational computers than anyone else.

The fact is, over 1,000,000 students are using our computers every year.

One of the ways we got to be the acknowledged leader was by being helpful. By giving people the kind of information they needed and wanted.

And that's what we're doing here.

We've pulled together a little booklet to tell you what 60 schools are doing with our computers. Write. We'll send you a copy

and a comprehensive information kit.

And when you've read that, let us know what else you want to know.

There's a lot more reading material waiting for you.

The Educational Products Group, Digital Equipment Corporation, Maynard, Mass. 01754. (617) 897-5111, ext. 2149. European headquarters: 81 route de l'Aire, 1211 Geneva 26. Tel.: 42 79 50.

The Educational Products Group  
Digital Equipment Corporation  
Maynard, Massachusetts 01754

Name \_\_\_\_\_

Title \_\_\_\_\_ Phone \_\_\_\_\_

School \_\_\_\_\_ Dept. \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Computer usage now: Applications of interest:

- |   |   |
|---|---|
| <input type="checkbox"/> None               | <input type="checkbox"/> Instruction    |
| <input type="checkbox"/> Timesharing or RJE | <input type="checkbox"/> Administrative |
| <input type="checkbox"/> On-site computer   | <input type="checkbox"/> Research       |
| <input type="checkbox"/> Service bureau     | <input type="checkbox"/> Other          |

**digital**



## FLIP CHIP ORDERS

Remember the ad for flip chips in EDU #5? How they could be used to amaze your friends and other keen things? Well, no one was more amazed than Jenny Beissinger at the overwhelming number of orders! You see, Jenny had to fill them—and what a job she did! Here's a sampling of the orders:

UNIVERSITY OF SOUTH CAROLINA  
Columbia, S. C. 29208  
October 27, 1972

Gentlemen:

I, too, want to amaze my friends and have the girls admire me, so I guess I need a real Flip Chip Module. In fact, since I know four girls, I even need four of them.

Please send them to:

Mr. Brian G. Gordon  
Department of Computer Science  
University of South Carolina  
Columbia, SC 29208

My \$1.00 (cash) is enclosed.

Sincerely,

Brian G. Gordon

32 Wachusett St. Apt. 3  
Worcester, Mass. 01609  
October 31, 1972

Dear Sir;

Upon reading the latest copy of EDU (number 5), your ad for the sale of FLIP CHIP MODULES caught my eye. Now, being a curious person as I am, I said to myself, "Self—what could you do with some Flip Chips, obsolete ones at that?". I thought and I thought and I came up with many ideas. I could use them as book-marks, use them as pieces for my MONOPOLY game and for many other uses. Then I realized I DON'T EVEN KNOW WHAT A FLIP CHIP LOOKS LIKE. It is because of this that I am writing this letter. Enclosed please find the sum of \$1.00, one dollar, to cover the cost of 4, count 'em, 4, obsolete Flip Chip modules at 25¢ each. Please rush them to me as soon as possible as my curiosity is killing me.

Very Truly Yours,

Robert H. Newman

David Dyer  
1HC/URS  
1850 Taft Ave.  
Los Angeles, Calif. 90028

Dear Whoever you are:

I agree that I cannot possibly hope to last much longer without at least two of your marvelous, (obsolete), flip-chips.

I WANT A BIG ONE.

or at least a red one.

Substitutes for the above specifications will be accepted, as long as it's a genuine DEC FLIP-CHIP.

Sincerely yours,

David Dyer

BALDWIN-WALLACE COLLEGE  
Berea, Ohio 44017

Computer Services

November 8, 1972

Gentlemen:

Please rush me by the most convenient method an exciting, educational "FLIP-CHIP MODULE." Enclosed please find two bits (monetary bits that is).

Sincerely,

Stanley J. Cloward  
Director, Computer Services

Enclosure: One two-bit piece

MEMORANDUM  
OCEANSIDE COMPUTER CENTER  
Oceanside High School  
Room 122B

DATE: Nov. 10, 1972

TO: Digital

RE: Flip Chip

My class has taken up a collection and would like one flip-chip.

Thank You,

Carmine Ferraro

Oceanside High School  
Brower & Skillman Aves.  
Oceanside, New York

# EMPLOYEE PERFORMANCE APPRAISAL

## DEGREE of PERFORMANCE

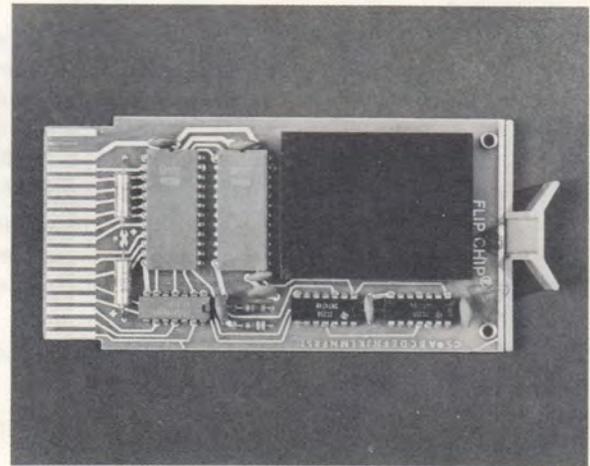
Area of Performance	Far Exceeds Job Requirements	Exceeds Job Requirements	Meets Job Requirements	Needs Improvement	Does Not Meet Minimum Requirements
Quality of Work	Leaps Tall Buildings In A Single Bound	Leaps Tall Buildings With Running Start	Can Leap Short Buildings With Prodding	Bumps Into Buildings	Cannot Recognize Buildings
Promptness	Is Faster Than A Speeding Bullet	Is As Fast As A Speeding Bullet	Would You Believe A Slow Bullet?	Misfires Frequently	Wounds Self When Handling Guns
Adaptability	Walks on Water	Keeps Head Above Water Under Stress	Washes With Water	Drinks Water	Passes Water in Emergencies
Communication	Talks With God	Talks With Angels	Talks to Himself	Argues With Himself	Loses Arguments With Self

## FLIP-CHIP MODULES (GIANT, ECONOMY SIZE)

Start the New Year off on the right foot—by taking advantage of our 1973 Flip Chip Module Special! If you recall, in EDU #5 we offered 25¢ modules; they were gone in a minute. So we did our end-of-year house cleaning and uncovered our current collection. These modules are bigger (but still obsolete). That means *more* integrated circuits, more resistors, more diodes, and *MORE* status!! New, some of these modules were valued at over a hundred dollars each!

Order yours today. A dollar each. Limit 5 to a customer. We ignore orders without money enclosed.

Education Products Group (5-5)  
Digital Equipment Corporation  
Maynard, MA 01754



Flip Chip

**FLASH**

We've gotten a fresh supply  
of 25¢ variety Flip Chips....

What house is complete without a genuine, operating flip chip module. If you haven't gotten a flip chip by now, send for one right away. After you've received it and used it, you will say, "How did I ever get along for such a long time without a Flip Chip?" Flip chips are cram full of resistors, integrated circuits, diodes and capacitors. They're also obsolete. Imagine the surprise on the faces of your friends when in the middle of nowhere you whip out your brand new Flip Chip. Wow! The girls will really admire you when they hear you have a real Flip Chip Module. Twenty-five cents each. Limit 4 to a customer. We ignore orders without money enclosed.

P.S. Flip Chips are worth \$20 to \$150 new!

## MUST READING

"Recommendations Regarding Computers in High School Education," is a report recently prepared, with the support of NSF, by a special committee of the Conference Board of the Mathematical Sciences. The recommendations of the committee deal with the future goals and aims of computing in secondary education. A great deal of emphasis is placed on curriculum development, design of textual materials for use in high school courses, and the effective dissemination of these materials.

A summary of the recommendations, based on the committee's findings, includes:

1. *Computer Literacy Course*—The committee recommends the preparation and periodic revision of a junior high level course in "Computer Literacy." This course should provide students with sufficient information regarding the nature of computers so they can understand the roles computers play in our society.
2. *Computer Literacy Course Materials*—Text materials for the course should be prepared in a manner that facilitates wide and rapid dissemination of information on the availability and feasibility of the course. It is suggested that it be based on the SMSG method of curriculum material development.
3. *Modular Curriculum Materials*—Text materials should be designed in a modular fashion, based on the BASIC language. Materials should be developed for:
  - Introduction to computing (post-literacy course)
  - Mathematics courses
  - Integration of mathematics and computing with other disciplines
  - Simulation modules for business, social studies, and sciences.
4. *Gifted Students*—It is suggested that special programs in computer science be developed for students with unusual aptitudes.
5. *Vocational Education*—A major effort should be aimed at making vocational computer training more generally available and improving the quality of such training.
6. *Teacher Training*—Action should be initiated on the development of a variety of teacher training programs, including courses and summer workshops, for the school teachers and the teachers of teachers of high school computing courses.
7. *Information Dissemination*—A clearing house should be established for the distribution of information about high-school computer education.

Single copies of this report are available on request from:

Conference Board of the Mathematical Sciences  
2100 Pennsylvania Avenue, N.W.  
Suite 834  
Washington, D.C. 20037

Another excellent report no computer resource library should be without is entitled, "The Impact of Computing on the Teaching of Mathematics," by Walter Koetke of Lexington High School, Lexington, Mass. Mr. Koetke lends broad perspective to the trends that have developed in the acquisition of computers by secondary schools and discusses the effects of the computer on classroom teachers and the students that use it. Copies of this report can be obtained by writing to Mr. Koetke directly at 16 De Marco Rd., Sudbury, Mass. 01776.

"All men by nature desire knowledge."

Aristotle

## BOOK REVIEW

*A Guided Tour To Computer Programming in BASIC*, by Thomas A. Dwyer and Michael S. Kaufman

This text is especially designed for secondary school students in grades 7-12. The "tour" covers the development, application, and language features of BASIC in a context that appeals to young people. *A Guided Tour to Computer Programming in BASIC* is largely a self-teaching text that approaches BASIC through games and simulations, and moves gradually to more complex problems.

*What is a Computer?* by Marion J. Ball

This book is a preface to the entire "world" of computers, for intermediate grades and junior high school students. The story of computers is presented in an informal style; its clear presentation removes the mystery of the machine as it introduces basic concepts to those without previous computer knowledge. Packed full of excellent illustrations, *What is a Computer?* is ideal for schools with or without a computer resource.

Both *A Guided Tour to Computer Programming In BASIC* and *What is a Computer?* can be obtained by writing to:

Houghton Mifflin Company  
110 Tremont Street  
Boston, MA 02107

*Computer Applications for Calculus* by William S. Dorn, Gary G. Bitter, David L. Hector

A text written to augment traditional calculus courses, *Computer Applications For Calculus* deals with a variety of conventional calculus topics. Designed for use in conjunction with a standard text, this book emphasizes computer applications and presents problems and solutions in both BASIC and FORTRAN languages. The text contains a variety of sample programs, exercises, and a cross-reference topical matrix for fifteen of the most widely used calculus texts.

Prindle, Weber & Schmidt, Inc.  
53 State Street  
Boston, MA 02109

## FILM FESTIVAL

There has been an overwhelming response to the announcement of the Educational Film Loan Library that appeared in EDU #5. Due to the numerous requests we have received over the last few weeks, we ask that you be patient while we service the long line that's formed at the box office. Don't think we've forgotten you!!

Those educators who plan to use the films in presentations or lectures, please note the following time corrections:

Project Solo 28 minutes  
My Computer Understands Me 20 minutes

Please let us know your opinions concerning the films that you borrow . . . and if you have a "film favorite" you'd like us to offer, pass the information on to us!

## SIMULATION GUIDE

The second edition of *The Guide to Simulations/Games for Education and Training* by David W. Zuckerman and Robert E. Horn is due off the press in January, with descriptions of over 600 simulations and games. This represents an increase of over 50% in the commercially available material in the field since the first edition of the guide appeared in 1970.

Descriptions of the more important and widely used games reportedly will be up to twice as long as those in the previous edition. The book will also contain new chapters on "How to Get into Simulation Gaming" (written primarily for the first-time simulation user), "How to Help Students Make Their Own Simulations," and a completely updated version of "A Basic Reference Shelf on Simulation and Gaming," by Paul A. Twelker and Ken Layden.

The price of the new guide will be the same as that of the first edition, \$15.

The guide is available from Information Resources, P.O. Box 417, Lexington, Mass. 02173.

## SIMULATION/GAMING/NEWS

An informative newspaper dealing exclusively with simulations, models, and games, computer and otherwise, comes out 5 times per year. S/G/N has all sorts of good stuff for those interested in simulations and games, ranging from simple "parlor" educational games to complex, sophisticated computer simulations. The November, 1972 issue had a feature on "Games Computers Play" about Bob Albrecht, Leroy Finkel and the People's Computer Company (who, incidentally, use a DIGITAL EduSystem 20).

Want a subscription? \$4 for 5 issues (check only, no purchase orders) to:

Don Coombs  
Simulation/Gaming/News  
Box 8899  
Stanford, California 94305

Be sure to mention EDU!

## THE WAITING GAME

You're waiting for the day that the school officials give the OK on the computer budget???

Well, here's something to help you and your anxious classes pass the time profitably and productively. It's called CARDIAC.

CARDIAC isn't new—it's been around since 1968. Maybe you're already using it to teach your students about computers and how they work. If you're not—CARDIAC (an acronym for CARDbOARD Illustrative Aid to Computation) is an excellent teaching aid that you shouldn't live without for another day.

CARDIAC includes a cardboard computer and a teaching manual packed full of fun learning exercises. Topics like looping, arithmetic operations, subroutines, and programs are discussed in a step-by-step manner that will involve students for hours.

Get yours today from Bell Laboratories. CARDIAC only costs \$2.50 (yes!) and it's worth every penny. And, by the way, even if you're not waiting for your EduSystem, CARDIAC is ideal as a preview to computer science course work. Try one and see!



Pollution is UGLY.

## POLLUTION

Program POLUT, a simulation module produced by the Huntington Two Computer Project indicates some of the nasty things pollution can do to lakes and rivers. (Get your copy free from DIGITAL.)

DIGITAL is doing its part to keep Massachusetts air and rivers clean. Is there much you and your family can do to help reduce pollution? YES; there are many small steps that all add up. A handy checklist, "71 Things You Can Do to Stop Pollution," can be obtained free by sending a business-size envelope, stamped and self-addressed to:

Keep America Beautiful  
99 Park Avenue  
New York, NY 10016

## MATH SHOP

Creative Publications of Palo Alto, California, produces a wide variety of economical mathematics laboratory materials, including texts and workbooks, games and puzzles, and posters to brighten every math resource center or classroom!

Some of these texts and workbooks lend themselves nicely to computer solution; they are packed full of ideas for computer math classes, extra projects, and even teacher workshops!

*Eureka* by Dale Seymour and Dick Gidley.

A unique math enrichment publication containing 128 pages of challenging problems that cover a wide range of topics. Designed to appeal to students from 7-12 grade levels, *Eureka* provides a contemporary approach to traditional mathematics topics. Complete with teacher's solution guide—\$4.50.

*Aftermath Series* by Dale Seymour and Mary Laycock.

A set of four books designed to reinforce the regular curriculum, as well as to introduce new aspects of mathematics. Emphasis is placed on teaching students to solve problems creatively. The series consists of four books for grades 5-9, is largely self-explanatory and contains a variety of puzzles, games, and codes that make students eager to learn! Each booklet has its own answer section.—\$3.50/book; \$12.00/series.

*Number Sentence Games* by Dale Seymour, Margaret Holler, and Nancy Collins.

Designed for use with grades 4-10, this 64-page booklet gives students extensive practice in fundamental operations and number combinations in a game-like approach. The problems vary in difficulty and can be used quite effectively for teaching the order of arithmetic operations and expression evaluation in BASIC. This book is ideal for use in the computer lab in conjunction with BASIC language courses. Solutions to the problems contained in this volume—\$2.50.

*Mathematics Contest Problems* by Brother Alfred Brousseau.

This book is a selection of problems from the problem solving contest held every spring at St. Mary's College, Moraga, California. It contains two levels of problems (grades 7-9 and 10-12) that vary in difficulty and cover a wide range of familiar topics in mathematics. *Mathematics Contest Problems* is suitable as a resource guide for secondary school mathematics and provides considerable "ammunition" for computer problem solving. Solutions included—\$3.50.

All of these creative publications materials and a free catalog describing other laboratory materials can be obtained from:

MATH SHOP  
5 Bridge Street, Box 153  
Watertown, Massachusetts 02172

Tell them EDU sent you.

## DESCHOOL PRIMER

How's that again?

If you've been wondering what happened to all the teachers of the world who, instead of rote facts, started to bring their classes reality and experience from The Whole Earth Catalog, well, we've found them. Or at least their contributions and ideas. They're now contained in a "newsbook" collection of inventive games, lesson plans, and learning experiences for use in and out of school. It's called the DESCHOOL PRIMER #4. Cost \$1.50 per copy. While you're at it, ask for the Sunflower Source, a catalog of toys and learning resources (free).

Mention EDU when you write to:

Ron Jones  
1201 Stanyan  
San Francisco, California 94117

## YELLOW PAGES OF LEARNING RESOURCES

The Yellow Pages of Learning Resources is available for \$1.95 from MIT Press, Massachusetts Institute of Technology, Cambridge, Massachusetts 02142. Imitating the Yellow Pages phone book, this book consists of about 70 alphabetical categories (airport, bricklayer, hospital, junk yard, TV station, tree stump, ward leader, etc) and tells how the various people, places, and things found in any city or town can be used as valuable learning resources.

## SCROUNGE WAREHOUSE

Project RECYCLE makes all kinds of industrial by-products available for educational and recreational needs. For \$2 anyone can go to RECYCLE and fill a grocery bag with materials (rubber in various shapes and sizes, leather, wood, plastic, paper, styrofoam, etc). Classroom teachers pay \$1 per child in their classes, which entitles them to come as often as they wish and take as much of the materials as they want throughout one school year.

RECYCLE is located at the Children's Museum, the Jamaica Way, Boston, Massachusetts 02130. A booklet called "Recycle Notes" describes things that can be done with recycled material and is available for 75 cents from the museum.

"The great end of life is not knowledge but action."  
Thomas H. Huxley

## NEW HUNTINGTON MATERIALS

In EDU #5 we announced that DIGITAL had been awarded the exclusive publishing rights for The Huntington II Computer Project materials. We are happy to announce that the following simulation packages are now ready for distribution. Each package is \$2.10 for one each of Student Workbook, Teacher's Guide, Resource Handbook and Paper Tape. To obtain the Huntington Computer Project Brochure and order form, write today to the Education Products Group (5-5), Digital Equipment Corporation, Maynard, Massachusetts, 01754.

### Biology:

- GENE 1:** Simulates the inheritance of genetic traits.
- LOCKEY:** Studies the lock and key model of enzyme action.
- POLUT:** Simulates the pollution of a lake, river or pond from various types of waste.
- STERL:** Investigates the effectiveness of insect control by means of male sterilization and pesticides:

### Physics:

- CHARGE:** Determines electron charge by simulating Millikan's oil-drop experiment.
- SLITS:** Young's double slit experiment, showing light interference patterns.

### Social Studies:

- MARKET:** Game engaging two companies in one-product competition.
- POLICY:** As members of various pressure groups, student formulate national policy.
- POLSYS:** As various community members, students influence city government policy.

## DARTMOUTH SOFTWARE

A new corporation, DTSS, Inc., has been formed to license the use of Dartmouth Time-Sharing System software to other computer centers. Each computing installation licensed to use the system will also receive a copy of the hundreds of programs stored in the main public program library.

For information, write to:

Robert F. Hargraves, Jr.  
DTSS, Inc.  
Box 799  
Hanover, New Hampshire 03755

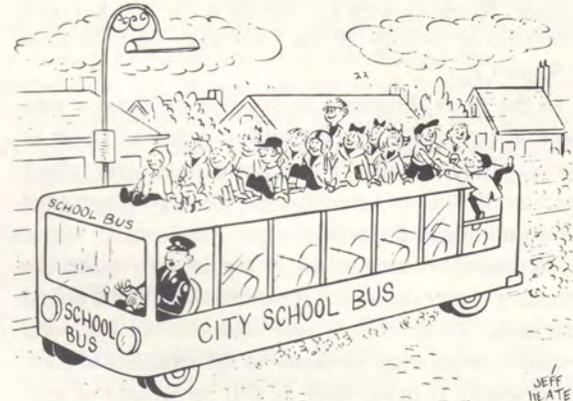
Or call (603) 643-4672. Be sure to mention EDU.

## EDU HANDBOOK

It's new. We put it all together. Everything there is to know about all the PDP-8-based EduSystems . . . in one big handbook!

The first chapter is a BASIC Self-teaching Primer. The remaining sections are dedicated to the software, hardware, and operational features of EduSystem 5 to 50.

It's a book of knowledge. Get your copy today. Only \$5; quantity discounts apply. Use the order form on the back page of this issue.



"Well, I'm glad to see that **ONE** day out of the year you kids can stop all that screaming and jumping around and behave like ladies and gentlemen"

MODERN DATA/September 1972

## PEOPLE'S COMPUTER COMPANY

A new concept of computing is spreading, namely, bringing real, live, interactive computing to the masses. Helping this revolutionary idea to spread, i.e., using computers for people and not against them, are Bob Albrecht and Leroy Finkel of the People's Computer Company.

PCC, an open computer workshop in Menlo Park, California, has kids (and adults) in it nearly 24 hours a day, 7 days a week "playing" games with a DIGITAL EduSystem 20. Number games, guessing games, simulations, moon landings, king of Sumeria, and all kinds of mind-expanding games are on tap at PCC. Or, best of all is when kids decide to write their own games—the enthusiasm has to be seen to be believed!!

PCC also puts out a contemporary newsletter called, appropriately enough, "People's Computer Company." Subscriptions are \$4 (check or money order) for 5 issues to:

Bob Albrecht  
DYMAX  
P. O. Box 310  
Menlo Park, California 94025

Be sure to mention EDU!

# Computer Would Model Nerve System

A computer model of a nerve system is being developed at Carnegie-Mellon. The project is funded by a \$176,200 grant from the National Science Foundation. Through construction of such a computer simulation, scientists hope to find out more about the correlation between the nerve cell structure and function.

Principal investigator for the project at CMU is Dr. D. R. Reddy, associate professor of computer science. Working with Dr. Reddy is Dr. W. J. Davis, professor of biology at the University of California at Santa Cruz.

In the study, Professor Reddy will construct a geometrical representation of a lobster ganglion (a set of nerve cells), specifically the ganglion system which operates the lobster's swimmerets, the appendages used for swimming and carrying eggs.

Computer reconstruction is required to make the necessary comparisons and measurements on the neural structures. To do this, a very sophisticated computer system incorporating elements on the frontiers of computer science is being used. It will be capable of constructing a three-dimensional model of a nerve system from photographs of sections, transforming the model into a two-dimensional graphical display with perspective, and permitting manipulation of the graphical image so that it can be studied from any viewpoint, enlarged, or reduced.



Dr. Reddy

Professor Reddy has done extensive work with visual and voice input to computers at Stanford and Carnegie-Mellon.

"Despite some of the sensational stories which have appeared about computers and robots replacing human beings," says Dr. Reddy, "we are a long way from any such possibility. In fact, in recent years we have begun to realize how little we know and how much more work needs to be done before we can even begin to construct computers or robots which might perform any but the most simple functions comparable to the human brain."

Dr. Reddy notes: "In effect we're working with a mini-brain, or a limited neural system. Lobsters have

various systems of nerve cells which perform limited functions."

Lobsters are being used for the study because the swimmeret system is one of the best understood small systems of nerve cells, a result of several years of intensive investigation. Dr. Davis has been one of the foremost researchers in these studies.

The study ultimately aims to provide "the most complete functional and structural understanding yet available of the neuronal control of a specific, relatively complex act of overt animal behavior." Techniques developed in the study are expected to be directly usable in the analysis of other invertebrate nervous systems, and ultimately to the analysis of any restricted neural network.

Reprinted from Carnegie Alumni News, December 1972.

## FURTWAGEN PURCHASES DECSYSTEM-10

MAYNARD, Mass.—The University of Furtwangen, Germany has purchased a large-scale DECSYSTEM-1040 computer from Digital Equipment Corporation.

Slated for academic and research work by the students and faculty, the DECSYSTEM 1040 will run up to 30 separate programs simultaneously from remote terminals located throughout the Furtwangen campus. The university also plans to provide computing power to other schools and colleges in the area via time-shared terminals over telephone lines.

This will be the tenth DECSYSTEM-10 computer system to be delivered by Digital Equipment Corporation to German universities. Other installations include Kiel University, University of Heidelberg, and University of Bonn.



*"Gee! my first computer date!  
I wonder what he'll be like?"*

MODERN DATA/September 1972

## ON GOOD TEACHERS, COMPUTERS AND ALL THAT JAZZ

At the NCTM convention in Knoxville a seventh grade math teacher came up to the DIGITAL booth and said, "What can the computer do in class better than I can?" A few minutes conversation revealed that here, indeed, was a very good teacher. She employed methods and hints from "The Math Teacher," used supplemental manipulative materials, and devoted a great deal of out-of-class time in preparation. So what can a computer really do for the teacher who could take his or her students outside on a rainy day and teach them, using no more than a charred stick and stone tablet?

Well, the truth is, that besides being an untiring source of extraordinary motivation, there's not much the computer can do. BUT WAIT! An *untiring* helper, not a set of attribute blocks or number sentence games that require the attention and guidance of the teacher! And *motivation* beyond compare! Kids clamoring to stay after school! Kids bounding ahead so they can get to the next challenge on the computer! Kids getting a sense of self-fulfillment that they never knew before the computer came into the classroom.

In Knoxville, the student pages converged on the DIGITAL booth whenever they were off duty. A group came over while the hesitant seventh grade teacher was there. It didn't take long before hesitation turned into enthusiastic acceptance. The kids are so turned on to computers, even slow learners, that good teachers can see their potential immediately.

Interestingly enough the same does not apply to dull, disinterested teachers—to them the computer is a threat. They feel that the kids will learn about something that they themselves (the teachers) don't understand. But so what? Seeing the kids master the computer, learning the joy of posing a challenge for themselves, and then meeting it, ought to be what teaching is all about. To the good teacher, yes; to the bad teacher, no.

Hence, we have the ironic situation in that schools with good teachers and administrators are getting computers and further improving the quality of their education, thereby widening the educational gap between these schools and those without good teachers and without computers. No easy solution to this dilemma exists. We're looking all the time. Ideas from our readers are welcome!



Computers Are For Kids.

## ATTENTION HOME ECONOMISTS

We're not sure all you beady-eyed computer bums caught the latest issue (November 1972) of the Journal of Home Economics. If not, you missed an interesting 6-page article, "Computer Use in Home Economics," by Francis Magrabi.

It described the possibilities of using the computer in Home Ec, as discussed at the 1972 annual meeting of the American Home Economics Association at Michigan State University.

In addition to discussing fundamental concepts of computer usage—tutorial, problem-solving, simulations—workshop participants were introduced to:

GROCR: A nutritional weekly food buying program for a family with varying food needs and budgets.

Budgeting for Retired Living: An interactive program that allows clients to sit down at a computer terminal and plan for retirement.

Teacher Education: Tutorial programs on the techniques of questioning (at the knowledge level), and other classroom techniques.

Child Development: A program to assess a student's underlying values and feelings in the area of family planning. Another program surveys attitudes on social, psychological, and cultural aspects of aging and gives the respondent instant feedback on how others answered the questions.

Textiles and Clothing: A program related to American Indian dress. Another answers questions about stain removal and new fibers and fabric finishes.

## SATURDAY REVIEW—EDUCATION

*Saturday Review* now publishes a family of four monthly magazines—*The Arts*, *The Society*, *Science*, and *Education*. For subscription information, write *Saturday Review*, Box 2043, Rock Island, Ill. 61207. Charter subscriptions to *Education* are available at \$6.00/year. *SR Education* got off to kind of a slow start and tended to have a super-liberal orientation. Of late it has moderated ever so slightly and, in fact, carried two great articles in the January 1973 issue.

"Learning Fair," by Susan Sands, described an open two-day free school at the Peninsula School in Menlo Park, California. Fifteen workshops and forty events. Mobile Solar Sculpture, People's Computer Center, Tree Loom, the Alexander Technique. Loosening people up so they recognize all conceivable forms of learning—emotional, physical, intellectual, and mystical.

"The Game Game," by James Fixx, described the history of games, gamers and gamesmen. The article contains an insight into the philosophy of Marvin Glass, one of the world's top game designers and Eddie Parker, president of Parker Brothers, who believes "the real fun of a game is what goes on off the board. Half the game is interactions between players as they try to wipe each other out. People like to clobber their best friends without doing any damage."

Articles about open college admissions at CCNY and the future of the OE after funding is cranked down round out the issue. Get it!

## MUSIC TO YOUR EARS

Reprinted below are some excerpts from a letter written to DECUS:

"Recently, while doing some late-night assembly in the Belmont Hill Computer Center I decided to switch on the radio to take some of the drudgery out of my task. However, it was almost impossible to hear the broadcast. Acting upon a hunch, I shut the system down to see what effect it would have. The interference cleared up right away. Intrigued, I tried a few experiments. The closer the radio was placed to the computer, the louder and more pronounced the interference got. It was clearer on certain frequencies also. Once, I even got a clear, almost musical tone. I tried certain combinations of instructions at different places in core, and each time the tone was different. The possibilities for tones are literally endless. Different combinations of instructions yield different tones.

I loaded FOCLX, 1972. In its idle state, FOCLX produced a low, unpleasant tone. But, when computing, such as in a FOR loop, the tone became higher and clearer. After considerable trial and error, I hit upon the fact that the longer the line of FOCLX coding to be interpreted, the lower the tone. Acting upon this, and a desire to keep the tone constant, I discovered that lines such as:

```
1.1 F I=1,Z; CCCCCCCCCCCCCCCCCCCCCCCCCCCCCC  
1.2 F I=1,Z; CCCCCCCCCCCCCCCCCCCCCCCCCC
```

produced different tones. Using such a program, but with 8 lines, it was possible to eventually develop a rudimentary scale. By varying the value of Z it was possible to lengthen or shorten the duration of the notes. Thus, it was possible to actually "compose" a song. Although the tones are quite "blah" I am certain that it is possible to improve upon them. Indeed, replacing the "C"s in the above program with "T"s yields a more pleasant sounding tone. User experiment is encouraged.

I discovered that a frequency of about 1525 on the AM band produces perhaps the clearest tone.

Robert L. T. Cronin, Belmont Hill School, Belmont, MA"

"With regard to excellence, it is not enough to know, but we must try to have and use it."

*Aristotle*

## COMPUT-A-DITTO

The days of typewritten and hand-made ditto sheets are over! Does that make you readers happy? Just think, now when you need classroom quantities of computer programs for discussion or tests, etc, etc . . . you can comput-a-ditto! Brother Paul Scheiter of De La Salle College in the Philippines submitted the idea to us—all you have to do is remove the regular paper from your teletype, insert the ditto stencil in its place, list and run a program, and reproduce it in quantities for all your students.

## PROBLEM

You know those terrible arithmetic problems about how many peaches some people buy and so forth? Well, here's one we like, made up by a third-grader who was asked to think up a problem similar to the ones in his book: "My father is forty-four years old. My dog is eight. If my dog was a human being, he would be fifty-six years old. How old would my father be if he was a dog? How old would my father plus my dog be if they were both human beings?"

FANTASIA MATHEMATICA

## PROGRAMMING APTITUDE TEST ANSWERS

### Evaluation of Responses

Number Right	Interpretation
30	You cheated.
25-29	Aptitude of the highest caliber. You could be president of IBM.
20-24	Excellent—capable of managing a full unit-record installation.
15-19	Good—possibilities as a systems analyst or computer circuit designer.
10-14	Have you thought about collecting unemployment benefits?
5-9	Menial tasks or teaching duties.
0-4	Would probably make a good administrator.

### Answers to MEDPA Programming Aptitude Test

1. One (no AM or PM on the alarm clock)
2. Yes (and a 5th and a 6th etc.)
3. He is still alive.
4. One.
5. The match.
6. All of them.
7. One hour. (one at 8, one at 8:30, one at 9)
8. White (this house can only be built at the north pole)
9. Halfway (after that he is running out of the woods)
10. 9/6.
11. A half-dollar and a nickel ("one is not a nickel," the other one is)
12. 9.
13. 70.
14. Two apples.
15. No (how would the minter know it was 46 years before the birth of Christ)
16. The beggar is the woman's sister.
17. Moses didn't, Noah did.
18. Hardly (if it's his widow's sister, he must be dead)
19. Misspelled (what word is word, what word is test, etc.)
20. Smoke from an electric locomotive?
21. Never (as the tide rises, so does the boat, and so does the ladder attached to the boat)
22. Three (only possible combinations are 3W, 2W/1B, 1W/2B, 3B, each combination guarantees a pair)
23. A mama bull?
24. United States of America.
25. 50.
26. You threw it straight up.
27. Same number on each side.
28. One.
29. None.
30. Bury the survivors?

(Editor's Note: If you did not do well, don't be discouraged. Spring this on someone else and revel in telling them the answers.)

## ROLLING STONE

Yes, indeed friends, the December 7, 1972, issue of Rolling Stone had a delightful 8-page feature article about computers entitled "Spacewar." The title, of course, refers to one of the more popular mind-growing computer games. In the article, Stewart Brand notes that, "Spacewar is low-rent . . . but pervasive." Alan Kay: "The game of Spacewar blossoms spontaneously wherever there is a graphics display connected to a computer."

"The first opportunity was at the Massachusetts Institute of Technology (MIT) Electrical Engineering Department back in 1961-1962. The earliest minicomputer, Digital Equipment Corporation's PDP-1, was installed in the kludge room with a cathode-ray-tube display hooked on. ("Kludge"—any lash-up, often involving chewing gum, paper clips, scotch tape; it works if no one trips over a wire; unadaptable; a working mess.) There it was that Steve Russell and his fellow hackers Alan Kotok, Peter Samson, and Dan Edwards introduced Spacewar to the world.

I phoned Russell at the sprawling old fabric mill in Maynard, Massachusetts, where Digital Equipment Corporation manufactures the most popular research and education computers on the market. Russell currently is a researcher for them, working on man-machine interface problems—adapting computer nature to fit human nature. Back in 1962 he was a hacker, 23 or so, a math major two years out of Dartmouth working in the brand new field of computer science for John McCarthy at MIT."

And so it goes, describing the origin of Spacewar, who plays it, and how it and other games foster creativity and originality.

"Spacewar serves Earthpeace. So does any funky playing with computers or any computer-pursuit of your own peculiar goals, and especially any use of computers to offset other computers."

"The hackers made Spacewar, not the planners."

"When computers become available to everybody, the hackers take over. We are all Computer Bums, all more empowered as individuals and as cooperators. That might enhance things . . . like the richness and rigor of spontaneous creation and of human interaction . . . of sentient interaction."

The article concludes with a piece on "Access to Computers" and notes that the best school computers come from DIGITAL and (beep). About DIGITAL: "They have a qualified educational staff, they're developing new stuff, they've got credibility."

JOIN

# SHAFT

Society to Help Abolish Fortran Teaching

## KIDS CONTEST

Hey kids! Here's your chance to be published authors and cash in on some fine prizes at the same time!

We're looking for lots of BASIC programs. Little ones, big ones, simple or complex ones. Programs for CAI, drill, and practice; programs that solve problems, or simulate games or real-life situations. All flavors and sizes are welcome. In any quantity. For elementary, secondary, or college level!! In any subject area like:

Mathematics (Algebra, Geometry, Trig, Mathematical Analysis, Calculus)

Science (Biology, Chemistry, Physics)

Business

Social Studies

Humanities

Games

Here is all you do. For each program you'd like to enter, send us an *original listing* (made with a decent ribbon!), a sample run, a paper tape copy, and a one or two paragraph description of what your program is designed to do.

We'll *publish* the best ones. Of course *you'll* get full credit for authorship. We'll also submit them to the DECUS Educational Program Library. The top five entries will also receive a grab bag of terrific prizes.

The winning programs will be chosen for originality of approach and educational value. Tell your teachers about our contest. We'll accept entries from the big kids, too!



## CHALLENGE FOR THE MONTH

Parents are those important people that we often neglect. We realized recently that we've been giving a great deal of ink to teachers, students, and computer ideas. But what about parents? We think they deserve to be truly involved in the educational process, and not just the open school nights and PTA. So we propose, as the challenge for this month that you get together and "TEACH A PARENT HOW TO PROGRAM."

How about sponsoring a visiting day . . . show your parents what a computer can do for learning. Show them what you can do with an EduSystem. Then set them loose. Watch them go. Teach your parent what it means to have a teacher *and* a computer in your classroom.

# calculating with the computer

EduSystems 5 and 10 may be used to perform calculations of almost any complexity. The user types in the algebraic expression whose value is to be calculated, the computer types back the value. For example:

```
:2+7-4
5
```

This command tells the computer to calculate the value of the expression and then print it out. Whenever the computer is to print out the results of calculations, this command must be used. It may be typed using either a colon (:) or the word PRINT, followed by the desired expression. For example:

```
:2+7-4
5
or
PRINT :2+7-4
5
```

Expressions may be made up of any decimal numbers and the five regular algebraic operations: addition, subtraction, multiplication, division, and exponentiation. Multiplication is indicated by an asterisk (\*), division by a slash (/), and exponentiation by an up-arrow ( $\uparrow$ ). Numbers may have up to seven significant digits. Additional digits are ignored by the computer. The following examples show the use of various expressions.

```
:3.14159*4 $\uparrow$ 2          Area of a circle of radius 4
50.26544
```

```
:17/12                  Approximation of  $\sqrt{2}$ 
1.416667
```

The computer always types answers in decimal form. If the answer is too big or too small to be typed in its normal form, it is typed in scientific notation; the number followed by the power of 10 by which it should be multiplied.

```
:8 $\uparrow$ 8
1.677722E+07
:1/8 $\uparrow$ 8
5.960464E-08
```

As expressions become more complex, the order in which they are evaluated becomes important. To prevent confusion, the computer always evaluates according to a fixed formula. Exponentiation is done first, then multiplication and division, then addition and subtraction. Operations of equal priority are performed from left to right. Thus,  $1/8\uparrow 8$  is evaluated as one over 8 to the eighth, not one-eighth raised to the 8th power. But  $1/2*3$  is evaluated as one-half times three, not one over the quantity two times three. Parentheses may and should be used to indicate the desired order of evaluation. Operations within parentheses are always performed first. For example:

```
:5/9*(98.6-32)      Convert 98.6 to Centigrade
37
```

Standard functions may also be used in calculations. Functions are indicated by typing the three letter name of the function, then the argument enclosed in parentheses. The value of the function is the result of applying the function to the specified argument. For example, the value of SQR(9) is 3, the square root of 9. The functions which may be used are:

SQR	Square root
SIN	Sine—argument in radians
COS	Cosine—argument in radians
TAN	Tangent—argument in radians
ATN	Arctangent—argument in radians
EXP	Exponential
LOG	Natural log
ABS	Absolute value
INT	Integer part
SGN	Sign
RND	Random numbers

Functions may be used anywhere within an expression. The argument of the function may itself be an expression as in the examples below.

```
:(-5+SQR(5 $\uparrow$ 2-4*2(-12)))/(2*2)
1.5          A solution of  $f(x)=2x+5x-12$ 
:SQR(5 $\uparrow$ 2+7 $\uparrow$ 2)      Length of hypotenuse when
8.602325          sides are 5 and 7
```

Most of the functions listed above are familiar from algebra and trigonometry. The others are unique to computer language. The integer function (INT) is used to convert a decimal number to an integer. The INT function produces the greatest integer which is less than the argument. The SGN function is used to determine the sign of a number. The value of the function is 1 if the argument is positive, -1 if it is negative, zero if it is zero. RND is used to obtain a random number between zero and one. Each time it is used, RND returns a different number. Thus, the value of the RND function is in no way dependent on its argument. It must, however, always have an argument when it is called. This "dummy argument" is required by the BASIC language.

# PROGRAM OF THE MONTH—GUNNER

This program simulates firing a field artillery weapon. The projectile has two forces acting on it, gravity (constant downward) and the explosive force (constant in the direction of travel). Maximum range is obtainable with a firing angle of 45°; firing angles greater or less than 45° yield shorter ranges. To destroy the target,

the firing angle must be correct within 0.2°. You get five chances to destroy the target; after that, it destroys you. Program submitted by Oregon Museum of Science and Industry (author unknown) and modified by David Ahl of DIGITAL.

LIST

```
90 RANDOMIZE \ PRINT
100 PRINT"THIS PDP-8 COMPUTER DEMONSTRATION SIMULATES THE"
110 PRINT"RESULTS OF FIRING A FIELD ARTILLERY WEAPON."
120 PRINT
130 PRINT"YOU ARE THE OFFICER-IN-CHARGE, GIVING ORDERS TO THE GUN"
140 PRINT"CREW, TELLING THEM THE DEGREES OF ELEVATION YOU ESTIMATE"
150 PRINT"WILL PLACE THE PROJECTILE ON TARGET. A HIT WITHIN 100 YARDS"

160 PRINT "OF THE TARGET WILL DESTROY IT. TAKE MORE THAN 5 SHOTS."
170 PRINT "AND THE ENEMY WILL DESTROY YOU!"\PRINT
180 PRINT"MAXIMUM RANGE OF YOUR GUN IS 46500 YARDS."
185 Z=0
190 PRINT
195 S1=0
200 T=43000-30000*RNDC(0)
210 S=0
220 GO TO 370
230 PRINT"MINIMUM ELEVATION OF GUN IS ONE DEGREE."
240 GO TO 390
250 PRINT"MAXIMUM ELEVATION OF GUN IS 89 DEGREES."
260 GO TO 390
270 PRINT"OVER TARGET BY";ABS(E);"YARDS."
280 GO TO 390
290 PRINT "SHORT OF TARGET BY";ABS(E);"YARDS."
300 GO TO 390
310 GO TO 320
320 PRINT"***TARGET DESTROYED*** ";S;"ROUNDS OF AMMUNITION EXPENDED"
322 GOSUB 600
325 S1=S1+S
330 IF Z=4 THEN 490
340 Z=Z+1
345 PRINT\PRINT
350 PRINT "THE FORWARD OBSERVER HAS SIGHTED MORE ENEMY ACTIVITY."
360 GO TO 200
370 PRINT "      DISTANCE TO THE TARGET IS";INT(T);"YARDS....."
390 PRINT
400 PRINT"ELEVATION:";
410 INPUT B
420 IF B>89 THEN 250
430 IF B<1 THEN 230
440 S=S+1
442 IF S<6 THEN 450
444 PRINT\PRINT "ROOM !!! YOU HAVE JUST BEEN DESTROYED ";
445 GOSUB 600
446 PRINT "BY THE ENEMY"\PRINT\PRINT\GOTO 495
450 B2=2*B/57.3 \ I=46500*SIN(B2) \ X=T-I \ E=INT(X)
460 IF ABS(E)<100 THEN 310
470 IF E>100 THEN 290
480 IF E<-100 THEN 270
490 PRINT\PRINT\PRINT "TOTAL ROUNDS EXPENDED WERE";S1
491 IF S1>15 THEN 495\PRINT "NICE SHOOTING !!!"\GOSUB 600\GOTO 500
495 PRINT "BETTER GO BACK TO FORT SILL FOR REFRESHER TRAINING!"
500 PRINT\PRINT "THANK YOU FOR PLAYING!"
505 PRINT\PRINT "TRY AGAIN....."\PRINT\GOTO 180
600 FOR N=1 TO 10\PRINT CHR$(7);\NEXT N
610 RETURN
999 END
```

RUN

THIS PDP-8 COMPUTER DEMONSTRATION SIMULATES THE RESULTS OF FIRING A FIELD ARTILLERY WEAPON.

YOU ARE THE OFFICER-IN-CHARGE, GIVING ORDERS TO THE GUN CREW, TELLING THEM THE DEGREES OF ELEVATION YOU ESTIMATE WILL PLACE THE PROJECTILE ON TARGET. A HIT WITHIN 100 YARDS OF THE TARGET WILL DESTROY IT. TAKE MORE THAN 5 SHOTS, AND THE ENEMY WILL DESTROY YOU!

MAXIMUM RANGE OF YOUR GUN IS 46500 YARDS.

DISTANCE TO THE TARGET IS 24454 YARDS.....

ELEVATION:? 16  
OVER TARGET BY 185 YARDS.

ELEVATION:? 15.8  
\*\*\*TARGET DESTROYED\*\*\* 2 ROUNDS OF AMMUNITION EXPENDED

THE FORWARD OBSERVER HAS SIGHTED MORE ENEMY ACTIVITY.  
DISTANCE TO THE TARGET IS 30284 YARDS.....

ELEVATION:? 20  
SHORT OF TARGET BY 396 YARDS.

ELEVATION:? 20.4  
\*\*\*TARGET DESTROYED\*\*\* 2 ROUNDS OF AMMUNITION EXPENDED

THE FORWARD OBSERVER HAS SIGHTED MORE ENEMY ACTIVITY.  
DISTANCE TO THE TARGET IS 39864 YARDS.....

ELEVATION:? 28.7  
SHORT OF TARGET BY 692 YARDS.

ELEVATION:? 29.5  
\*\*\*TARGET DESTROYED\*\*\* 2 ROUNDS OF AMMUNITION EXPENDED

THE FORWARD OBSERVER HAS SIGHTED MORE ENEMY ACTIVITY.  
DISTANCE TO THE TARGET IS 29874 YARDS.....

ELEVATION:? 20  
\*\*\*TARGET DESTROYED\*\*\* 1 ROUNDS OF AMMUNITION EXPENDED

THE FORWARD OBSERVER HAS SIGHTED MORE ENEMY ACTIVITY.  
DISTANCE TO THE TARGET IS 22462 YARDS.....

ELEVATION:? 14  
SHORT OF TARGET BY 633 YARDS.

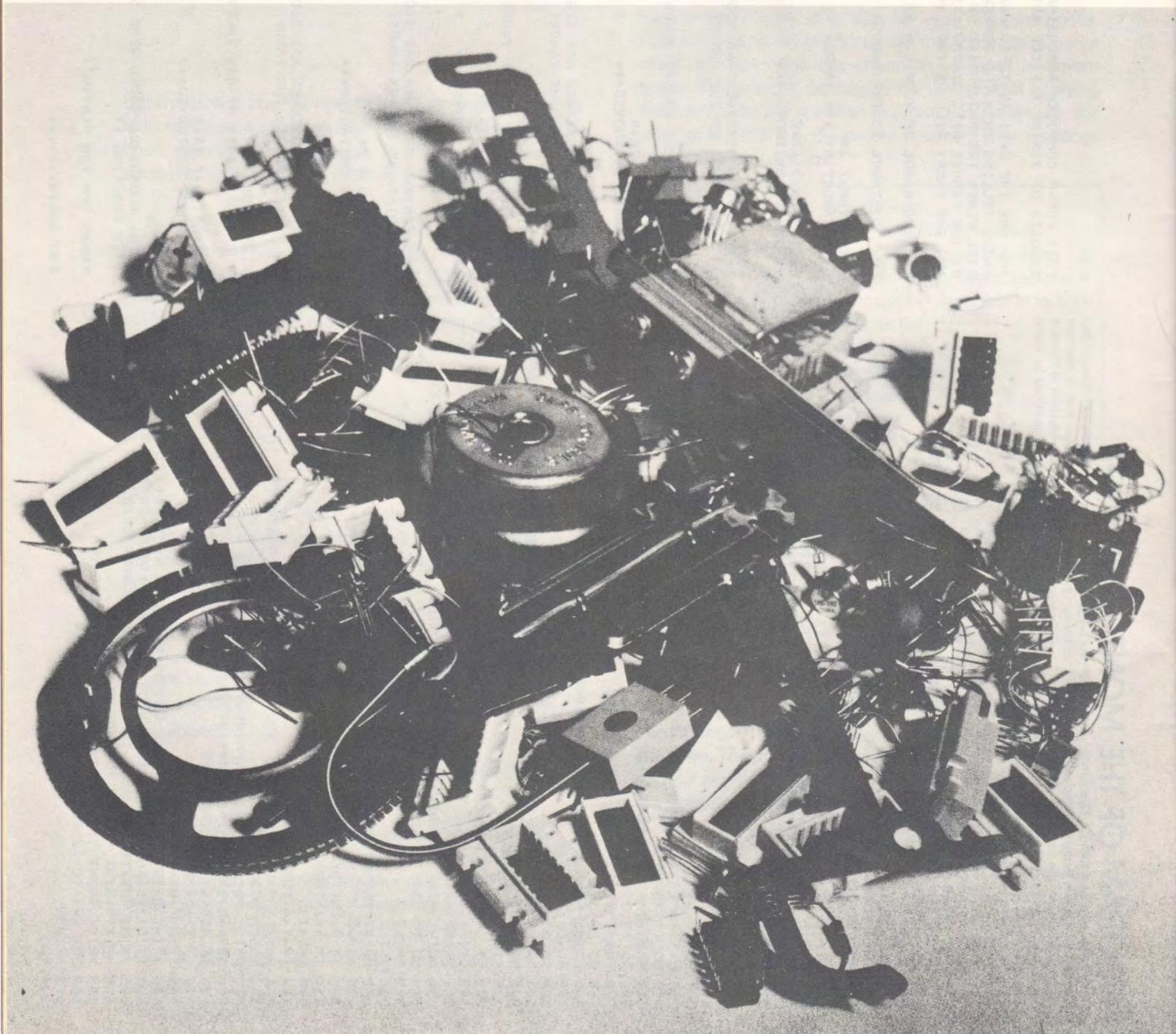
ELEVATION:? 14.5  
\*\*\*TARGET DESTROYED\*\*\* 2 ROUNDS OF AMMUNITION EXPENDED

TOTAL ROUNDS EXPENDED WERE 9  
NICE SHOOTING !!

THANK YOU FOR PLAYING!

TRY AGAIN.....

# EduSystem 10 for Schools with tight budgets.



This poster on 11 X 17" cardboard is available for 35¢ each, 3 for \$1. Send to Edu Products Group, DIGITAL, Maynard, Ma. 01754

## TIMESHARED-8: THE BIG LITTLE SYSTEM

Timeshared-8 (also known as TSS/8 or EduSystem 50) combines powerful multi-language timesharing software with the proven dependability and economy of the PDP-8/E computer. The system allows up to 17 users simultaneous access to a multi-language, interactive, resource/timesharing system for a cost of *under \$1.00 per terminal hour*.

Timeshared-8 runs an exceptionally powerful version of the BASIC language as well as FORTRAN, ALGOL, Assembly Language, FOCAL, QUICK-POINT, and a full complement of utility software for editing, debugging, and device handling. *And all languages are available simultaneously.*

A key advantage of Timeshared-8 over other timesharing systems is that each user has access to all the system peripherals and devices. The ability of any user to access any system device is called *resource sharing*. With resource sharing, peripheral devices such as disk storage units, magnetic tape units, high-speed paper tape reader and punch, card reader and line printer are available to any user *while the computer is timesharing*.

Timeshared-8 is the most versatile low-cost computer system available anywhere. Over 100 Timeshared-8 systems are in use today. They are used in schools for student problem-solving, science simulations, data reduction, business education, and administrative data processing.

### GENERAL PROBLEM-SOLVING

In training students in "General Problem Solving," the computer forces the student to break down a problem into manageable pieces, then to organize the pieces. The student works from a subject with which he is familiar to subjects with which he is not. Programming also teaches the student how to react to an approach which doesn't work. With an interactive computer, the student is continuously aware of his progress, hence he is motivated to isolate "bugs" and fix them.

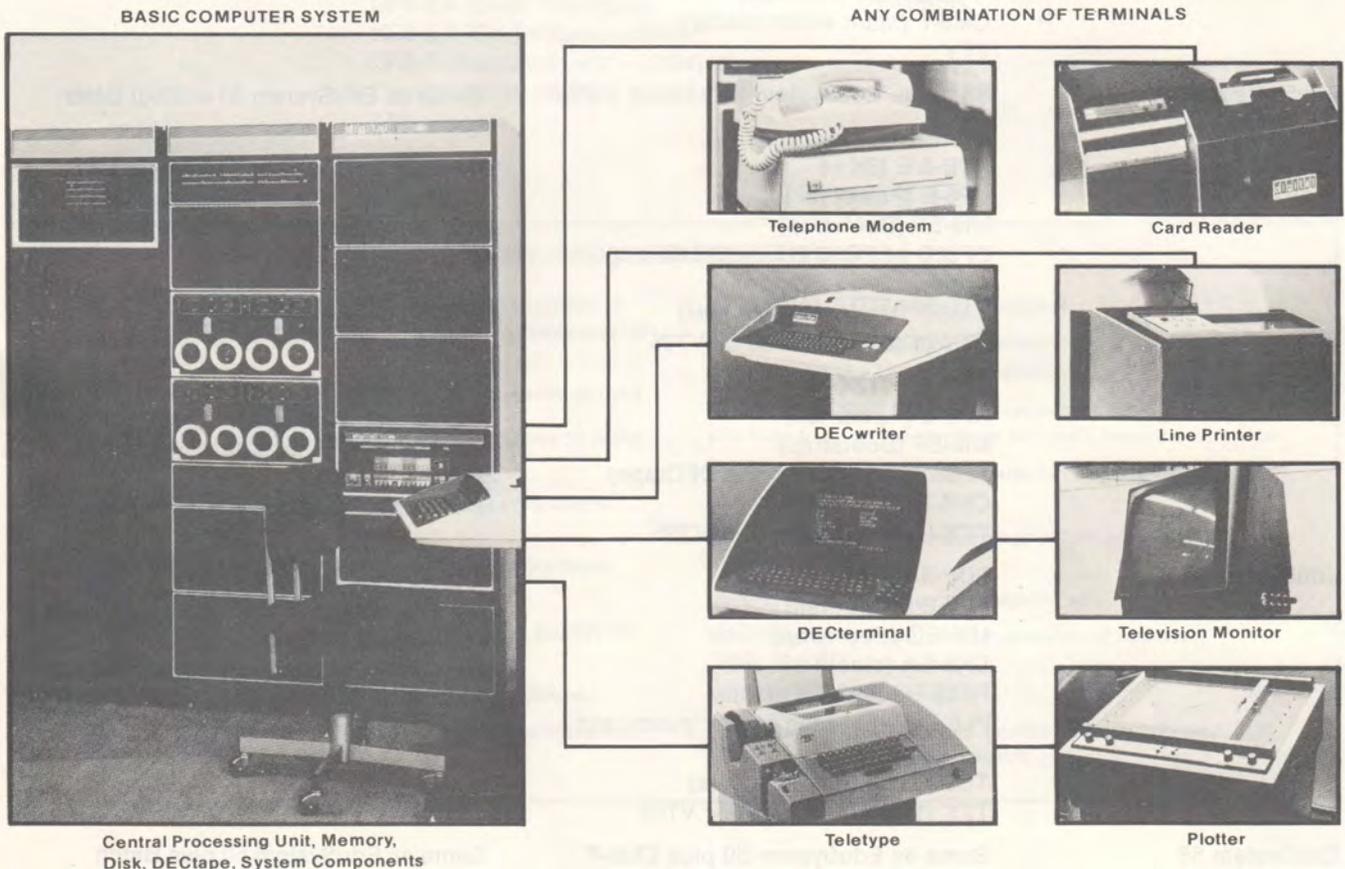
### SIMULATION

A simulation is a mathematical and logical model of a real-world process programmed on the computer. Timeshared-8 can simulate a simple laboratory apparatus like an inclined plane or a more complicated apparatus like that used in Young's double slit experiment. By means of such simulations the computer can extend the range of standard laboratory equipment and shorten measurement time.

### COMPUTER SCIENCE

Timeshared-8 alone, among small timesharing systems, can be used to teach computer science, not in stand-alone mode, but in the timesharing mode. This ability to service both those *using* the computer and those *learning about* the computer is a major advantage.

### TIMESHARED-8 CONFIGURATION CHART



# PDP-8 Based Educational Computer Systems

SYSTEM	HARDWARE REQUIREMENTS	SOFTWARE DESCRIPTION
EduSystem 5	PDP-8/F (4K) TTY	1-User BASIC Super-calculator
EduSystem 10	PDP-8/E (4K) MI8-EF (Bootstrap) TTY	1-User BASIC Super-calculator
EduSystem 15	PDP-8/F (4K) TD8-E (1 drive OMNIBUS DECTape) MR8-EC (ROM) TTY	1-User BASIC with program storage on DECTape. Time-sharing terminal eliminator.
EduSystem 15-B	Same as EduSystem 15 plus CM8-F	Same as EduSystem 15 plus Batch capability
EduSystem 20	PDP-8/E (8K+) KP8-E (Power fail) MI8-EF (Bootstrap) TTY (1 to 8) or LA30 or VT05	1 to 8 user BASIC. Lowest cost Time-sharing (8K: up to 4 users, 12K: up to 8 users)
EduSystem 21	Same as EduSystem 20 except 12K+ Memory	1 to 8 user BASIC with string handling
EduSystem 25	PDP-8/E (12K+) KP8-E (Power fail) MI8-EF (Bootstrap) TC08/TU56 (dual drive DECTape) TTY (1 to 8) or LA30 or VT05	1 to 8 user BASIC with string handling, program and data file storage on DECTape. (12K: up to 4 users, 16K: up to 8 users)
EduSystem 30	PDP-8/E (4K) MI8-EF (Bootstrap) DF32D or TC08/TU56 (32K disk or dual drive DECTape) CM8-F (Mark sense reader) TTY	Fast Batch BASIC or 1-user BASIC with program storage on disc or DECTape.
EduSystem 30-A	Same as EduSystem 30 without CM8-F	Same as EduSystem 30 without Batch capability
EduSystem 40	PDP-8/E (8K+) KP8-E (Power fail) MI8-EF (Bootstrap) DF32D or TC08/TU56 (32K disk or dual drive DECTape) CM8-F (Mark sense reader) TTY (1 to 8) or LA30 or VT05	Fast Batch BASIC or 1 to 8 user BASIC. (EduSystem 20 and EduSystem 30) (8K: up to 4 users, 12K: up to 8 users)
EduSystem 45	PDP-8/E (12K+) KP8-E (Power fail) MI8-EF (Bootstrap) TC08/TU56 (dual drive DECTape) CM8-F TTY (1 to 8) or LA30 or VT05	Fast Batch BASIC or 1 to 8 user BASIC with string handling, program and data storage on DECTape. (EduSystem 25 and EduSystem 30) (12K: up to 4 users, 16K: up to 8 users)
EduSystem 50	PDP-8/E (12K+) KP8-E (Power fail) MI8-EG (Bootstrap) DK8-EA (clock) RF08/RS08 (262K disc) PL8-E (Paper tape reader/punch and LA30) TC08/TU56 (for 12+ users) TTY (1 to 17) or LA30 or VT05	1 to 17 user time-sharing resource-sharing system. Simultaneous multiple language capability. (12K: up to 4 users, 16K: up to 8 users, 20K: up to 12 users, 24K: up to 17 users)
EduSystem 55	Same as EduSystem 50 plus CM8-F	Same as EduSystem 50 plus Batch

SYSTEM	HARDWARE REQUIREMENTS	SOFTWARE DESCRIPTION
EduSystem FORTE	PDP-8/E (16K) MR8-EC (ROM) FPP12-AP (Floating Point Processor) RK8-EA (cartridge disk) TD8-EH (1 drive) LA30 (DECwriter)	Fast Operating Real Time EduSystem (RTPS Fortran IV and EduSystem 25)
EduSystem 40/EDP	PDP-8/E (12K) KP8-E (Power fail) MI8-EF (Bootstrap) (2) TC08/TU56 (dual DECTape) CM8-F (mark sense reader) LS8-EA (line printer) TTY	Administrative software includes school records, attendance accounting, grade reporting, and student scheduling. Instructional software optional.
EduSystem 45/EDP	Same as EduSystem 40/EDP with RK8-EA Cartridge disk instead of (2) TC08/TU56	Same as EduSystem 40/EDP
EduSystem 50/EDP	PDP-8/E (12K) KP8-E (Power fail) MI8-EG (Bootstrap) DK8-EA (clock) RF08/RS08 (262K disk) TC08/TU56 (dual drive) CM8-F (Mark sense reader) LS8-EA (line printer) PL8-E (paper tape reader/punch and LA30)	Same as EduSystem 40/EDP, but EduSystem 50 for instructional use.
Remote Batch Terminal	PDP-8/E (8K) DK8-EA (clock) DP8-EA (Sync interface) KC8-EA (Redundancy check) CR8-F (Punched card reader) Choice of line printer TTY	Remote batch terminal for turn-key IBM 2780 emulation to 360 and 370 series systems.

#### DATA PROCESSING DEFINITIONS

**ASSUMED DECIMAL POINT.** Located two positions to the right of a programmer's current salary in estimating his own worth.

**BIT.** The increment by which programmers slowly go mad.

**CHAINING.** A method of attaching programmers to desks to speed up output.

**CHECKPOINT.** The location from which a programmer draws his salary.

**COMMON LANGUAGE.** The first thing a programmer must forget in order to be successful.

**CORE STORAGE.** A receptacle for the center section of apples.

**COUNTER.** A device over which martinis are served.

**ERROR.** What someone else has made when he disagrees with your computer output.

**EXTERNAL STORAGE.** Wastebasket.

**FIXED WORD LENGTH.** Four-letter words used by programmers in a state of confusion.

**FLOATING CONTROL.** A characteristic exhibited when you have to go to the restroom but can't leave the computer.

**FLOATING POINT.** The absolute limit before floating control is lost.

**FLOW CHART.** A graphic representation of the fastest route to the restroom.

**INPUT.** Food, whiskey, beer, aspirin, etc.

**MACRO.** The last half of an expression of surprise: "Holy Macro."

**MEMORY DUMP.** Amnesia.

**PROGRAMMER.** Red-eyed, mumbling mammal capable of conversing with inanimate objects.

—Modern Data



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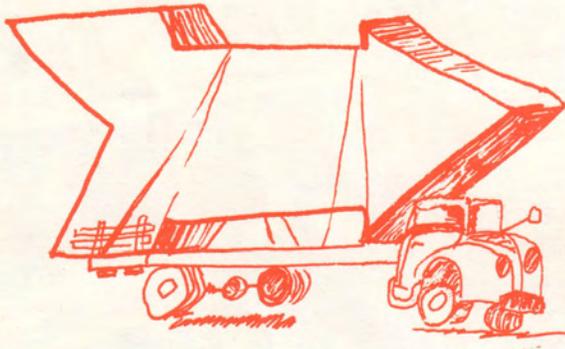
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