THE PEOPLE'S COMPUTER COMPANY
is a newspaper. . .

about having fun with computers

and learning how to use computers

and how to buy a minicomputer for yourself or your school

and books. . .and films. . . and tools of the future.

help us write

the next issue
and the next issue
and the next issue
and

does your school, group or organization have a computer?

do you have a computer?

do you like your computer? (do you like the computer manufacturer?)

how do you build a cheap tape winder?

do you have any good game playing programs or simulations (in BASIC)?

what do you want?

would you like to do one or more pages of photo-ready copy for a future issue?

would you or your group like to edit and produce a complete issue?

CONTENTS:

There's not another like it.

Volume One, Number One; October, 1972.

WE DID THIS ISSUE

BOB ALBRECHT
MARY JO ALBRECHT
JERRY BROWN
LE ROY FINKEL

Contributors:

Marc LeBrun (cover art, page 2 art)
Jane Wood (page 4 art)
Tom Albrecht (page 15 art)

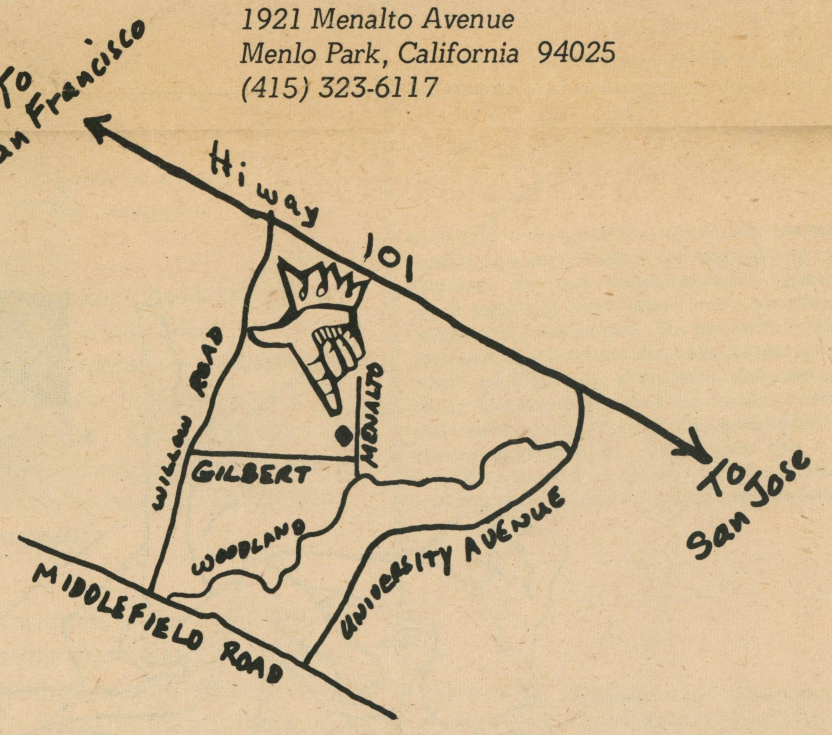
PEOPLE'S COMPUTER CENTER

is a place.

. . . a place to do the things the People's Computer Company talks about.
. . . a place to play with computers – at modest prices.
. . . a place to learn how to use computers.

We have a small, friendly computer . . . an EduSystem 20 (see Page 14), a timesharing terminal that connects us to the world and a Textronix programmable calculator, and some small simple calculators and books to help you learn and . . .

PEOPLE'S COMPUTER CENTER
1921 Menalto Avenue
Menlo Park, California 94025
(415) 323-6117



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10 to 99	$0.50 ea.
100 or more	$0.30 ea.

Please send ____ copies of the OCT 1972 issue of PCC. $_____ enclosed.

Name _____
Address _____
_____
ZIP

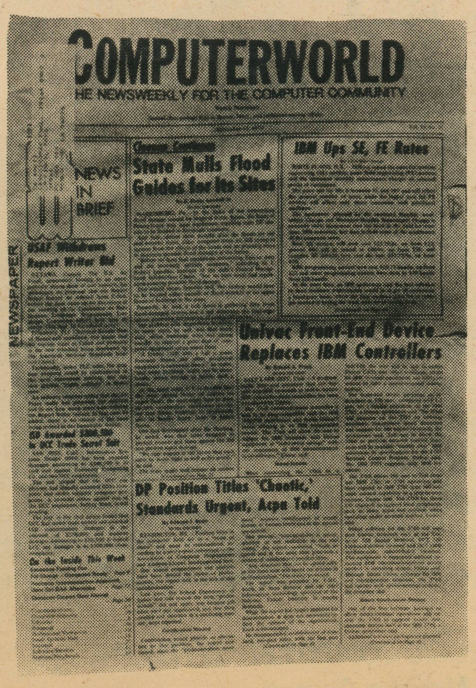
LOOKING OVER THE LITERATURE. jrb

COMPUTERWORLD

"The newsweekly for the computer community"

$9/year, published weekly.
Circulation Department
797 Washington Street
Newton, Mass. 02160

How do you keep up with computer science? Read *Computerworld.* New products, new applications, new companies, mergers, failures. The *Wall Street Journal* of the computer industry. Standard newspaper mosaic format and reporting, with columnists, editorial page, in depth serialized features, and articles of general interest.



COMPUTERS AND AUTOMATION

"The magazine of the design, applications, and implications of information processing systems."

This periodical is the closest thing to being the *Scientific American* of the computer-oriented press. Apparently well researched articles, broad spectrum of topics: Technical (hardware and software), social, educational, political. It's a magazine with a conscience. *Computers and Automation* is heavy on social comment and humanistic uses of computers. Every August issue focuses on Computer Art; every March issue on Computer in Education.

Computers and Automation thrives on controversy – try these: *"The Assassination of President John F. Kennedy: The Application of Computers to the Photographic Evidence."* (May, 1970, a dynamite article); *"The Vietnam Peace Game: Computer-Assisted Simulation of Complex Relations in International Relations."* (March, 1970); *"A Computer Laboratory for Elementary Schools."* (June 1972); *"The Uses of Computers in a Political Campaign."* (August, 1971).

From: Berkeley Enterprises, Inc.
815 Washington Street
Newtonville, Mass. 02161

One year (excluding the Computer Directory and Buyers Guide) 12 issues, U.S. only: $9.50.

One year (including the Computer Directory and Buyers Guide) 13 issues, U.S. only: $18.50.

COMPUTERS AND COMPUTATION

This is the best book *about* computers . . . what they are, how they happened, how they work and how they are used. *Computers and Computation* consists of 26 articles from *Scientific American*, 1950 through 1971.

The book is divided into five sections:

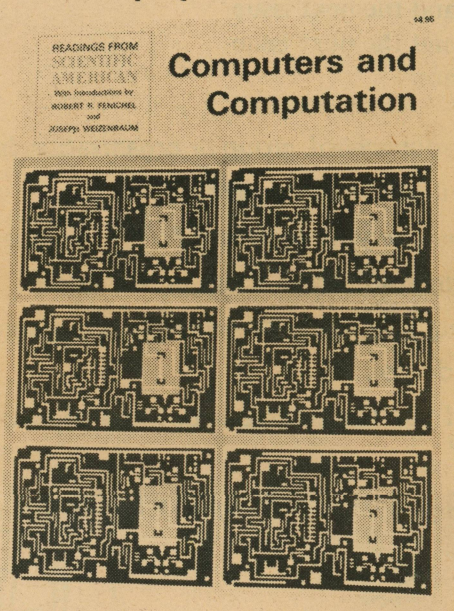
I	*Fundamentals*
II	*Games, Music and Artificial Intelligence*
III	*Mathematics of, by, and for Computers*
IV	*Computer Models of the Real World*
V	*Four Essays on the Uses of the Computer*

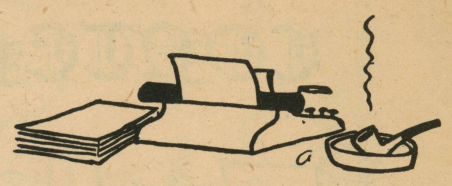
Articles include: "Computer Logic and Memory", "Computer Inputs and Outputs", "Computer Displays", "Time Sharing on computers", "A Chess Playing Machine", "Computer Music", "Artificial Intelligence", "Games, Logic and Computers", "The Monte Carlo Method", "Systems Analysis of Urban Transportation", "Chromosome Analysis by Computer", "Man Viewed as a Machine", and "The Uses of Computer in Education."

Note: We believe books about computers are best introduced to students or budding computer freaks after they have had some hands-on contact with the Modern Technological Marvel itself.

From: W.H. Freeman & Company
660 Market Street
San Francisco, Calif. 94104

Published, 1971, 283 pages.
$4.95 postpaid.





2nd page, just in case you were wondering.

The Huntington Project has developed and distributed the most comprehensive set of computer simulation programs written in BASIC that we have seen. NSF (National Science Foundation) funded this project from 1968 to 1970 at the Polytechnic Institute of Brooklyn. The project involved several high schools and dealt primarily with writing simulation programs for science, though some were written for math and social science as well. The programs are yours, in the form of a fat teachers manual which contains some 80 different programs under the headings of Biology, Earth Science, Chemistry, Math, Physics, Social Studies and Teacher Assistance. We have listed a few abstracts from the table of contents here.

A nice feature of the programs is that they use a rather standard BASIC without string variables or files. This means you can run them on most systems ... provided you have memory space. Most of the programs take about 1500 to 2000 words. Each program includes a small amount of documentation outlining possible objectives, preliminary preparation, discussion topics and follow-up suggestions. A RUN of each program is also included so you can see what the program does. My only complaint is that some of the programs were run on a DEC TSS8 which had no RENumber command. Therefore, when you're typing in a program you have to pay close attention to avoid line number errors, as the line numbers are eratic as hell. Sounds picky but you try it and you'll see what I mean. No school program is complete without these programs. They are a must. If you're having trouble involving your science department – they're the solution to your program. They are so good that DEC and HP have reprinted the programs and make them available to their school users. (Addresses listed on Pages 14 and 15.)

DROS – Game approach to determination of the genetic characteristics of Drosophila. EVOLU – Simulated experiment. The relationship between evolution and natural selection of accomplished by studying a population of mutant moths. PHOSYN – Simulated experiment Photosynthetic production of sugar varies as student varies light intensity or carbon dioxide concentration. CLIMAT – Practice in identifying climates and climatic patterns. CLOUDS – Explores problems related to the formation of cumuliform clouds. ATWT – Calculates atomic weight from percent abundance of isotopes. DECAY 1 – qualitatively in a game type situation. BANK – Solves financial problems concerning installment buying, long term loans and savings accounts. PLOTTR – Plots the graph of any function. SIMEON – Finds solutions to sets of up to ten simultaneous equations. STOCK – Simulates the stock market. WATER 1 – A tutorial program which goes through the calculations of a water budget. WATER2 – Prints out a complete water budget.

HUNTINGTON If

POLICY – A social science simulation that demonstrates the influence of pressure groups at the federal government level. The class is divided into six pressure groups: business, military nationalists, internationalists, civil rights, labor. Each team has 100 points which it can expend to try to influence 14 different economic policies. These 14 policies have their impact on 18 economic indicators which the computer changes each round of the simulation. It sounds complicated, but really looks impressive. Students should have some economics background in advance of using this program. For sure, they will learn a lot from it.

CHARGE – Simulation of Millikan's oil drop experiment for physics students.

STERL 1 & STERL 2 – Your goal is to control a fly population of one million flies by using pesticides or releasing sterile males over a 75 day period. STERL 2 tells you how much your methods will cost you! The output is a graph showing how effective your procedures are. Usage requires detailed reading of the resource materials but is easy to use. The output takes a while to print out (suggest group activity).

GENE 1 – Simulation of the inheritance of genetic traits using Mendel's Laws. User inputs a dominant and recessive trait plus the genotype of each offspring, and the computer will print the genotype and phenotype and details of any number of offspring. Easy to use with standard biology textbooks.

HUNTINGTON TWO

Whatever good can be said for the original Huntington Project goes *double* for Huntington Two. Again, NSF has funded a winner with the purpose of developing simulation packages in BASIC for use in schools. Over 200 schools in the country were testing these packages last year. They're great!

Each program comes with the following kinds of documentation.

Resource Handbook – This is really a mini computer textbook which tells the student all about the subject of the simulation. Simple, straight forward writing supplemented with illustrations and articles reprinted from periodicals. Also included is a detailed explanation of the model. The best two are 30 pages each. (You can reproduce these for your students.)

Teacher Support Material – In 7 or 8 pages the program is described, you are advised of preparatory activities and follow-up activities and shown how the program runs.

Computer Laboratory Guides – Provides the student with a series of recommended learning activities to try on the computer.

Now you've got the answer for the teacher whose excuse has been "I don't have time to teach it" or "I don't know how to use a computer" or "I don't have the resources available" or "I have a headache" or whatever. The teacher is provided with **everything**. The resource handbooks are so complete they are usable as a self-instruction book. The Lab books give all the guidelines needed for computer experimentation. We're using these simulations as optional units with teachers who have no computer background but are really excited about the materials.

More programs are expected as the project continues. Their availability at this moment is questionable. They're still testing these materials. When they are available, **you must get them**. We could go on and on and on with praise for Huntington Two materials, but we'll stop and let you look at some runs.

POLSYS – Political system simulation which is brutal to figure out but is exciting once you do. This simulation is designed to teach students how political decisions can be influenced by community action at the local government level. It is a rather modern simulation in keeping with the times and the 18 year old vote.

POLUT – A water pollution simulation. User controls the type of water, water temperature, type of waste (industrial or sewage), waste dumping rate, type of treatment. The output is a graph or table showing what your conditions created. This program is very effective and easy

LOCKEY – A simulation of the biochemical investigation of the lock and key enzyme model.

MARKET – A simulation where two teams represent two companies in the competitive marketplace. The teams make managerial type decisions regarding production level, advertising budget and selling price. On the basis of these decisions, the computer then tells the teams their profit, market share, cash status, and asset position. The teams then have the chance to change their earlier decisions and the game continues quarter after quarter. We suspect this is a simplified version of some of the fancy managerial simulations used in colleges and businesses.

SLITS – An "extended Lab" experience for students who are learning about Young's Double-Slit experiment. Like the others, this program comes complete with a mini-text and lab guide.

Polut

In this study you can specify the following characteristics:

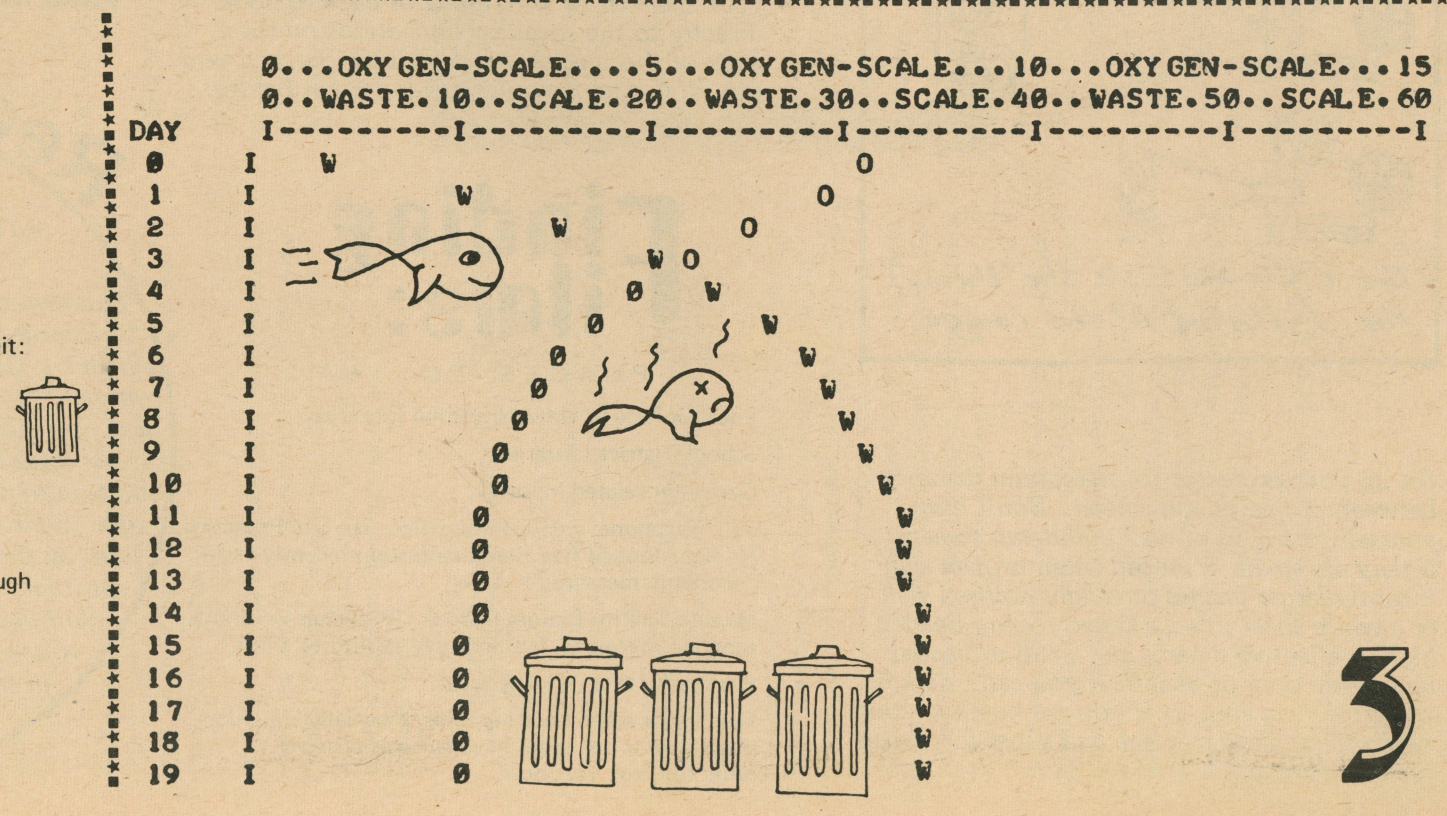
A. The kind of body of water:
   1. Large pond
   2. Large lake
   3. Slow-moving river
   4. Fast-moving river

B. The water temperature in degrees fahrenheit:

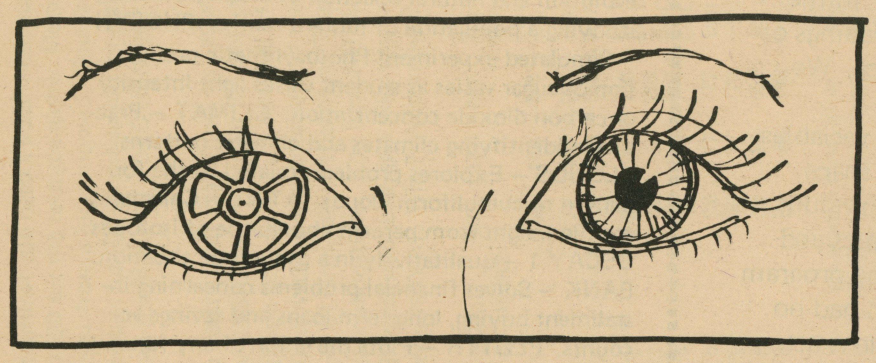
C. The kind of waste dumped into the water:
   1. Industrial
   2. Sewage

D. The rate of dumping of waste, in parts per million (PPM)/day.

E. The type of treatment of the waste:
   0. None
   1. Primary (sedimentation or passage through fine screens to remove gross solids).
   2. Secondary (sand filters or the activated sludge method to remove dissolved and colloidal organic matter).



AUDIO-VISUAL ACCESS AND UTILIZZZATION



Art by Jane Wood

Premise: Education is real life experience. Experience processed through verbalization and created or reproducible images have their place in education, but only as auxiliaries to direct experience. Films just aren't as good as terminal availability and computer time for Computer Education. Movies can present information about things to which it is hard to have direct access for direct experience, such as exotic research and uses of computers or for summarizing computer development, theory and utilization.

Truism: The computer field changes rapidly. So try to ascertain the production date of the films you want to use, or you'll get hopelessly outdated stuff. This isn't true across the board. For instance, Charles Eames' film A COMMUNICATIONS PRIMER is still quite relevant and does not offend "modern" sensibilities even though it is almost 20 years old. There are few "educational" films to which this compliment can be paid.

Tired Notes from an Old Hand at the Media Biz: Preview your films! Make their viewing optional; not everybody can comfortably or efficiently absorb information from the film media.

If you can possibly arrange it, use a darkened room. Sharply defined visual information is easier to understand, despite McLuhan. If you are prone to visual media utilization, you may wish to scrounge or invest in some room darkening material.

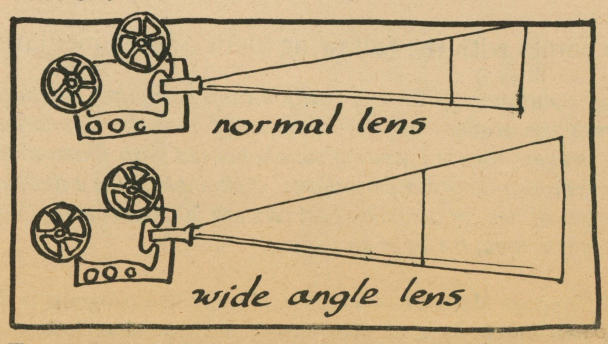
Temporary: Poster board, cardboard, heavy butcher paper.

More reusable: Heavy curtains, old blankets, opaque black vinyl plastic.

If you usually use the same room, then your room darkening system can be made to fit; otherwise flexible material that can be compactly folded for easy transportation (and storage) is desirable. Don't forget tacks or staples or tape.

Have a lot of projectionists available (but one competent one at a time) responsible for projecting. Teachers are sometimes the worst choice for projectionists. Kids, 10 years and up, often dig manning the machines, and do it well. To teach projector handling, demonstrate threading, rewinding and trouble-shooting once, (loss of loop, loose plugs, burned out bulbs) then supervise the learner's doing it him/herself a minimum of six times, even with auto-loads or automatic threading projectors. Remember that damaged film is expensive to replace and gets you in trouble with your film sources.

Many projector speakers are a hoax, especially the built-in kind. People like Bell & Howell make it even worse by using esoteric external speaker jacks so that often you can't use a good speaker near the screen even if you have one available. The bad reputation of optical sound track quality is at least as much because of speakers as from inherent limitations in optical tracks. If you are going to use media, use it effectively; don't cripple it with poorly projected images because of too much light in the movie room, or with poor sound reproduction.



To project a large image at a short distance, you need a wide angle lens for your projector. National Camera Exchange, 9010 Olson Hwy., Minneapolis, Minnesota, 55427, has the following lenses for the Bell & Howell Auto-load (quoted 11/15/71).

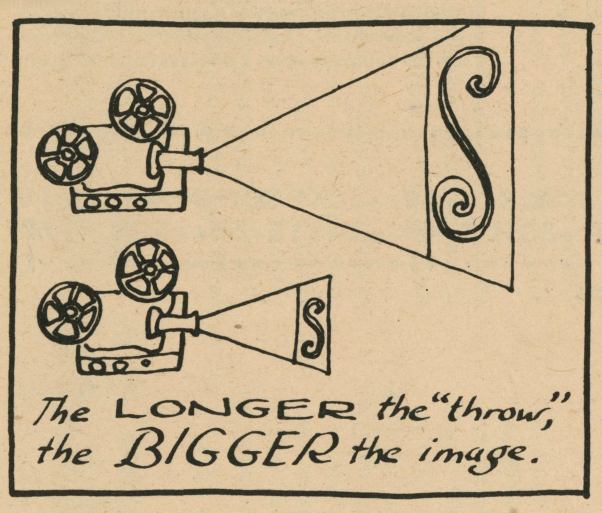
1"	*F 1.9*	*$29.50*
1½"	*F 1.6*	*$33.50*

External speaker jacks for recent model Bell & Howell projectors: from your projector service center, or get a Switchcraft (brand) S-280 ... try Brill, Radio Shack, or other electronic parts suppliers, or order from:

Photo & Sound Company
116 Natoma Street
San Francisco, Calif. 94105

Switchcraft S-280, $1.30 each (quoted 12/71) but, they request a $10 minimum order.

You can wire the plug yourself, either with the appropriate jack on the other end to plug into your speaker, or with alligator clips to hook directly to the speaker connections on the back of the speaker itself. It's simple, and you can do it even if you've never done it before!



Set up your projector for maximum distance between projector and screen. Don't limit yourself to tripod or wall pull-down screens if they are small. You can often project significantly larger images on a light colored wall or a white sheet in a darkened room. Beaded, highly reflective screens and small projected images are only of benefit if you can't darken the projection area, or if you are hustling your media from place to place and super-fast setup time is necessary.

Finding Films:

PLACES TO TRY

Local College or University Film Libraries.

School District Libraries.

Computer-related industry.

Bell Telephone – your local office. (In San Francisco, Ma Bell stopped free film distribution recently as an "economy measure.")

Modern Talking Picture Service. (Branches in various geographic regions, free industry sponsored films.)

Public Libraries in many areas.

Remember when booking films, especially free films, place your order as far in advance as possible ... order for next year now.

SHORT REVIEWS of films we like to use at computer workshops for beginners.

THE THINKING ??? MACHINE
20 minutes, from Bell Telephone, color

Presents in live action and animation an introductory overview of how computers work; discusses how computer "intelligence" differs from human intelligence; shows the complete dependence of computers on programmers for operation. Best introductory film available for free that we've seen. Contact your local Ma Bell office.

THE INCREDIBLE MACHINE
14 minutes, from Bell Telephone, color

Some exotic research, emphasizing computer graphics. Computer generated animation, teaching computers to talk, designing electronic circuits with CRT displayed schematics, computer generated music sound track.

THE COMPUTER REVOLUTION Parts I and II
30 minutes each part, color. From CBS News TV series "The 21st Century." Free from Modern talking Picture Service.

Uses of computers in teaching, research, medicine, and other applications; some discussion of social issues raised by computer use; the future of computers in society.

THE CARMAKERS (Volkswagen of America)
Free from Modern Talking Picture Service, 30 minutes, color

A mindblowing film of the VW plant in Germany that uses huge automated machines to manufacture and assemble VW's, producing one every 8 minutes at the end of the line. Computers are also used in development and testing. Good film for disucssions of technology *vs* ecology and men *vs* machines.

Modern Talking Picture Service
Addresses of Regional Libraries

Atlanta, Ga. 30308, 412 W. Peachtree St., N.W.
Boston, Mass. 02167, 230 Boylston St., Chestnut Hill
Charlotte, NC 28202, 503 N. College Street
Chicago, Ill. 60611, 160 E. Grand Ave.
Cincinnati, Ohio 45202, 9 Garfield Place
Dallas, Texas 75207, 1411 Slocum Street
Detroit, Mich. 48235, 15921 E. 8 Mile Road
Houston, Texas 77027, 4084 Westheimer Road
Indianapolis, Ind. 46204, 115 E. Michigan Street
Kansas City, Mo. 64111, 3718 Broadway
Los Angeles, Ca. 90038, 1145 N. McCadden Place
Minneapolis, Minn. 55420, 9129 Lyndale Ave. S.
New York, NY 10036, 1212 Ave. Of the Americas
Philadelphia, Penna. 19107, 1234 Spruce Street
Pittsburgh, Penna 15222, 910 Penn Avenue
San Francisco, Ca. 94105, 16 Spear Street
Washington, C.D. 20036, Suite 4, 2000 "L" St. N.W.

PCC WOULD LOVE TO HEAR FROM YOU REGARDING FILMS YOU'VE USED. TELL US ABOUT THE BAD ONES AS WELL AS THE GOOD ONES AND THE SETTING IN WHICH YOU USED THEM. WE WOULD REALLY APPRECIATE IT. THANKS.

PREVIEWS OF COMING ATTRACTIONS

In the next issue we will critically review several computer film catalogs and tell you where to obtain these lists of films. These media lists are of interest to computer education people, as well as those interested in computer technology, graphics, research, applications, and computer animation.

Record Review

FIRESIGN THEATER
"I Think We're All Bozos on This Bus"
Columbia C30737

This stereo record album might be subtitled "Adventures in Computerized America-land," which is a Disneyland-like place. Plenty of satiric comment on science, technology, computers, politics. Surrealistic audio theater at its best. It merits several close listenings, and would be an excellent addition to any resource center, not to mention your own record collection. This is the fourth album by these extremely talented and perceptive spiritual heirs of Stan Freberg and Tom Lehrer. Nothing is sacred to the Firesign Theater. If your local record store doesn't have it in stock, be persistent and have them order it, or order from Columbia direct.

jrb

BASIC!
Or, U2 can control a computer.

PRINT
LET
GO TO
READ
IF
DATA
FOR
RESTORE
INPUT
STOP
GOSUB
ON
REMARK
NEXT
RETURN
DEF
RANDOM
DIM
END
+-*/↑
< > =
INT
RND
TAB
SQR
SGN
ABS
SIN
COS
TAN
ATN
LOG
EXP

IF YOU WANT TO TALK TO COMPUTERS, YOU GOT TO LEARN A LANGUAGE. THERE ARE LOTS OF LANGUAGES FOR TALKING TO COMPUTERS. MOST OF THEM ARE O.K. FOR COMPUTER FREAKS BUT LOUSY FOR PEOPLE. WE WILL USE THE COMPUTER LANGUAGE CALLED BASIC – GREAT FOR PEOPLE, NOT SO GOOD FOR COMPUTER FREAKS.

Basic BASIC

You can learn basic BASIC from this book ... but you can't learn how to use strings and files. Strings? See pages 10 and 11 of this issue of PCC. Files? Maybe next issue.

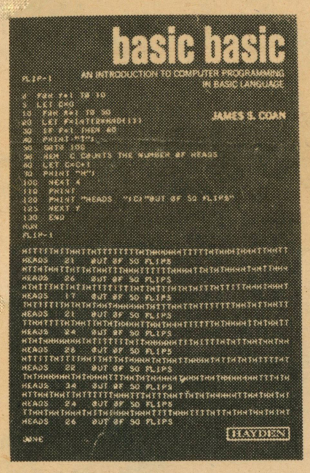
CHAPTER TITLES

Introduction to BASIC
Writing a Program
Loops and Lists
Computer Functions
Elementary Data Processing
Introduction to INPUT and RESTORE
Specific Applications
The Quadratic Equation
Trigonometry
Complex Numbers
Polynomials
MAT Instruction in BASIC
Elementary Probability

The first 6 chapters (103 pages) cover all the elementary language elements of BASIC and are relatively nonmathematical.

Chapters 7 – 13 can be read in any order and cover various applications of BASIC - mostly heavy math.

Plus appendices – A) Storing Programs on Paper Tape B) Error Diagnosis C) Special Formatting Functions D) Summary of Flowchart Shapes E) Summary of Statements in BASIC F) Index of Programs in Text G) Answers to Even Numbered Problems.



Basic BASIC *by James S. Coan*

from: Hayden Book Company, Inc.
116 West Fourteenth Street
New York, NY 10011

price: $5.95

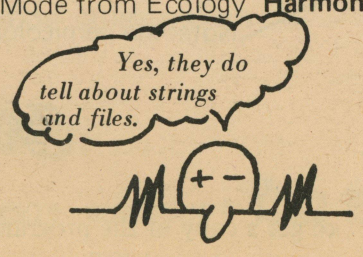
1970; 256 pages

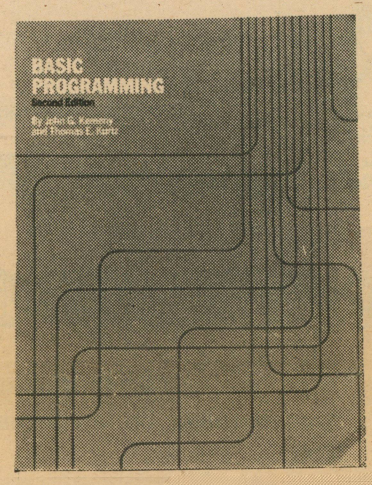
BASIC PROGRAMMING Kemeny and Kurtz

On the first day, Kemeny and Kurtz invented BASIC. Then they wrote a book. We don't recommend this book for *learning* BASIC but we *do* recommend it as a reference guide ... applications resource ... idea generator for people who already know a little BASIC.

Here is a sampling of section titles:

What is BASIC? What is Timesharing? **String Variables** Eternal Calendar **Roots of Equations** Curve Plotting **Prime Numbers** Random Numbers **Dealing a Bridge Hand** Knight's Tour **Tictactoe – A heuristic Approach** Tax Depreciation **Critical Path Analysis** String Files **Linear Regression** Electrical Networks **Markov Chains** Polynomials **Marriage Rules in a Primitive Society** A Mode from Ecology **Harmony in Music.**





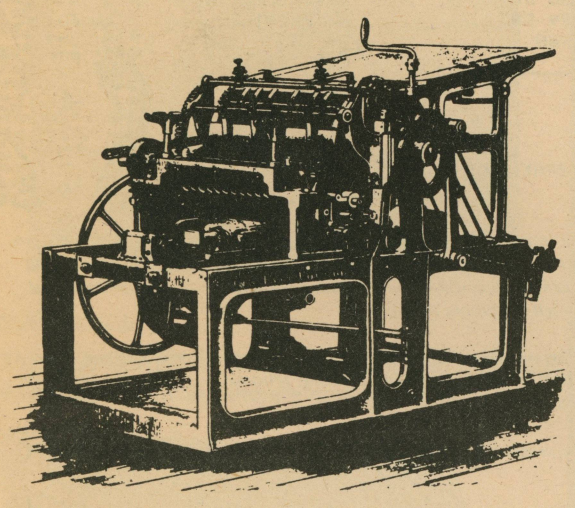
BASIC Programming *(2nd Ed.)*
by John G. Kemeny
and Thomas E. Kurtz

from: John Wiley and Sons, Inc.
605 Third Avenue
New York, NY 10016

price: $6.25

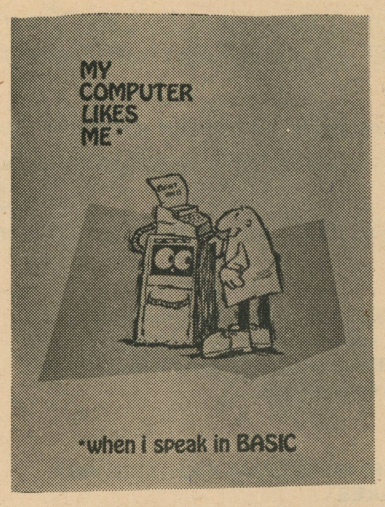
1967, 1971; 150 pages

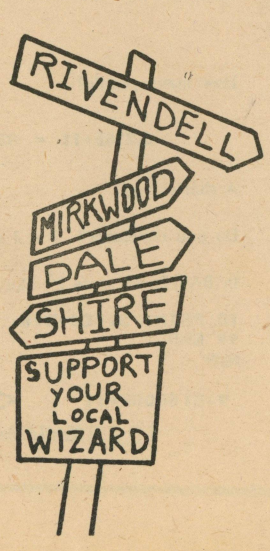
HOT OFF THE PRESS!!



MY COMPUTER LIKES ME*
*when I speak in BASIC

The second printing of our very own introduction to BASIC. Completely re-typeset, now with a bright orange heavy duty cover. In an easy going, conversational style, this 64 page workbook introduces BASIC to young or old. Designed to be used with frequent access to a timeshare terminal (learn by doing!), we use this large format book in our introductory workshops for people with no previous computer experience or knowledge of programming. The teaching examples are oriented around population problems and demographic data. See Page 6 of PCC for excerpts from MY COMPUTER LIKES ME.





BOOKS TO HELP YOU GET THERE

GETTING STARTED IN BASIC

Strings? Numerical expressions?

```
PRINT "MY HUMAN UNDERSTANDS ME"
```

This is a string. It is enclosed in quotation marks.

with " " **without** " "

```
PRINT "7 + 5"        PRINT 7 + 5
```

This is a string. It is enclosed in quotation marks.

This is not a string. It is a numerical expression.

Your turn again. Try these.

If a PRINT statement contains more than one item. (string or expression), the items must be separated by commas or semi-colons.

SCR

```
10 PRINT "7 + 5=" , 7 + 5
20 END
RUN
7 + 5=          12
```

comma spacing

Note the comma.

```
10 PRINT "7 + 5=" ; 7 + 5
20 END
RUN
7 + 5= 12
```

semicolon spacing

Note the semicolon.

Good luck!

remember... to get a copy of the program in the computer's memory, type LIST and press RETURN.

REMEMBER

A program is a set of statements. Each statement tells the computer to do some specific thing. So far, we have used only two types of statements, **PRINT** and **END**.

A statement begins with a line number. The computer obeys statements in line number order.

We space line numbers (10, 20, 30, etc.) so that we have room to insert new lines between existing line numbers. For example, we can insert up to nine new lines between Line 10 and Line 20.

You may choose line numbers arbitrarily and capriciously except for two things. A line number must be a positive integer between 1 and 9999, inclusive and the **END** statement must have the highest line number of any line in the program.

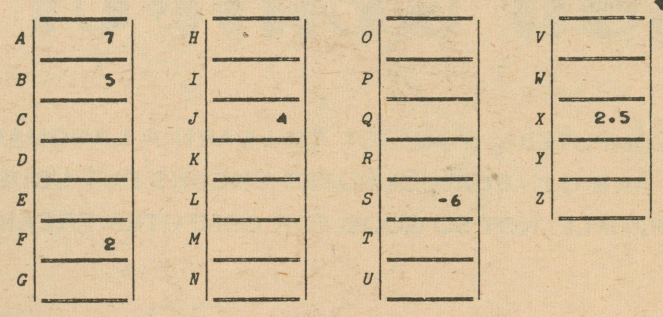
Type **SCR** to tell the computer to scratch (erase) the program in its memory. This is sort of like erasing a blackboard before you begin writing on it.

Type **RUN** to tell the computer to obey the program in its memory.

The material on this page has been condensed, reduced, cut, pasted and collaged from MY COMPUTER LIKES ME. Here is the table of contents from MCLM.

BOXES

Deep down inside the computer there are 26 little boxes.



Each box can contain one number at any one time. We have already stored numbers in some of the boxes.

7 IS IN BOX A
5 IS IN BOX B

What number is in box F? _____ *In J?* _____

–6 is in box _____ *and 2.5 is in box* _____

O.K., using a *pencil*, put 8 into C. In other words, write the numeral "8" in the box labelled "C." Then do the following, carefully!

FIRST – *Put 12 into N.*
SECOND – *Put 27 into N. But wait! A box can hold only one number at a time . . . before you can enter 27 into N, you must first erase the 12 that you had previously entered.*

When the computer puts a number into a box, it *automatically* erases the previous content of the box.

Tell it to the computer.

```
10 LET A = 7 <------ PUT 7 INTO BOX A.
20 PRINT A   <------ PRINT THE CONTENT OF BOX A.
99 END
RUN

 7
```

Another example.

```
10 LET A = 7
20 LET B = 5
30 PRINT A+B, A-B, A*B, A/B
99 END
RUN

 12            2             35            1.4
```

More practice? O.K.

```
10 LET A = 2
20 LET B = 3
30 LET C = 4
40 LET D = 5
50 PRINT A+B+C+D, A*B*C*D, A*(B+C), (A+B)/(C+D)
99 END
RUN

 14            120           14            .555556
```

We call **A, B, C, . . . , Z variables.** The number in box A is the **value of A**, the number in box B is the value of B, the number in C is the value of C, and so on. Without using the computer, complete each of the following RUNS as you think the computer would do it. Then use the computer to find out if you are correct.

```
10 LET A = 1
20 LET A = 2
30 PRINT A
99 END
RUN
_____
```

```
10 LET A = 7
20 LET B = A
30 PRINT B
99 END
RUN
_____
```

```
10 LET A = 1
20 PRINT A
30 LET A = 2
40 PRINT A
99 END
RUN
_____
_____
_____
```

SORCERER'S APPRENTICE

Do you know the story about the Sorcerer's Apprentice? While the Sorcerer was gone, the apprentice instructed the magic broom to fetch water from the well. The broom complied and began carrying water, more water, more water . . . the apprentice had forgotten how to tell the broom to stop.

The following program makes the computer behave like the Sorcerer's broom. Once you set it in motion, it will start printing, printing, printing, . . . you, the apprentice, must know how to stop it!

Before typing the program, find the BREAK key. It is on the righthand side of the keyboard.

Now, enter the program.

```
10 LET N = 1
20 PRINT N
30 LET N = N+1
40 GØ TØ 20
99 END
```

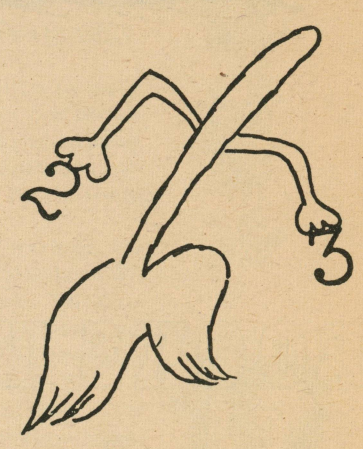
RUN

BEFORE TYPING RUN, READ THIS:

To STOP the computer,
Press BREAK for 1 second.
If that doesn't work, press the S key.
If that doesn't work, try ESC or ALT MODE.
If that doesn't work, yell for help!

```
1
2
3
4
5
6
7
8
.
.
.
```

and so on forever unless you stop the computer!



At the end of 1970, the population of the earth was about 3.6 BILLION people.

3.6 BILLION = 3,600,000,000 = 3.6E9

If the present growth rate persists, the population will double every 35 years. Suppose this actually happens . . . what will the population be in the year 2250?

$$\frac{2250 - 1970}{35} = \frac{280}{35} = 8 \text{ doublings}$$

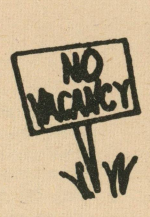
We could do it like this.

```
10 PRINT 3.6E9*2*2*2*2*2*2*2*2      (8 doublings ... count them!)
99 END
RUN

 9.216000E+11
```

← too many

How many people?

9.216E+11 = 921600000000 = 921.6 BILLION



A shorter way.

Do you remember? $2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^8$

In BASIC, we write 2^8 like this: 2↑8

```
10 PRINT 3.6E9*2↑8      Multiply 3.6E9 by 2^8.
99 END
RUN

 9.216000E+11
```

← Still too many people!

Remember ... to compute a *power* use ↑ N

RANDOM NUMBERS

A random number is a number *chosen at random* or *selected by chance.* Here is a sequence of random numbers. Each number is either 1 or 2.

Random numbers: 2 2 1 1 2 1 1 1

We got the random numbers by flipping a coin. If it came up HEADS we wrote "1." If it came up TAILS we wrote "2." How many HEADS did we get? How many TAILS?

Roll a die ... get 1 or 2 or 3 or 4 or 5 or 6. We did it 10 times:

3 1 6 2 5 1 3 3 5 6

Suppose we wanted a sequence of random numbers in which each number is 1 or 2 or 3 or 4. Easy ... roll the die. If it comes up 1, 2, 3 or 4, write it down. But if it comes up 5 or 6, don't *write it down.*

How can we use a die to get a sequence of random numbers in which each number is 0 or 1 or 2 or 3 or 4 or 5?

Random digits ... how can we get a sequence of random digits – 0 or 1 or 2 or 3 or ... or 9? Use superdice! A regular die is a cube with 6 faces, numbered 1 through 6. An icosahedron has 20 faces. Two faces numbered 0, two faces numbered 1, two faces numbered 2 and so on up to 9. Here is a sequence of random digits we got by rolling our icosahedron 20 times.

3 2 2 9 7 0 9 1 9 5 1 6 3 7 9 2 2 5 2 4

How could you use a regular die (6 faces) and a coin to get random digits?

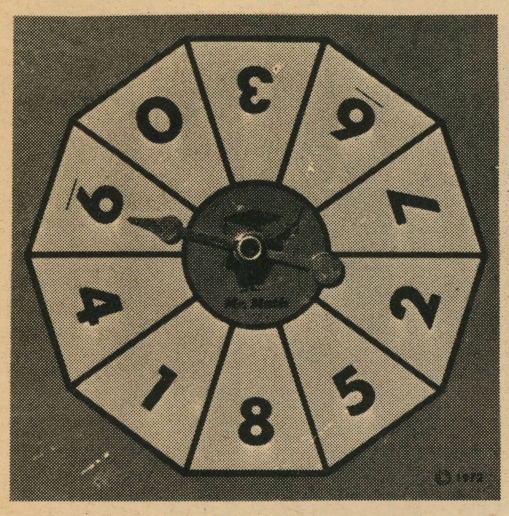
We have a dodecahedron (12 faces) with faces numbered 1 through 12. How can we use it to get random digits?

SPINNERS ... DICE ... SUPERDICE

From: *CREATIVE PUBLICATIONS*
1101 San Antonio Road
Mountain View, Calif. 94040

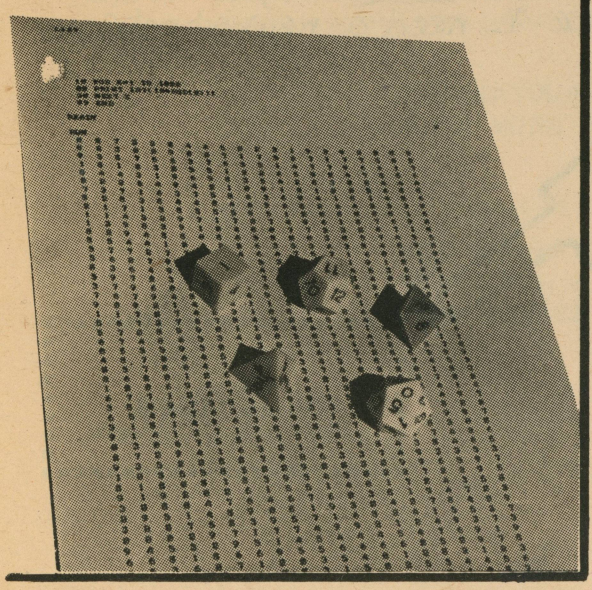
SPINNERS

Random digits? Use a spinner. Whole numbers from 0 to 99? Use a spinner twice or use two spinners. How about a sequence of random numbers in which each number is 0 or .1 or .2 or ... or .9? And how do we get a sequence of random numbers in which each number is 0 or .01 or .02 or .03 or ... or .99?



SUPERDICE

The icosahedron has 20 faces ... numbered 0 through 9 (twice). Use it to generate random digits.



In **BASIC**, we use the **RND** function to compute numbers that **appear to be** chosen at random.

The statement: **PRINT RND(0)** tells the computer to generate and print one "random number."

```
100 REMARK RANDOM NUMBERS
105 RANDOM
110 PRINT "HOW MANY RANDOM NUMBERS";
120 INPUT N
130 PRINT
140 FOR K=1 TO N
150 PRINT RND(0)
160 NEXT K
170 PRINT
180 GO TO 110
999 END
RUN

HOW MANY RANDOM NUMBERS? 10

 .9933801
 .3014295
 .8681556
 .4960684
 .1630098
 .5134436
 .6135728
 .06044509
 .840515
 .499084

HOW MANY RANDOM NUMBERS? 3

 .4298691
 .08745875
 .6559309

HOW MANY RANDOM NUMBERS?
```

Your turn.

To RUN this program on an HP2000, delete Line 105.

THESE THINGS ARE TRUE:

Random numbers generated by the RND function are printed as decimal fractions **greater than zero, less than one.**

- RND(0) is greater than zero.
- RND(0) is less than one.

Change Line 150

```
150 PRINT 10*RND(0)
```

and

```
RUN

HOW MANY RANDOM NUMBERS? 12

 9.934811
 5.302479
 2.401577
 6.687152
 8.508723
 .8679659
 8.629288
 3.964037
 6.120626
 1.047425
 1.198915
 7.766666

HOW MANY RANDOM NUMBERS?
```

etc.

THESE THINGS ARE TRUE:

- **10*RND(0) is greater than zero.**
- **1*RND(0) is less than ten.**

Another change

```
150 PRINT INT(10*RND(0))

RUN

HOW MANY RANDOM NUMBERS? 13

 3
 2
 9
 2
 6
 2
 7
 8
 5
 9
 6
 4
 0

HOW MANY RANDOM NUMBERS?
```

INT(10*RND(0))
is a random digit.

ba

GAMES ba

But what are random numbers used for? Here is one example ... a program to play a number guessing game, human vs. computer. The computer generates a random whole number between 1 and 100. The human tries to guess the number.

7
13
21
5
49
0
8
30
6
73

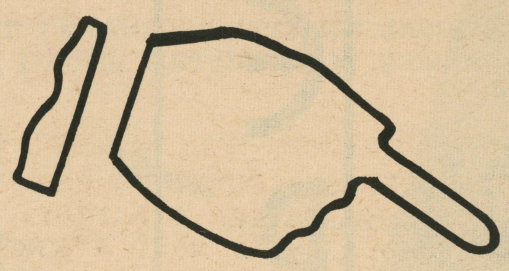
```
100 REM *** NUMBER - A NUMBER GUESSING GAME
110 RANDOM

200 REM *** PRINT INSTRUCTIONS ON HOW TO PLAY
210 PRINT "I WILL THINK OF A WHOLE NUMBER BETWEEN 1 AND 100."
220 PRINT "TRY TO GUESS MY NUMBER. AFTER EACH GUESS, I WILL"
230 PRINT "TELL YOU IF YOU HAVE GUESSED MY NUMBER OR IF YOUR"
240 PRINT "GUESS IS TOO SMALL OR TOO BIG."

300 REM *** COMPUTER 'THINKS' OF A NUMBER - CALL IT X
310 LET X=INT(100*RND(0))+1
320 PRINT
330 PRINT "OK, I HAVE A NUMBER. START GUESSING."

400 REM *** HUMAN STARTS GUESSING
410 PRINT
420 PRINT "WHAT IS YOUR GUESS";
430 INPUT G
440 IF G=X THEN 500
450 IF G>X THEN 480
460 PRINT "TOO SMALL. TRY A LARGER NUMBER."
470 GO TO 410
480 PRINT "TOO BIG. TRY A SMALLER NUMBER."
490 GO TO 410

500 REM *** HUMAN HAS GUESSED THE COMPUTER'S NUMBER
510 PRINT
520 PRINT "YOU GOT IT! LET'S PLAY AGAIN.
530 PRINT
540 GO TO 300

999 END
```

This program is written for our EduSystem 20 (see page 14). To make it work for the HP 2000 (see page 15) simply delete Line 110.

```
RUN

I WILL THINK OF A WHOLE NUMBER BETWEEN 1 AND 100.
TRY TO GUESS MY NUMBER. AFTER EACH GUESS, I WILL
TELL YOU IF YOU HAVE GUESSED MY NUMBER OR IF YOUR
GUESS IS TOO SMALL OR TOO BIG.

OK, I HAVE A NUMBER. START GUESSING.

WHAT IS YOUR GUESS? 10
TOO SMALL. TRY A LARGER NUMBER.

WHAT IS YOUR GUESS? 20
TOO SMALL. TRY A LARGER NUMBER.

WHAT IS YOUR GUESS? 30
TOO SMALL. TRY A LARGER NUMBER.

WHAT IS YOUR GUESS? 40
TOO SMALL. TRY A LARGER NUMBER.

WHAT IS YOUR GUESS? 50
TOO SMALL. TRY A LARGER NUMBER.

WHAT IS YOUR GUESS? 60
TOO SMALL. TRY A LARGER NUMBER.

WHAT IS YOUR GUESS? 70
TOO SMALL. TRY A LARGER NUMBER.

WHAT IS YOUR GUESS? 80
TOO BIG. TRY A SMALLER NUMBER.

WHAT IS YOUR GUESS? 71
TOO SMALL. TRY A LARGER NUMBER.

WHAT IS YOUR GUESS? 72
TOO SMALL. TRY A LARGER NUMBER.

WHAT IS YOUR GUESS? 73

YOU GOT IT! LET'S PLAY AGAIN."

OK, I HAVE A NUMBER. START GUESSING.

WHAT IS YOUR GUESS?
```

I played the game. Examine the results and discover my strategy. There are better strategies... Can you invent one?

I got it in 11 guesses. Not too good ... I should always be able to guess the number in at most 7 guesses. Looks like I need a new strategy.



Your turn ... carry on!

How does it work? Follow the arrows!

START HERE

```
100 REM *** NUMBER - A NUMBER GUESSING GAME
110 RANDOM
```

Keep a truckin

```
200 REM *** PRINT INSTRUCTIONS ON HOW TO PLAY
210 PRINT "I WILL THINK OF A WHOLE NUMBER BETWEEN 1 AND 100."
220 PRINT "TRY TO GUESS MY NUMBER. AFTER EACH GUESS, I WILL"
230 PRINT "TELL YOU IF YOU HAVE GUESSED MY NUMBER OR IF YOUR"
240 PRINT "GUESS IS TOO SMALL OR TOO BIG."
```

```
300 REM *** COMPUTER 'THINKS' OF A NUMBER - CALL IT X
310 LET X=INT(100*RND(0))+1
320 PRINT
330 PRINT "OK, I HAVE A NUMBER. START GUESSING."
```

```
400 REM *** HUMAN STARTS GUESSING
410 PRINT
420 PRINT "WHAT IS YOUR GUESS";
430 INPUT G
```

Computer checks the guess (G) against its number (X).

```
440 IF G=X THEN 500
```

Follow me if guess is CORRECT!

Follow me if guess is NOT correct!

```
450 IF G>X THEN 480
```

Follow me if guess is too big.

If guess was
- not right on and
- not too big, then

it must be too small

```
460 PRINT "TOO SMALL. TRY A LARGER NUMBER."
470 GO TO 410
```

```
480 PRINT "TOO BIG. TRY A SMALLER NUMBER."
490 GO TO 410
```

```
500 REM *** HUMAN HAS GUESSED THE COMPUTER'S NUMBER
510 PRINT
520 PRINT "YOU GOT IT! LET'S PLAY AGAIN."
530 PRINT
540 GO TO 300
```

Go back for a new game ... a new computer number.

Go back for a new guess.

```
999 END
```

Your turn. Modified versions of the number guessing game are suggested below. Pick one ... write the program.

MOD 1. Computer keeps track of the number of guesses and, when the human guesses the number, prints one of two possible messages. If the human guesses the number in at most seven guesses, the computer prints:

```
CONGRATULATIONS! YOU HAVE GUESSED MY NUMBER.
GOOD WORK ... YOU GOT IT IN ONLY 6 GUESSES.
```

Actual number of guesses.

If the human requires more than 7 guesses, the computer prints a message such as:

```
YOU HAVE GUESSED MY NUMBER, BUT YOU USED 9 GUESSES.
BY USING A BETTER STRATEGY, YOU SHOULD ALWAYS GUESS
THE NUMBER IN AT MOST 7 GUESSES.
```

Actual number of guesses.

MOD 2. Invent your own!

STRINGS-A MINIPRIMER

ba

Strings? `10 PRINT "MY HUMAN UNDERSTANDS ME"`

↑ This is a string. ↑

A **string** is an arbitrary string of **characters**. A Character is a letter or a digit or a space or a **special character**. Special characters are symbols such as + or * or # and so on.

In PRINT statements, strings are enclosed in quotation marks. The quotation marks are **not** part of the string. They simply mark the beginning and the end of the string.

The statement: `10 PRINT "MY HUMAN UNDERSTANDS ME"`

tells the computer to print: `MY HUMAN UNDERSTANDS ME`

The quotation marks are not printed. The string which is **enclosed** in quotation marks is printed.

A PRINT statement may contain more than one string. The strings must be separated by commas or semicolons.

```
10 PRINT "SEMICOLON";"SPACING"
99 END
RUN

SEMICOLONSPACING
```

```
10 PRINT "COMMA","SPACING"
99 END
RUN

COMMA          SPACING
```

LENGTH OF A STRING

The **length** of a string is the number of characters, **including spaces**, in the string.

```
37 PRINT "THE LENGTH OF THIS STRING IS 43 CHARACTERS."
```

The length of the string in the above PRINT statement is 43 characters. Count them . . . include spaces and the period at the end, but don't include the quotation marks. They are not part of the string.

Several strings are shown in the table below. Each string is enclosed in quotation marks and the length of each string is shown.

STRING	LENGTH
"MY HUMAN UNDERSTANDS ME"	23
"ABCDEFGHIJKLMNOPQRSTUVWXYZ"	26
"7 + 5 ="	7
"A"	1
" "	1
""	0
"DOES YOUR COMPUTER UNDERSTAND YOU?"	34

THIS MINIPRIMER IS ABOUT STRINGS FOR THE

HP 2000A *HP 2000B*
HP 2000C *HP 2000E*
HP 2000F

See page 15.

BEWARE! Even if your computer does understand string variables, their characteristics may differ from the string variables described here. If our programs don't work on your computer, ask someone to explain how string variables work (if they do) on your computer.

STRING VARIABLES

Does your computer understand string variables? They look like this:

`A$  B$  C$  D$ ... Z$`

The string variable is a **letter** followed by a **dollar sign**. The value of a string variable must be a string. Here is a program using the string variable C$.

```
10 DIM C$(30)
20 LET C$="MY HUMAN UNDERSTANDS ME"
30 PRINT C$
99 END
RUN

MY HUMAN UNDERSTANDS ME
```

The statement:

`10 DIM C$(30)`

tells the computer that the string variable C$ may have string values of up to 30 characters.

The statement:

`20 LET C$="MY HUMAN UNDERSTANDS ME"`

assigns the string MY HUMAN UNDERSTANDS ME as the value of C$. The length of this string is 23 characters which does not exceed the maximum of 30 set by Line 10.

The statement:

`30 PRINT C$`

tells the computer to print the current value of C$.

STRING INPUT

Yes, you can INPUT a string.

```
10 REM PROGRAM TO DEMONSTRATE STRING INPUT
20 DIM N$(25)          <-- N$ may have up to 25 characters.
30 PRINT "WHAT IS YOUR NAME";
40 INPUT N$
50 PRINT "YOU SAY YOUR NAME IS ";N$
99 END
RUN

WHAT IS YOUR NAME?GANDALF
YOU SAY YOUR NAME IS GANDALF
```

When we hit the (RET) key, the computer types this line.

We do not put quotation marks around our typed response to the input question mark because there is only one string variable in the INPUT statement (Line 40). If there were two or more string input variables, the string corresponding to each string variable would have to be enclosed in quotation marks and separated by a comma.

page 10 already.

Let's RUN it again.

```
RUN

WHAT IS YOUR NAME?JOHN JACOB JINGLE HEIMERSCHMIDT
BAD INPUT, RETYPE FROM ITEM 1
??
```

An error message ... too many characters in the name.

Double question mark means *try again*.

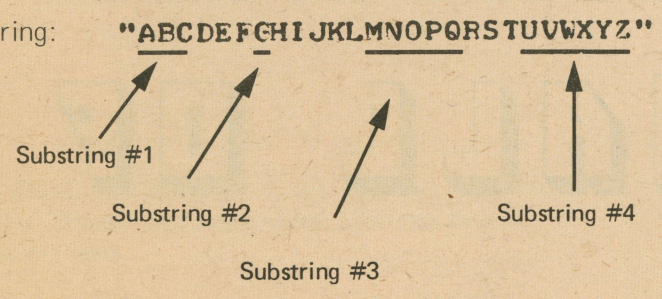
(Well, go ahead. If you are at a computer terminal enter the program, or your variation of it, and try it out!)

SUBSTRINGS

```
120 LET A$="ABCDEFGHIJKLMNOPQRSTUVWXYZ"
```

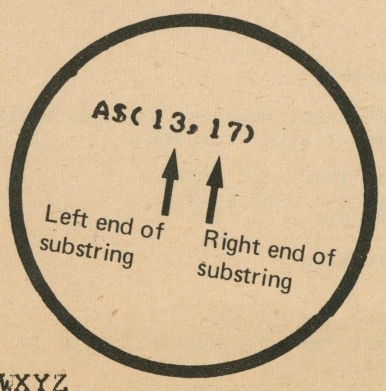
The value of A$ is a string of length 26. That is, the string has 26 characters. Number the characters in A$ from 1 to 26 beginning at the left end of the string.

A **substring** is a portion of a string. For example:



Here is a program to print the underlined substrings in the string above.

```
10 REM PROGRAM TO PRINT SUBSTRINGS
20 DIM A$(26)
30 LET A$="ABCDEFGHIJKLMNOPQRSTUVWXYZ"
40 PRINT "THE STRING IS:    ";A$
50 PRINT "SUBSTRING #1 IS: ";A$(1,3)
60 PRINT "SUBSTRING #2 IS: ";A$(7,7)
70 PRINT "SUBSTRING #3 IS: ";A$(13,17)
80 PRINT "SUBSTRING #4 IS: ";A$(21,26)
99 END
RUN
```




```
THE STRING IS:    ABCDEFGHIJKLMNOPQRSTUVWXYZ
SUBSTRING #1 IS: ABC
SUBSTRING #2 IS: G
SUBSTRING #3 IS: MNOPQ
SUBSTRING #4 IS: UVWXYZ

DONE
```

WRITE A PROGRAM TO PRINT RANDOM LETTERS.

WRITE A PROGRAM TO GENERATE & PRINT 3 LETTER "WORDS" IN WHICH THE MIDDLE LETTER IS A VOWEL AND THE FIRST AND LAST LETTERS ARE CONSONANTS.

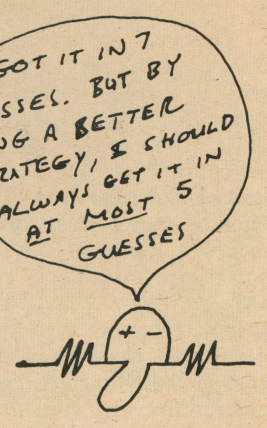
ba

letter guessing game

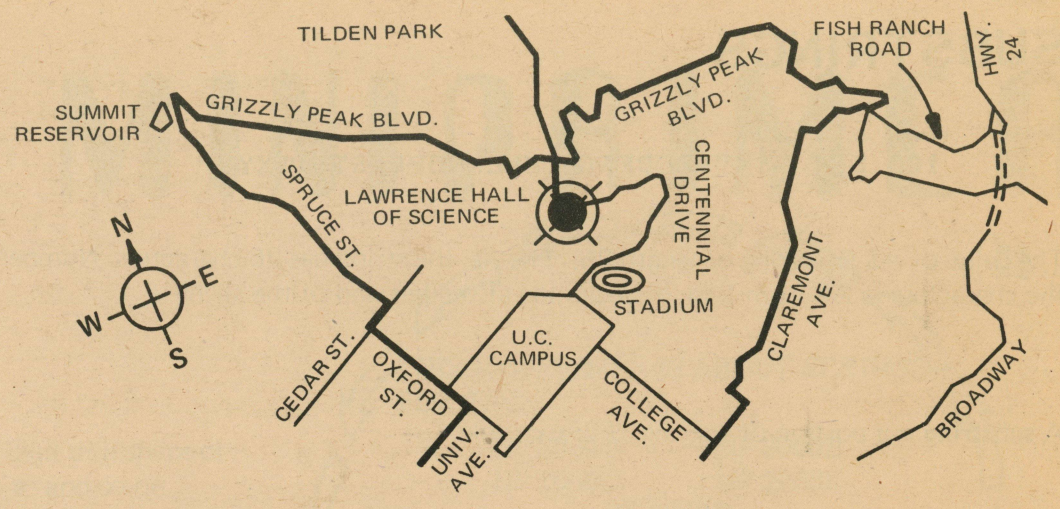
run

```
100 REM *** LETTER - A LETTER GUESSING GAME
110 DIM A$(26)
120 LET A$="ABCDEFGHIJKLMNOPQRSTUVWXYZ"

200 REM *** PRINT INSTRUCTIONS ON HOW TO PLAY
210 PRINT "I WILL THINK OF A LETTER OF THE ALPHABET, A TO Z."
220 PRINT "TRY TO GUESS MY LETTER. AFTER EACH GUESS, I WILL"
230 PRINT "TELL YOU IF YOU GUESSED MY LETTER OR IF YOUR GUESS"
240 PRINT "IS TOO HIGH OR TOO LOW. THE LOWEST LETTER IS 'A'"
250 PRINT "AND THE HIGHEST LETTER IS 'Z'."

300 REM *** COMPUTER 'THINKS' OF A LETTER - CALL IT L$
310 LET X=INT(26*RND(0))+1
320 LET L$=A$(X,X)
330 PRINT
340 PRINT "OK, I HAVE A LETTER. START GUESSING."

400 REM *** HUMAN STARTS GUESSING
410 PRINT
420 PRINT "WHAT IS YOUR GUESS";
430 INPUT G$
440 IF G$=L$ THEN 500
450 IF G$>L$ THEN 480
460 PRINT "TOO LOW. TRY A HIGHER LETTER."
470 GO TO 410
480 PRINT "TOO HIGH. TRY A LOWER LETTER."
490 GO TO 410

500 REM *** HUMAN HAS GUESSED THE COMPUTER'S LETTER
510 PRINT
520 PRINT "YOU GOT IT! LET'S PLAY AGAIN."
530 PRINT
540 GO TO 300

999 END
```

```
I WILL THINK OF A LETTER OF THE ALPHABET, A TO Z.
TRY TO GUESS MY LETTER. AFTER EACH GUESS, I WILL
TELL YOU IF YOU GUESSED MY LETTER OR IF YOUR GUESS
IS TOO HIGH OR TOO LOW. THE LOWEST LETTER IS 'A'
AND THE HIGHEST LETTER IS 'Z'.

OK, I HAVE A LETTER. START GUESSING.

WHAT IS YOUR GUESS?D
TOO LOW. TRY A HIGHER LETTER.

WHAT IS YOUR GUESS?K
TOO LOW. TRY A HIGHER LETTER.

WHAT IS YOUR GUESS?M
TOO LOW. TRY A HIGHER LETTER.

WHAT IS YOUR GUESS?R
TOO LOW. TRY A HIGHER LETTER.

WHAT IS YOUR GUESS?U
TOO HIGH. TRY A LOWER LETTER.

WHAT IS YOUR GUESS?T
TOO HIGH. TRY A LOWER LETTER.

WHAT IS YOUR GUESS?S

YOU GOT IT! LET'S PLAY AGAIN.

OK, I HAVE A LETTER. START GUESSING.

WHAT IS YOUR GUESS?
```



Beginning next issue, we will print listings of one or more Lawrence Hall of Science game playing programs (for HP 2000C) along with other news from the Hall. LHS is one of our favorite sources of computer games and one of our favorite games is BAGELS.



LAWRENCE HALL OF SCIENCE NEWSLETTER

STORE OPENING– "DISCOVERY CORNER"

Science games, puzzles, and materials will now be sold at our new "Discovery Corner," located near the reception desk on the entrance level. The primary object of the store is to make available to visitors and school groups items developed at the Lawrence Hall of Science, at a reasonable price. For those who find it difficult to come to the Hall, mail order forms will be available. For further information, please write to Discovery Corner, Lawrence Hall of Science.

NEW DISCOVERY VAN PROGRAM

A special, new van, equipped with math games, puzzles, and materials from the sciences, will carry new educational programs directly to surrounding school districts. Schools within a 100-mile radius of Berkeley who, because of finances or distance, have not been able to visit the Hall will have the opportunity to work with our staff to set up programs to fit their needs.

The development of the Discovery Van program is based on our experience with classes and in-service teacher workshops held at the Lawrence Hall over the past five years. The van will supply tools and workshop materials for classroom discovery activities. Members of our professional staff, as well as UC grad students will assist teachers in developing and using the discovery approach for lab activities. Mathematical and environmental sciences will be emphasized at the elementary level, and mathematics, environmental, physical, and computational skills at the junior and senior high levels.

Visits will vary: some schools may prefer several one-day programs, while others may wish to pursue a long-range project. The schools will be asked to purchase instructional materials for classroom use as well as provide some release teacher time for workshops in the district. Detailed information on the program can be obtained by calling 642-4193, or writing c/o Discovery Van program.

SCHOOL VISIT PROGRAM

This year an exciting program of special activities is scheduled for school groups visiting the Hall. Designed for 4th–8th graders, it will be held on Tuesdays, Wednesdays, and Thursdays, from 10 am to 2 pm. Starting the day will be a lecture-demonstration on chemistry, including suggestions for at-home experiments. Following the lecture will be workshops in biology, computer science, and physics. Activities are planned to stimulate further investigation in the students' own classrooms. The Science Playground will be open for additional demonstrations, and students will be able to purchase games, puzzles, and experiments in the new "Discovery Corner."

Since the program can accommodate only 100 students per day, reservations will be necessary. The charge will be $1/student, teachers and chaperones admitted free. For further information, call Christine Ledeux at 642-4193.

bagels

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RUN
BAGELS

WØULD YØU LIKE THE RULES?YES

I AM THINKING ØF A THREE DIGIT NUMBER.  YØU CAN GUESS WHAT
NUMBER I HAVE IN MIND AND I WILL TELL YØU:

PICØ    - ØNE DIGIT IS IN THE WRØNG PLACE
FERMI   - ØNE DIGIT IS IN THE CØRRECT PLACE
BAGELS - NØ DIGIT IS CØRRECT

ØKAY, I HAVE A NUMBER IN MIND.

GUESS # 1     :500

ØH.  I FØRGØT TØ TELL YØU THAT THE NUMBER I HAVE IN MIND
HAS NØ TWØ DIGITS THE SAME.

GUESS # 1     :567      BAGELS
GUESS # 2     :123      PICØ PICØ
GUESS # 3     :214      FERMI
GUESS # 4     :239      PICØ FERMI
GUESS # 5     :918      PICØ FERMI
GUESS # 6     :319

YØU GØT IT

AGAIN?YES

ØKAY, I HAVE A NUMBER IN MIND.

GUESS # 1     :123      BAGELS
GUESS # 2     :456      FERMI FERMI
GUESS # 3     :478      PICØ
GUESS # 4     :756      FERMI FERMI
GUESS # 5     :856

YØU GØT IT

AGAIN?YES

ØKAY, I HAVE A NUMBER IN MIND.

GUESS # 1     :789      FERMI
GUESS # 2     :712      PICØ
GUESS # 3     :185      BAGELS
GUESS # 4     :209      FERMI FERMI
GUESS # 5     :239      FERMI FERMI
GUESS # 6     :249      FERMI FERMI
GUESS # 7     :269

YØU GØT IT

AGAIN?NØ

A  3    - PØINT BAGELS BUFF
DØNE
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LAWRENCE HALL OF SCIENCE

MEMBERSHIP

LHS members receive the **Kaleidoscope**, information on special programs, and free admission to regular activities. Membership categories include: Sustaining, $100; Sponsoring, $50; Family, $15; Double, $12; Adult, $8; Student, $4; Lifetime, $1,000. Contributions are tax-deductible. Join now!

Lawrence Hall of Science
University of California
Berkeley, California, 94720
General Information (415) 642-5132

FALL COMPUTER EDUCATION PROGRAM

The LHS Computer Education Project is offering newly organized courses for its afternoon, evening and Saturday series for children and adults. Classes include game-playing, problem solving, programming, and an introduction to computers and their impact on society.

Each 80-minute class will meet once a week for eight weeks, beginning the week of October 9, 1972. The program will also be offered in the spring. Enrollment fee for each course is $35 *for LHS members.* Non-members will also be required to purchase a $15 family membership with the following exceptions:

(a) Single adults (18 and older) may purchase an adult membership for $8.

(b) UC students with current registration cards are automatically LHS members.

Respondent interests and time preferences will determine final class scheduling. For information, call **642-3134.**

Creative Play with the Computer (Course I)

A get-acquainted course designed for 8–12 year olds, although older children and adults will enjoy it. Participants will explore the computer as an artistic, creative and recreational medium: develop dialogues, stories and rhymes, draw pictures with a teletypewriter, and work with a computer-controlled musical tone box, robot, and electronic graphic plotter. Preparatory for computer programming, but does not include actual programming.

Planful Thinking and Problem Solving (Course II)

Ages 10–13 will learn skills for solving problems, ranging from mysteries and strategy games to math and science. Includes a program developed in the Psych. Dept. at UC Berkeley and a problem-oriented programming language developed at LHS.

Computer Programming in NYLON and BASIC (Course III)

Programming in NYLON and/or BASIC programming languages for writing computer-based instructional materials and dialogues, solving problems, or using the computer for creative play. One section for ages 13–18, another for college students and adults.

Computer Sophistication (Course IV)

Demonstrations, films, lectures, and hands-on activities will introduce uninitiated adults to the world of computers. Topics include, "What are computers?" and "How will they affect our future lifestyles?"

Teletype terminals will continue to be available to the public at $.50/hr. (plus LHS entrance fee) on weekends and afternoons.

WOODSHOP FACILITIES AVAILABLE

This fall teachers are invited to make science and math materials in our Woodshop. Our staff will be on hand to assist in various shop activities–cardboard carpentry, design work, use of power tools, and construction of kits.

These Saturday Open Workshops for Teachers will be held one Saturday each month from 9:30 am–4:30 pm. The first workshop will be held on October 14, and thereafter on the first Saturday of each month through February, 1973. A lab fee of $20 is required in advance. For more information or a reservation form, write to the Lawrence Hall, Workshops, or call 642-4193.

ENGINEERING BERKELEY 12

HARDWARE

EDUCATIONAL COMPUTER BUYERS GUIDE

This buying guide concerns itself with two families of computers for school use; two core-based systems available for under $20,000, from Digital Equipment Corp. and a new timeshared system, starting at $50K from Hewlett-Packard. We chose these systems and these two companies because they have the most popular systems used in education today and because of our favorable experience with the systems in question (except where noted).

As this is a newspaper, we will deal with current information, as of this writing (October, 1972). By next July, much of this information will be dated, by next October, obsolete!

There are too many minicomputer manufacturers to even keep track of, let alone write something about. HP and DEC have proven track record and have proven BASIC software to run their hardware. Future issues will discuss other companies and other HP and DEC systems.

BEWARE!

Old equipment is often difficult or expensive to maintain and/or expand and you are stuck with old software.

For each company we have noted the most current hardware available. It is our opinion that because of technological improvements and price economies brought on by new technology, you should only consider purchasing the current models. You'll save money and not inherit someone else's problems. The current models are also the easiest systems to expand and tend to have the best software.

Before you get too deep into this we must jog your minds to remind you to PLAN AHEAD. If you are planning to buy a system now and add on to it as your needs expand (and they will), you must be super cautious in choosing a system that permits expansion easily. At this writing, DEC and HP have such systems. DEC offers two different large systems expansions to further confuse the issue.

Expandability should be near the top of your list of selection guidelines.

lf

BITS, BYTES, WORDS AND OTHER JARGON

If you start digging into the technical details of minicomputers you will quickly get hung-up in an unbelievable array of jargon that is really of little concern to the mini user who will only be using BASIC. Here's a meek effort to clear up some of the confusion.

The memory of a mini is divided into words. The word length is expressed in bits. The more bits in the word, the more data or instructions can be stored in each word. The WANG 3300 has an 8 bit word, the DEC PDP8 has a 12 bit word, and DEC PDP 11, NOVA and HP mini's all have 16 bit words.

bit — *a bit is a binary digit, 0 or 1.*

byte — *a byte is a bunch of bits. For most computer systems, a byte is 8 bits. A byte can represent a binary number (0 to 255) or two decimal digits (4 bits per digit) or a teletypewriter character (A, B, C, *, +, etc.)*

word — *the memory of a computer consists of thousands of bits, organized in groups of bits called words. In a contemporary minicomputer, a word is 8, 12 or 16 bits. Typical memory capabilities of todays minicomputers are 4096 to 65536 words, in increments of 4096 or 8192 words.*

For the average school BASIC user all this doesn't mean a hill of beans. Word length is invisible to the BASIC user so whether you're using an 8 bit, 12 bit or 16 bit machine makes no difference. Is it obvious that 4096,16 bit words is more memory than 4096, 12 bit words or 4096, 8 bit words? (We think so.)

User space is normally expressed in bytes or bytes per user. A byte is usually 8 bits or ½ of a 16 bit word. For the WANG 3300, an 8 bit machine, a byte equals one whole word.

For the DEC PDP8, a byte is only 6 bits or ½ of the 12 bit word. For PDP11, NOVA and HP a byte is ½ of the 16 bit word. If you're lucky the computer supplier of your choice will tell you how much user space is available in his computer. Be sure you know if he means bytes or words ... it makes a difference.

If you're concerned about speed, circuitry and all those other goodies, then try Data General's nice little booklet called *How To Buy A Minicomputer*. It has 23 pages of factual, non-commercial information about mini's in general. They'll send it to you free and maybe it will answer your questions and clear up any further confusion.

Data General Corporation
Southboro, Mass. 01772

TTY COST SAVING TIPS

Definition: *ASR 33, is a Model 33 TTY with paper tape reader/punch*

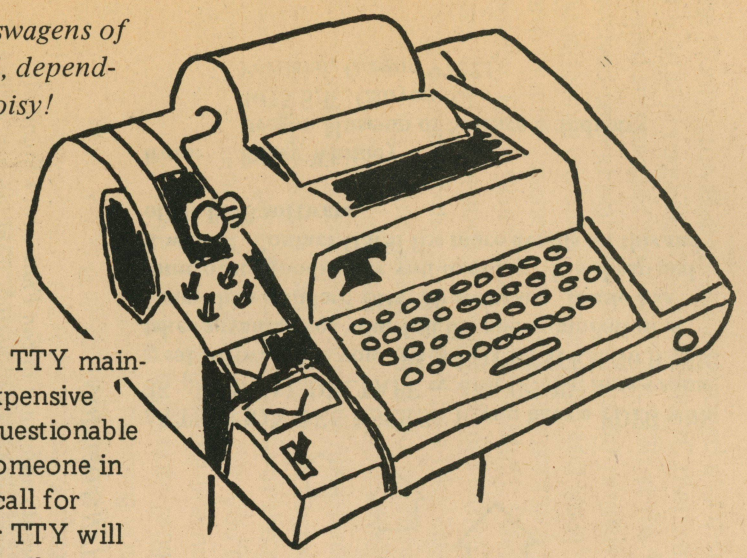
KSR 33, same but without paper tape.

Nothing can beat an ASR 33 TTY for price, performance and reliability, but buying them is a gas. One way to save lots of dollars is to buy your TTY from a different supplier than your computer vendor (DEC and HP now encourage this). This requires that your school business office prepare two bid forms, one for the computer and one for the TTY.

The reason for this is simple. TTY bought from Teletype Corporation only cost about $800 (though you may have to wait 6 to 8 months for delivery). From a computer supplier, the same TTY may run as high as $1600. In most metropolitan areas you can find 3 or 4 independent sources of TTY that will sell you a new ASR 33 for $1200 or less. They'll make any modifications necessary to make your computer and TTY compatible. Rebuilt like new models are selling today for less than $900 from these same sources. You can lease a TTY for $50 to $60 per month, including maintenance if you'd care to go that route.

Think twice before you buy KSR models. They'll save you a few dollars but at some point you'll discover you need the paper tape capability.

Teletypewriters are the Volkswagens of computer terminals ... rugged, dependable, inexpensive, ugly and noisy!



MAINTENANCE CONTRACTS. TTY maintenance contracts are absurdly expensive ($20 to $25 per month) and of questionable necessity. There's bound to be someone in your area who will come out on call for around $10 per hour or so. Your TTY will take a big beating but not big enough to justify the charge by vendors for monthly maintenance contracts.

TTY PAPER. By the roll, your local office supply dealer charges as much as $2.00 for average quality TTY paper. At that price the poor house beckons for you! Buy in case lot quantities and save a fortune. Our recent experience dropped the price to $0.98/roll for a case of 12 rolls. When we bought 6 cases (72 rolls), the price dropped to $0.73 per roll. The paper is not fancy but more than adequate for classroom use. This experience was with the brand PERFECTION, stock number 6210. Have your district office supply store order this brand for you.

PUNCH PAPER TAPE. Ditto with paper tape. $1.25 was the going price until we bought a case of 28 rolls. That brought the price down to $0.52/roll or $12.88 for the case. Brand: PERFECTION again, stock number 8219.

TTY RIBBONS. Ribbons cost about $1.00 each and constantly need replacement. One way to save money is to simply flip your used ribbon over (the print mechanism only uses the top half of the ribbon). That will double the life of the ribbon. To save BIG money go to your school business education department and ask them for any old (unused) ribbons they still have in stock for machines they no longer have. We found some Underwood ribbons that had been around for years. We had to respool them onto teletype spools (a pain) but it saved us money.

If you're buying terminals with acoustic couplers, I suggest you do NOT buy the built in couplers. Rather, buy a separate coupler that you will have to locate on the floor. The built-in couplers are too easy for some smarty to disconnect accidentally or on purpose. Separate couplers are also accessible for repair, etc.

If you have some hints for cost savings or if you can recommend a TTY supplier in your area, let us know and we'll include it in future issues.

In the San Francisco Bay Area, a source for TTY purchase, lease and/or maintenance is:

Data Terminals & Communications
P.O. Box 5583
San Jose, California 95150
(408) 378-1112

June 1972 price list tells us:

ASR 33	$49/mo. year lease	$1100 purchase
Acoustic Coupler	$14/mo.	298 purchase

They also have used and rebuilt materials at considerable savings and an excellent, cheap acoustical enclosure (an acoustical closure cuts the volume of sound down to something less than a rock band). We've had excellent experience with these people.

For those of you out there in the big, wide, wonderful world, you can always lease TTY from Western Union. Call their toll free number (800-631-7050) for more information. Model 33 ASR with acoustic coupler is $65/month.

HARDWARE

DIGITAL EQUIPMENT CORPORATION

DEC is the IBM of the mini-computer manufacturers. Their bread and butter mini, the PDP8, has sold over 15,000 units. DEC easily has more mini-computers in schools than any two of their competitors combined. They claim over 1,000,000 kids will use DEC computers this year. This is due, in part, to the companies past strong interest and pioneering effort in education which is being perpetuated today in the form of an aggressive, creative, educational marketing team. In what is becoming a highly competitive marketplace, it's nice to find people who are still sensitive to the needs of educators.

DEC's primary educational product is the EduSystem series of mini's, each designed to meet the needs of education. They are off-the-shelf system configurations that come complete, ready to plug in and use.

A nice thing about DEC is the unbelievable amount of software support material they provide or have available. Here are brief descriptions of a few.

PRESENTATION/CONVINCER KIT, $5. To help convince teachers and administrators of the need for computers, DEC has prepared a kit complete with 10 transparencies, a script, some appropriate quotations, some impressive statistics and answers to most of the questions that will be thrown at you. This kit turns you into a salesman to convert the squares within your school system. Because it's a sales pitch for DEC, we feel it should be loaned or given away, rather than making you pay $5.

BASIC APPLICATION PROGRAMS, Sets 1-4, about $1 ea. Each set contains small demonstration programs that you can use to promote computers. If you have a system, you can use these programs in your classroom. Written for math, science, business and social science by teachers and kids throughout the country.

BASIC SIMULATION PROGRAMS, Vol. I — VI. Reprints of the Huntington project programs reviewed elsewhere in this issue. Six volumes for $10.

EDU MAGAZINE, free. Contemporary educational newsletter published "whenever the mood is upon us." EDU includes a lot of tidbits, some letters to EduMan and some sales-type information from DEC. It's free, so you should get it to keep informed.

1,000,000 STUDENTS, free. A booklet from DEC that lists hundreds of educational users of DEC hardware in the country. Find out which of your neighbors have DEC computers.

DECUS. DEC users groups now have an educational subsection that provides a means for educators to exchange ideas and attend a conference with sessions just for educational users. (DECUS is free to DEC users but is open to "outsiders.")

There's lots more but that's the best of it. Get on DEC's mailing list and get the rest.

Clean out on dotted line.

TO: David Ahl
Digital Equipment Corp.
146 Main Street
Maynard, Mass. 01754

I read about DEC in the People's Computer Company. Please place my name on your mailing list to receive information about your educational computer products.

Thanks.

Name _____

School _____

Address _____

City _____ State _____ Zip _____

EDUSYSTEM 10 AND 20

If you start with Edu 10, you can expand to Edu 50 as your needs expand.

Todays central processor is the PDP8/E. The EduSystems can be configured on older versions of the PDP8 but the 8E is newest and cheapest (when new).

Prices are based on PDP8/E processors and taken from DEC's published price list. They claim these are "installed" prices. More details will follow in future issues.

EDUSYSTEM 10 — This is DEC's starter system, a 4K single terminal mini that talks in BASIC, FOCAL, FORTRAN (barely) and PAL III assembler. DEC's 4K BASIC is really quite powerful. It includes nearly all of Dartmouth BASIC except TAB and, of course, matrices. You can pick and choose which functions you want to keep operable when you load the BASIC interpreter. The fewer you choose, the more space remaining for your programs. You can also scrunch multiple statements on one line, thereby saving space, as in this example:

```
10 FOR N = 1 TO 100\PRINT N,SQR(N)\NEXT N\END
```

We guess that user space is about equal to 900 words on other systems. With a little programming imagination you'd be amazed at what can be done in those 900 words.

You can buy a 4K EduSystem 10 complete with teletype for $6960. We don't suggest you buy a 4K system unless you're really strapped for money. First reason is that for just $1410 more ($8370 total) you can have an 8K Edu 10 or an 8K Edu 20. That gives you much more storage for very little extra cost. Secondly, that 4K core plan is a dead end as far as expansion is concerned. Edu 10 will expand all the way up to Edu 50 (that's a 16 terminal system). We'll show you how and how much in future issues.

EDUSYSTEM 20 — Edu 20 is the bread and butter system for a larger school. DEC claims this 8K system handles up to 8 terminals timesharing in BASIC. Or, you can run a single terminal in FORTRAN or PAL III assembler. (FORTRAN on a core-based mini is ludicrous!) The BASIC software is Dartmouth BASIC (without matrices) including TAB, ON...GO TO and RANDOMIZE features.

We've had plenty of experience with this little system and have the following STRONG recommendations:

- An 8K Edu 20 cannot support more than two users. There just isn't enough space for more.
- If you plan to run three or four users, get the 16K, Edu 20 (16K is a much better buy than 12K).
- If you want more than four users or if you want still more space, add a disk and make your system an Edu 25. It's the best way to increase capacity and space. (We'll have some nitty-gritty expansion details in the next issue.)

DEC is trying to sell computers, not TTY, therefore pricing this system is difficult. But here goes.

Edu 20, single user		
8K including 1 TTY		$8370
Edu 20, 2 user		
8K including 1 TTY	$8370	
1 TTY interface	300	
1 TTY (DEC)	1620	
TOTAL		$10290
Edu 20, 3 user		
16K including 1 TTY	$12270	
2 TTY interface	600	
2 TTY (DEC)	3240	
TOTAL		$16110
Edu 20, 4 user		
16K including 1 TTY	$12270	
3 TTY interface	900	
3 TTY (DEC)	4860	
TOTAL		$18030

For each terminal you need a $300 interface. DEC charges $1620 for the teletype alone. Moral: Buy your teletype from a local source. (Caution: DEC systems require a $100 modification on a standard TTY before it will run on a DEC computer.)

Below is a handy chart that shows you approximately how many BASIC statements (at 25 characters per statement) you can run at each terminal of an EduSystem 20 for various configurations of memory size and number of terminals in operation. These are *required* user allocations. You have NO control over how much space each user gets (like you can on a Data General NOVA). Why? Who knows?

MEMORY SIZE: NUMBER OF USERS		8K	12K	16K
1	USER 1	147	158	158
2	USER 1	71	158	158
	USER 2	71	146	158
3	USER 1	~~45~~	77	158
	USER 2	~~45~~	77	158
	USER 3	~~45~~	144	144
4	USER 1	~~32~~	77	77
	USER 2	~~32~~	77	77
	USER 3	~~32~~	69	158
	USER 4	~~32~~	69	142

We crossed these off as being completely impractical.

The Edu 20 ref. manual lists additional info for 24K and 28K. But we stopped at 16K because we feel it is better to go to a DECDISK or DECTAPE system than to continue to add core. We will go into more detail next issue, especially about $$$ and how to expand at least cost.

Hey DEC, I'd rather do it myself! And if I could, I'd allocate small programming space to two terminals for beginners, and give one lots of space so I could run some of those great Huntington Project programs you provide. The way it is now, it's impossible to squeeze most of them in. For example, I might like my 3 terminal, 16K system to look like this:

USER 1	40	Beginners learning BASIC.
USER 2	100	Running large programs.
USER 3	320	BIG programs (e.g. Huntington).

ATTENTION DEC USERS: If you have a PDP8 with 8K plus DUAL DECTAPE or disk (PS/8), here's some great software for you. PS/8 EDUSYSTEM 30 BASIC takes advantage or your full 8K and compilation is faster than standard EDU 30 software. It aslo has some other goodies for you to enjoy. It's cheap and it works! Contact OMSI for more details on this and other PS/8 software.

from: Rusty Whitney
Oregon Museum of Science & Industry
4015 S.W. Canyon Rd.
Portland, Oregon 97221

ONE MAN'S OPINION

At a recent conference in San Francisco, I found myself answering the same question from teachers all day long. So, I thought I'd commit my response to writing and if you'd care to respond, do so and it will appear in a later issue of PCC.

The problem presented was: How can I get the money for hardware or how can I get more money to increase the system we have? The situation is the same and therefore my response is the same to each question.

YOU HAVE TO GET THE ENTIRE SCHOOL INVOLVED IN YOUR COMPUTER EDUCATION PROGRAM! If you set up a program that is limited to math students or you set up all sorts of fancy prerequisites so that only a limited number of students use your computer, then you cannot expect support or more money from anyone but the few people who use the system. Even if every math student in school uses the computer at some time during the year, only you and he know it and he can't do you much good when it comes to promoting more money.

You have to get out of the math problem-solving syndrome (that's what I call it) and try to get as many other people involved with your computer as possible. The science department is the first logical choice. The Huntington Project computer programs (see page 3) make it easy for any science teacher to get involved with a computer. These programs cover a wide range of science topics and are available, ready to run on most educational computer systems. The business department is the next logical user. I'm a business teacher and I'm not convinced that you'll find much support there, but look anyway for the one person who is teaching data processing or is interested in teaching it. Social studies teachers have an inherent disdain for computers but you can probably find one who is into gaming or simulations who would enjoy having his students do a simple economic simulation or simply play a computer game. The resources are available from HP and DEC. All you need to do is get them and use them.

Some schools have done some far out things like scouting football games for the athletic department using the computer. Some have done work in English on a very basic level. There are even things that can be done with home economics and art. One easy thing to do for anyone, is the tabulation of surveys or correcting tests, if you want to get into that.

The important thing is you have to get others involved. You'll break your fanny doing it, but if you want to get more than a one terminal minimum system you are going to have to substantiate your need. You can't substantiate a need if only the math department is using the computer.

Finis LF

HARDWARE

HEWLETT PACKARD

HP is the other Big One in the ed biz. While DEC's emphasis has been in small system installations, HP's strength has been in 8, 16 and 32 user timesharing systems. The HP 2000 series timesharing systems start at $50K and zoom to $150K before you know it. They offer reliability and have a great track record in education. The 2000 series has been around since 1968. In our experience the HP 2000 hardware and software combination has been the most reliable timesharing system we've ever used. A number of small timesharing services in our area sell time on HP 2000's for under $5 per hour. We have had nothing but excellent experience dealing with these sources over regular telephone lines, using acoustically coupled terminals. If you use telephone communications you know how messy it can be. We've had excellent luck with HP. Some of these little businesses leave their systems unattended as they're so confident of their reliability.

The latest central processor from HP is the 2100A. The older model for the 2000 series is the 2116 which you can pick up used at reasonable prices, but if you plant to expand, buy the 2100.

HP's BASIC includes matrix operations, logical operators (AND, OR, NOT) and string functions and operations. (Strings? See Pages 10 and 11.) HP has also added a few goodie features to their software which make it awfully nice. The software has been around for years and is essentially bug free. The 2000 also runs batch FORTRAN IV, ALGOL and assembler.

For some years HP has been selling CAI drill and practice software for their large timesharing system. Only recently have they put any real dollars and sense into the problem-solving market. Primarily, this effort is represented by the HP Educational User's Group, their newsletter and a semi-annual journal. The users group has an executive board of educators who represent all types of users and are dispersed geographically. They are mostly HP users, as you might suspect. Admission to the users group is free to HP users and $15 per year for "outsiders."

The HP Educational Users Group Newsletter is GOOD and is worth every penny of the $15 you might have to pay for it. The newsletter includes articles contributed by users on the order of ... this is about what we are doing ... project information ... what others are doing as described by the editor ... descriptions of computer education organizations ... workbook and textbook reviews ... where to get-types of info (tidbits) ... and of course, the inevitable sales pitch for new HP educational products. This is the first quality newsletter that meets the needs of the classroom computer education teacher, that we have seen. It's success is largely due to the effort that is made to provide good, factual information for classroom teachers without trying to kill 10 other birds with the same stone. (Now that we've said it, let's hope they keep it up!)

HP also has a fantastic program library of BASIC application programs for every possible application. Most are contributed by users. The educational user group has their own education program library available free to members of the Education Users Group.

TO: Ed McCracken
Hewlett-Packard Company
11000 Wolfe Road
Cupertino, Calif. 95014

I read about HP in the People's Computer Company. Please place my name on your mailing list to receive information about your educational computer products.

Thanks.

Name_____
School _____
Address _____
City _____ State _____ Zip _____

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CRASH? When the computer dies, requiring you to attend to the malady and start it up again.

DOSM? Disk Operating System for cartridge disk system. Controls the operation of the computer for batch processing.

2000 SERIES HARDWARE

The 2000 A, B & C are the disk or drum storage versions of the 2000 series. The 2000A is the original timeshare BASIC system. The B and C are bigger versions of same. The 2000E and F are cartridge disc models that are brand new. The differences in the BASIC software of each system are minor. We place most of the software improvements on the 2000 C in the category of "luxury" items. Hardware differences between the models are mainly found in the amount of storage available and the number and type of terminals the system will drive. Under DOS, HP 2000 software includes FORTRAN IV, ALGOL and assembler.

HP 2000E — Had we gone to press 6 months ago, this description would have been found under the heading of "Science Fiction." But now we are pleased to report the latest addition to the HP 2000 series, the 2000E, is alive and well!

The 2000E is the low price ($50,000) latest technology, replacement for the 2000A. It features a 16K CUP and HP's new 5 million byte cartridge disk. This new disk has two platters. One (2½ million bytes) is a removable disk pack which offers all sorts of possibilities. One nice aspect of the removable disk pack is that it allows you to keep a copy of your entire "system" so that in case of a crash, you can reload in seconds. You don't need a magnetic tape unit for the 2000E. The E also has a hardware multiplexer and uses HP's floating point hardware. Contrary to competitive rumors, the E is not a slow system ... we've been on with 6 other users and have not noticed any appreciable delay. We're also impressed with the reliability of this early version of 2000E software. It's not perfect but no bad crash-bugs have shown up yet. (Yet!)

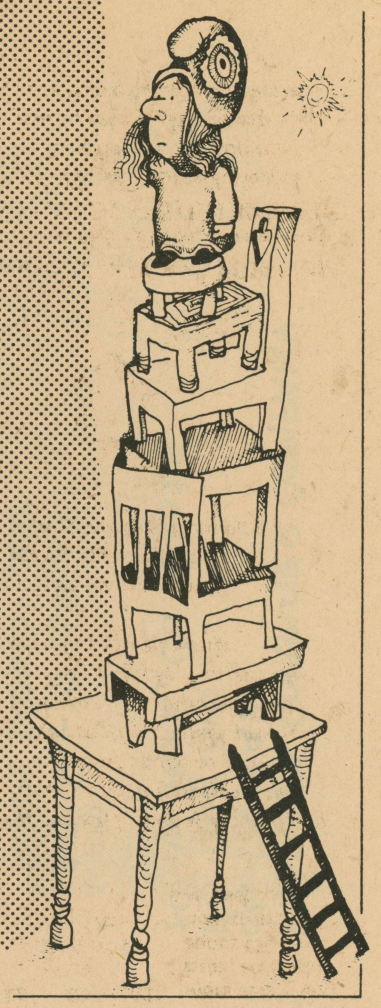
The 2000E drives 16 terminals at 10 to 30 CPS (rumor has the speed up to 240 CPS). The BASIC is standard HP 2000 BASIC without any bells or whistles (they didn't include ENTER for some dumb reason). CHAIN and COMMON are available and necessary as user space is only 4180 words. It's our opinion that this system, software and hardware, will adequately meet the needs of most any school of district.

Our local district runs the E as a timesharing classroom system each day and runs a batch FORTRAN application under DOSM each evening. So far, we have heard few complaints.

16K processor
5 million bytes cartridge disk
16 terminals (10 to 30 CPS)
$50,000 plus terminals

DARTMOUTH BASIC	Edusystem 10	Edusystem 20	Hewlett-Packard 2000E
LET, PRINT, READ, DATA, GO TO, IF-THEN, FOR-NEXT, GOSUB, RETURN, INPUT, REM, END, DEF, DIM, STOP, RESTORE	✓	✓	✓
RND, SGN, SIN, COS, TAN, ATN, SQR, LOG, EXP, INT, ABS	✓	✓	✓
ON...GO TO, TAB		✓	✓
CHAIN, COMMON			✓
MATRIX			✓
STRING VARIABLES			✓
FILES			✓
PRINT USING			
ENTER			

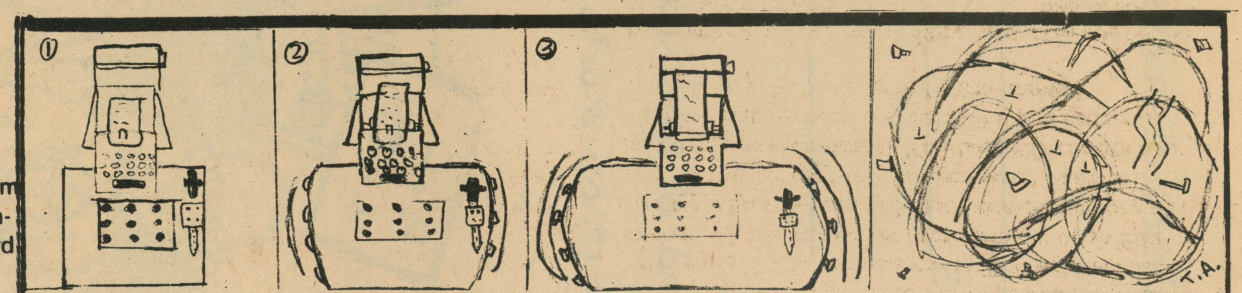
Note: This chart compares the software for two systems that sell for less than $20,000 with a system that starts at $50,000. For more $$$ you get enriched software!



HP 3000 — At press time, HP is awaiting it's first delivery of the HP System 3000. If it does what is promised, this system may revolutionize the industry. The 3000 is a multiprogramming system that runs simultaneously in timeshare BASIC, FORTRAN and SPL, (HP's newest language). Users can be running in batch, on-line terminal or real time modes at the same time. Sounds fantastic! Prices start at $124K. We're looking forward to more information on this one (maybe next issue).

If you disagree with what we say or if you would care to contribute your comments to the next issue, please write. We're interested in creating an exchange of information through PCC. Your experience and opinions may be helpful to others who confront similar situations and decisions.

lpf



Art: Tom Albrecht, age 14.

Moral: Be sure you buy a system that is expandable and will meet your future needs.

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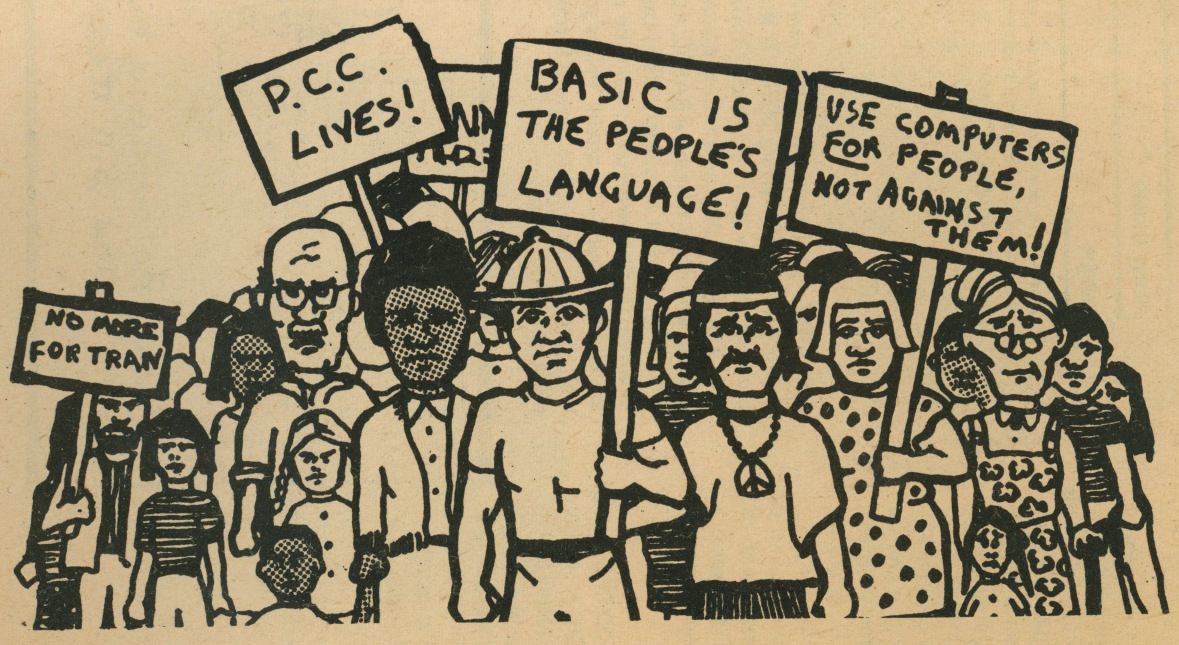

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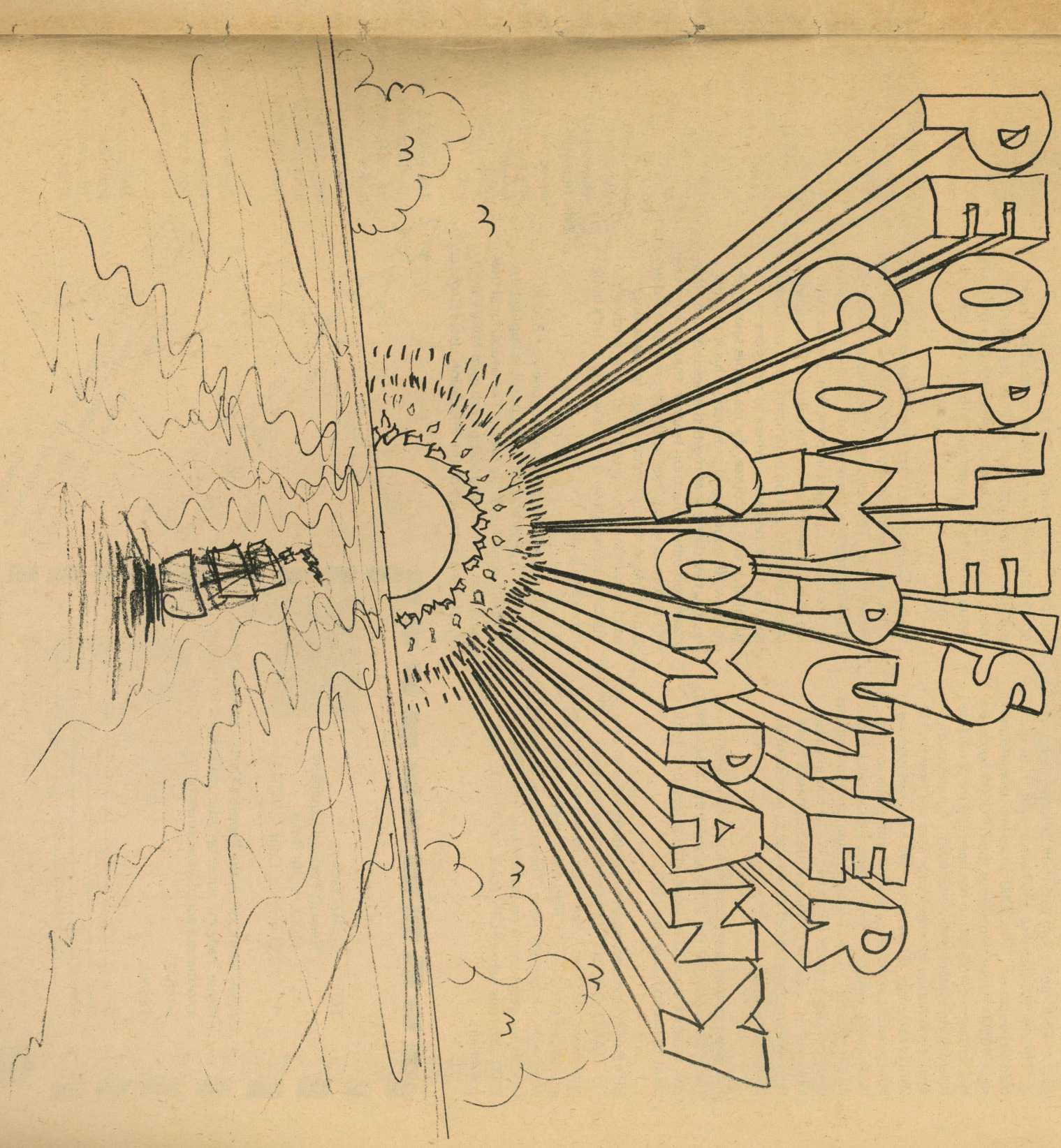

Computers are mostly
used against people instead of for people
used to control people instead of to free them
time to change all that —
we need a ...