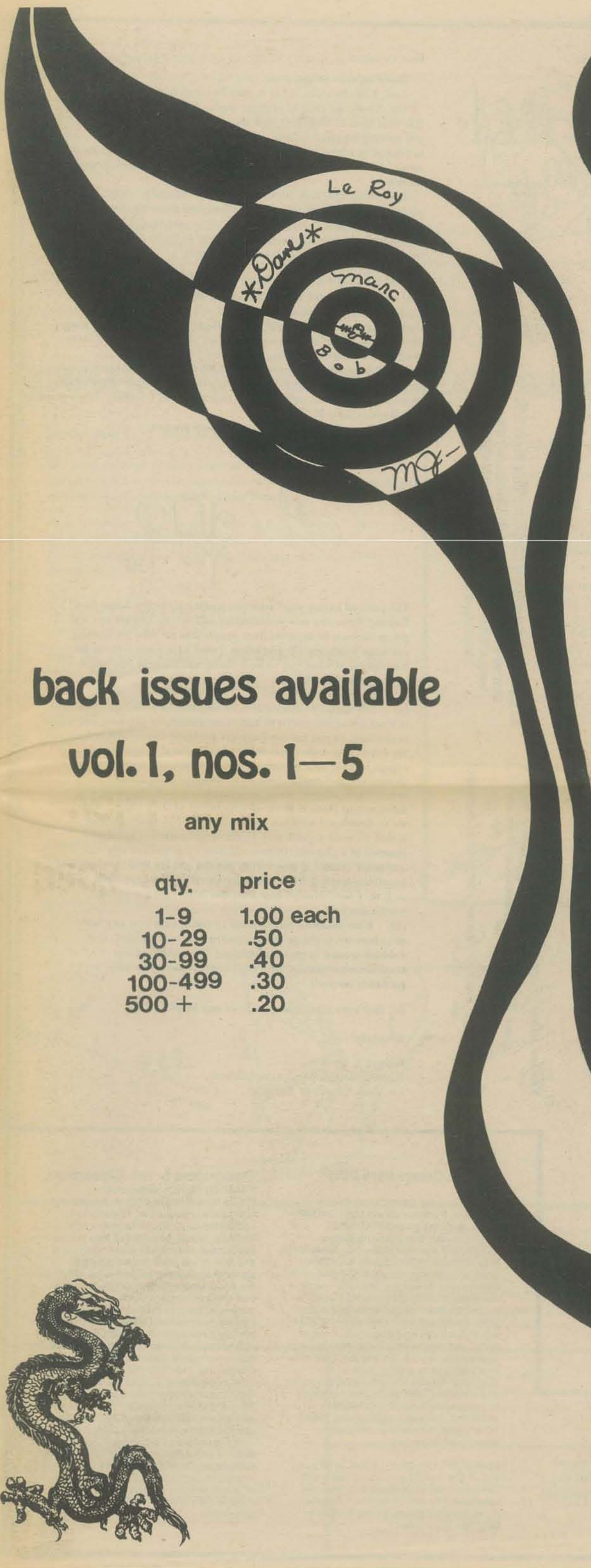

PCC

1/2 PRICE

If you are an elementary or secondary school student, you can subscribe to PCC for ½ price ($2 for 5 issues). Send us some evidence that you are a student – for example, a letter from a teacher on your school's letterhead is O.K.

Send check or money order to:
PEOPLE'S COMPUTER COMPANY
P.O. Box 310, Menlo Park, Ca. 94025

name_____

address_____

_____ zip

school_____

- ☐ regular subscription
- ☐ student subscription
- ☐ back issues (any mix)

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Single subscriptions – $4 for 5 issues [$5 outside U.S.A.]. Group subscriptions, mailed all to the same address –

10 or more	$3.00 each
30 or more	$2.50 each
100 or more	$2.00 each

back issues available

vol. 1, nos. 1–5

any mix

qty.	price
1-9	1.00 each
10-29	.50
30-99	.40
100-499	.30
500 +	.20

Dear P.C.C.,

Dear PCC,

A friend and I have a small people's computer project underway in Los Angeles. We currently have one teletype installed in a public grammar school and are using an HP 2000 at the University of Southern California. The terminal is used for play and denystification (for teachers as well as kids) and some "teaching." We are trying to involve teachers and kids in inventing new programs.

We recently got 3 more teletypes which we want to place in the Venice Community. One will be in the public library, one in a free school and the third in public school classroom. The library location is unlike the schools in that it is a community center and we hope to have individuals and organizations in the community using the machine in addition to school children.

While we have access to an HP 2000, we are having difficulty with phone costs. It turns out that we need $41 per month per terminal if we are to call from Venice to the computer; and even with free people, teletypes and time, $41 is hard to come up with. If any PCC reader knows of a mini computer which is gathering dust in some corporate backroom, we would certainly be open to a contribution or perhaps could trade services (programming, software design, yoga lessons, etc.) for hardware.

We would like to get in touch with others in the LA area who share our interests even if they don't know of any dusty PDP8's.

Sincerely,

Larry Press
128 Park Pl
Venice Ca. 90291

Dear Bob:

What can you tell me about the People's Computer Center? How is it organized? How big is it? What does it cost to run? What talent is on your staff and what is hired? How are you organized; are you a profit-making corporation or not-for-profit? Part of another corporation or company, or part of an educational enterprise? How many terminals are you running on the Edu System 20? What's the population base within commuting distance of the computer center?

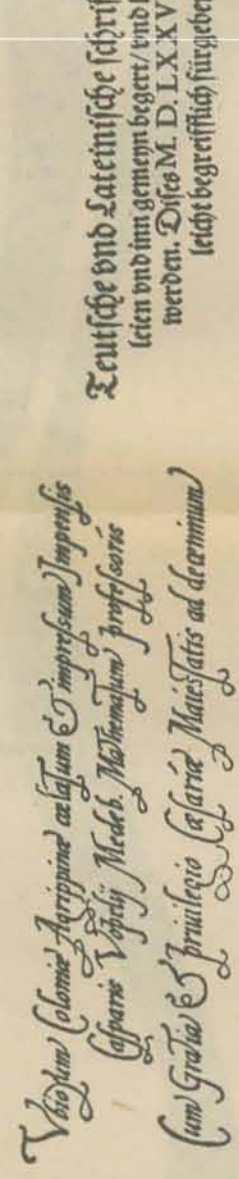
I think the People's Computer Center sounds both worthwhile and fun and we might like to start one here if we had a little guidance. We had also in mind to offer low cost time share services by using a small computer and offering line connect time at very low rates within the local telephone calling area. Let us know if you have any experience with this kind of time share. I realize these questions are not very structured, but I don't yet have enough information about your operation to ask questions in an orderly fashion. At this point, the best I can do is ask you to tell me what you did and how and why.

Please let me hear from you soon, as I really wish this microphone were on a telephone and not a dictator.

Sincerely,

Kirtland H. Olson, P.E.
The Harvard Group

OK, next issue we will start answering some of these questions. AND . . . who else wants to start a People's Computer Center?



Dear People:

God damn the pusher man.

And, while he's (she's?) at it, may he (she) damn the two of you.

For the second time in as many weeks, I came down to see y'all (the first time to Berkeley) with the intention of doing interviews and putting together some kind of story on you, the PCC, computers in general or wherever my notes and interviews led me. And for the second time in two weeks I was seduced by those damned game-playing machines!

Bob set up Star Trek for me at 5:30 of a Thursday night, and I planned to play until seven, after he returned from dinner. Did he ever come back? I don't know, truthfully. The next thing I remember is that somebody tapped me on the shoulder at 12:30 AM the following morning and told me it was time to go home.

SEVEN HOURS!!!!!!!!!!!!!!!!!!!!

Not that it wasn't fun. Not that it wasn't an absolute ball, and not that I didn't wipe out 17 Klingons in 30 stardates and keep my 4 starbases intact (warmonger that I am), it's just that I still haven't done my interviews and I still have nothing to tell an editor beyong that I spent a total of 28 hours so far just playing games with those seductive machines. This has got to stop.

I will, in fact, be back one of these days (after calling first) to talk to the two of you about PCC. That is, after I can figure out a way to inure myself fromthe seductive call of a clattering teletype. Mugwumps and Hurkles indeed!

In the meantime, may you live long and prosper.

Sincerely,

Rick Beban
999 END

The price of having your activities written up in the Simulation/Gaming/News as a new contributing editor may be that you will get an increase in requests from people like me who are looking for some assistance. Nevertheless, I read with some interest the description of what you've been doing and thought you might be the person to ask.

What I'm looking for is:

(a) The names of some games or simulations which teach or at least introduce people to basic components of planning and in our case, as you can see from the enclosed description, we are developing some approaches whereby local congregations engage in their own planning, submit certain information about themselves, and receive back a computer assisted list of resources – persons, media, and events – which should be of assistance to them in the implementation of their plans. What we've discovered with our initial round of 175 congregations is that we need a quick way to introduce some of the components of a planning/implementation cycle particularly computer assisted if possible, to pastors and lay leaders who are either deciding if they're going to use such an approach or if they have decided how they can better get a grasp on what's involved.

(b) If no names of games come to mind, have you any clues as to how we might go about constructing such games? I've dabbled around in games a little and have attended one conference on simulation – so, I know some of the basic ingredients involved.

So, that's my story; can you be of any help?

Sincerely,

Robert N. Bacher
Project Manager for Action Research
Lutheran Church in America

I sent some info – anyone out there got some more? ba

Some of us PCC people teach courses at University of California Extension. Here are descriptions and schedules and stuff –

Games Computers Play

X 407 (2)

Spend a weekend matching wits with a computer. Participants will play: CHOMP—a cookie-eating game; STARS and BAGELS—number-guessing games; MUGWAMP and HURKLE—two-dimensional hide and seek; ABAGEL and HANGMAN—word-guessing games; QUBIC—three-dimensional tic-tac-toe; MARKET—a two-company product competition; POLICY—try to influence national economic policy; LUNAR—try to land on the moon; POLUT—experiment with a polluted lake, river, or pond; and many more. If you want to learn to program, you can do that too, then write your own games and try them on the computer. Games are simulation programs, and simulation and games are becoming important functions of computers in education, business, politics, and many other areas. No previous computer experience necessary.

BERKELEY: Oct. 20–21; 9 a.m. to 10 p.m., Sat.; 9 a.m. to 6:30 p.m., Sun.; room 120, Lawrence Hall of Science; $75, includes computer time and all required materials. If you have questions, please telephone 642-1061 in Berkeley.

Computers in the Classroom

X 402A (2) (Computer Science)

A "hands-on" introduction to the use of computers in education. The course is conducted as an open classroom with learning centers designed to help participants teach themselves about computers and how to use them in mathematics, science, social science, business, or just for fun. Multi-Media Center: general information about computers, instructional materials, sources of information, projects, funding. Instructional Materials Center: copies of materials in current use from publishers, computer manufacturers, educational projects. Learn to Program Center: use of BASIC (the most commonly used computer language in schools) or PILOT (a new easy-to-learn language). Games and Simulation Center: match wits with a computer; games of skill, games of chance, games to learn by, simulation, computer-assisted instruction. Discussion session and mini-lectures are conducted on demand and include whatever topics are of interest to participants. The course spans all grade levels—elementary, secondary, college. No previous computer experience is required.

COMPUTERLAND FOR TIME TRAVELERS: A Computer Fair

Take a trip into your own future, Thursday thru Sunday, September 20–23, 9–5

At Lawrence Hall of Science
Computer games, computer music, computer art, Star Trek, Spacewar, talk to Eliza
Workshops – learn to program, design a computer circuit . . .

Lots of computers to play with
Mini-seminars. Real-life experts will show how computers work and what they do

Thursday and Friday are for school groups, students and teachers – bring a bunch from your school! Saturday and Sunday are for everyone.

University Extension will offer a credit course in connection with the fair, focusing on the computer as an educational resource. How to obtain computers for use in the schools and how to make knowledgeable decisions about computer systems are among the topics to be covered. A course meeting on Saturday morning, Sept. 22, and a post-session on Thursday evening, October 4, are planned.

For more info, contact University Extension, 2223 Fulton St., Berkeley, CA., 94720.

people's computer center info

Curious about PCC? Come on Thursday nite – it's FREE!

This is get to know us nite. Come on Thursday nites (7–9 PM) and play computer games, rap about computers in the classroom or computers for people or bring your own topic!

Do-it-yourself-hands-on-courses. Sign up for a "course." Play computer games or learn BASIC or both or ??? 6 times . . . 2 hours each time . . . $20. Arrange your own schedule. Here are the possibilities –

Tuesday 1 – 3 PM
Wednesday 1 – 3 PM or 3 – 5 PM
Thursday 1 – 3 PM or 3 – 5 PM

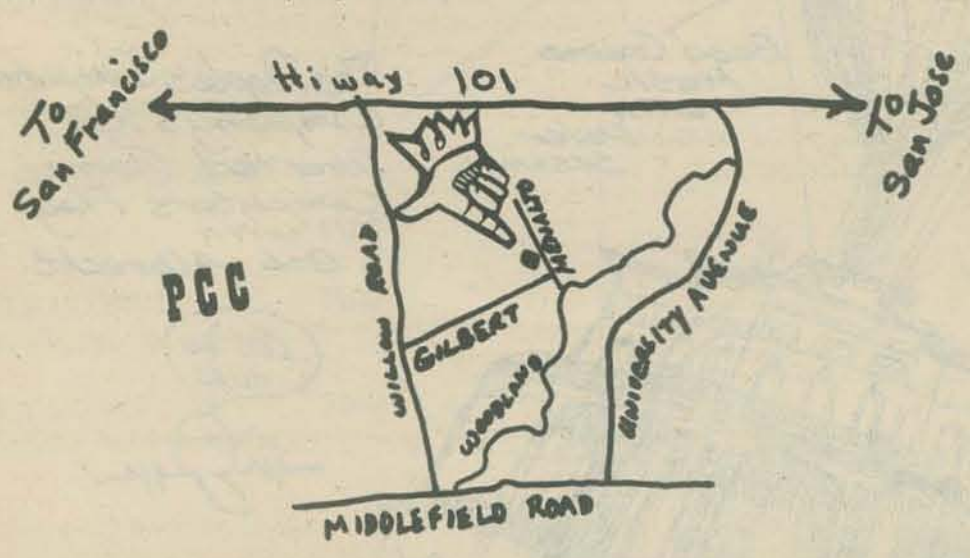
Come once a week for 6 weeks or twice a week for 3 weeks or whatever schedule you like.

Liberate some kids from school! We'll set up special courses for students from your school. Bring em by bus or carpool or bicycle brigade.

Or sign up for the "Dave Show" described elsewhere on this page. This is a course for people who are serious about learning how to program (in BASIC).

Or just buy computer time and do your own thing – play games, learn BASIC, design your own games, zap out math homework . . . Younger people pay less than older people. From $1 per hour to $2 per hour depending on age and other variables.

WANT MORE INFO? CALL (415)323-6117



FIRST INTERNATIONAL CONVENTION ON OPTIONS IN PUBLIC EDUCATION

The Myths and the Realities of Alternative Public Schools

October 4 – 6, 1973
Minneapolis, Minnesota
Sponsored by the National Consortium for Options in Public Education
Choose from Six Alternative Programs
- *Alternative Schools in Action*
- *The Politics of Change: Making Schools More Responsive to Community Needs*
- *Lifelong Learning Options: Alternative Futures for Public Education*
- *Starting Alternative Schools: Why and How*
- *New Designs for Learning: Roles, Processes, Resources*
- *New Evaluation for New Schools*

Plus Preconvention Activities, October 2–3, including visits to alternative schools

For Information School **ICOPE School of Education 328**
Indiana University, Bloomington, Indiana 47401

3

PCC's BASIC Programming Course (The Dave Show)

Here's your chance to learn BASIC, the most common educational computer language going. The course will meet once a week, for 10 weeks beginning sometime in September (probably Sept. 18, Call us for more info)

We will probably offer two "sections", one in the afternoon and one in the evening, depending on how many of you sign up.

Each week we will –

- Present a few BASIC *commands* for you to experiment with.
- Show you some programming *techniques* to get your ideas flowing.
- Propose some *problems* (especially games to program) for you to work on if you wish.
- Help you to plan and write program of your own choosing.

There will be NO regular textbook, but –

- We'll Xerox our class presentations for distribution.
- We'll recommend "supplementary" study material on an individual basis. We have a good library of materials right here at PCC.
- Getting your hands on the computer is the best way to learn, anyway. We have four terminals, plugged into two different computers, for you to use.

Instructor – Dave Kaufman
Other PCC staff
Occasional guest appearances

How to enroll for the course – CALL or WRITE

Dave or Mary Jo
People's Computer Center
1921 Menalto Avenue
Menlo Park, CA. 94025
323-6117

Enrollment for any one section (afternoon or evening) will be limited to 10 people maximum. We'll have the details of time worked out by June 1, hopefully, and we'll let everyone know.

RSVP now! Make it easy on us . . . . One more thing, we almost forgot –

Cost – $30 each person for the series. This covers materials, computer time, and instructors' fees.

WORKSHOPS
Starting soon – one day workshop for teachers and learners.

"Computer Critters" Teach someone to program using INCHWORM, LADYBUG and other COMPUTER CRITERS. Expecially designed to show how the concepts of computer programming can be taught to very young children. Best of a all, you don't even need a computer!

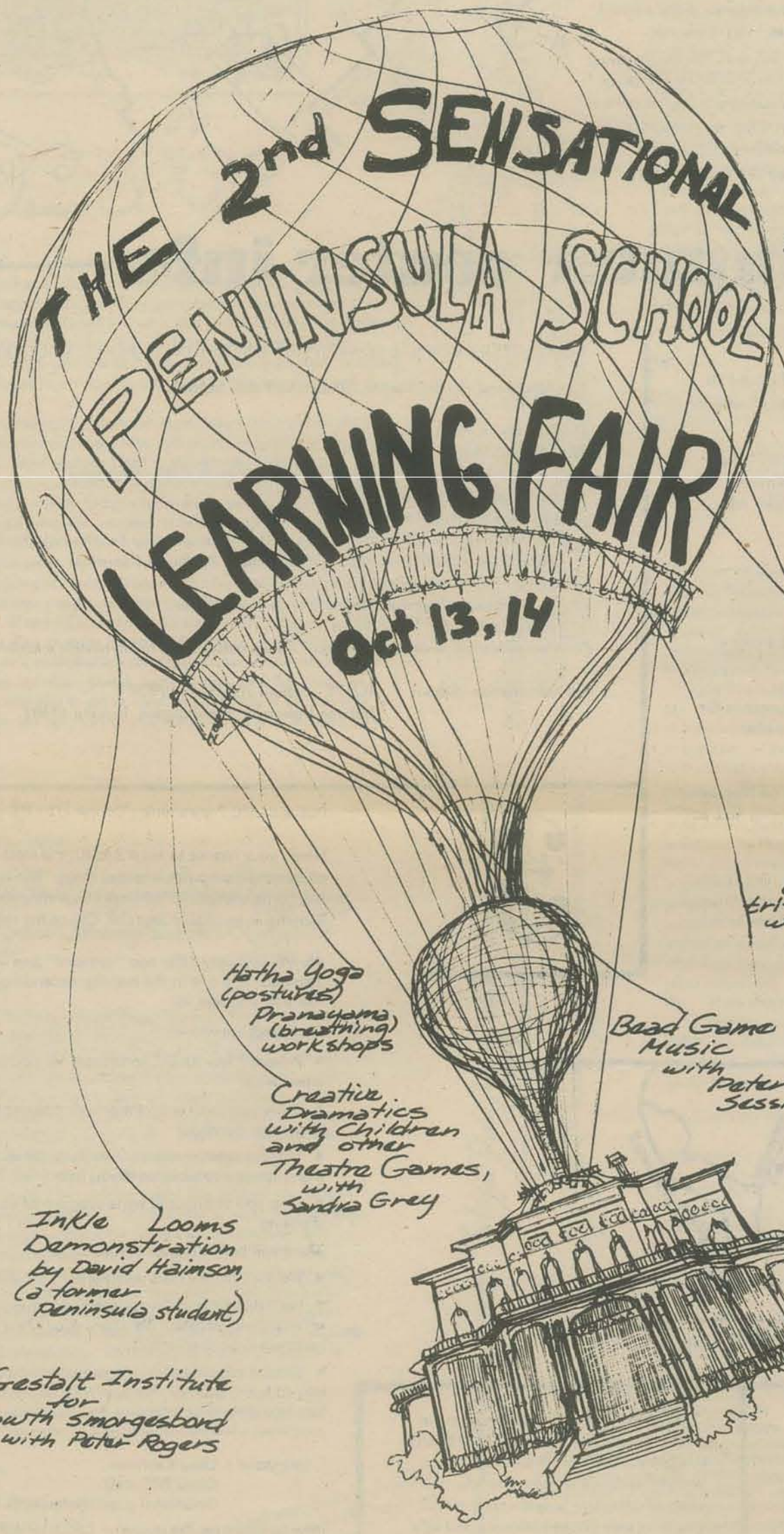
"Math Games – Games to Learn Math from First Grade Up" Number, Stars, Trap, Bagels, Hurkel, Mugwump, Snark, Qubic, Caves, Wumpus, and Reverse. Match wits with a computer, with another person, with yourself. These mini-courses involve you in game playing with computers and people.

This space reserved for workshops not yet invented. Would you like to invent one? or suggest one for us to invent?

We will probably start these workshops in October. For info, call us at 323-6117 or write to PCC, P.O. Drawer 310, Menlo Park, CA. 94025

If you were sorry you missed it when you read about it in the Saturday Review . . . REMEMBER October 13th and 14th when

THE 2ND SENSATIONAL PENINSULA SCHOOL LEARNING FAIR*
happens between 10:00 and 5:00 at Peninsula School, Peninsula Way, Menlo Park (Bayshore freeway to Willow Road exit and follow the signs.)



What is a LEARNING FAIR?*

A Joyous coming together of people young and old in multitudinous learning-by-doing trips

such as:

Sunflower Source tri-wall carpentry with Mike Young

Hatha Yoga (postures) Pranayama (breathing) workshops

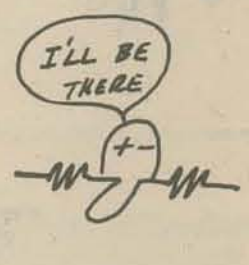
Band Game Music with Peter Sessions

The People's Computer Company's Kid-Directed Games Computer's Play, with Bob Albrecht

Creative Dramatics with Children and other Theatre Games, with Sandra Grey

Inkle Looms Demonstration by David Haimson, (a former Peninsula student)

Gestalt Institute for Growth Smorgesbord with Peter Rogers



These are just a few of our participators, which will include far-reaching crafts for everyone to do; good food; Greek folk dancing and much much more.

COME TOGETHER AS PARTICIPATORS/INNOVATORS
space available to others who want to present Learning Experiences.

*LEARNING FAIR by Susan Sands SATURDAY REVIEW EDUCATION JANUARY, 1975

BUY YOUR TV SET SOMETHING NICE, LIKE A COMPUTER

or

BUY A BRAIN FOR YOUR BOOB TUBE

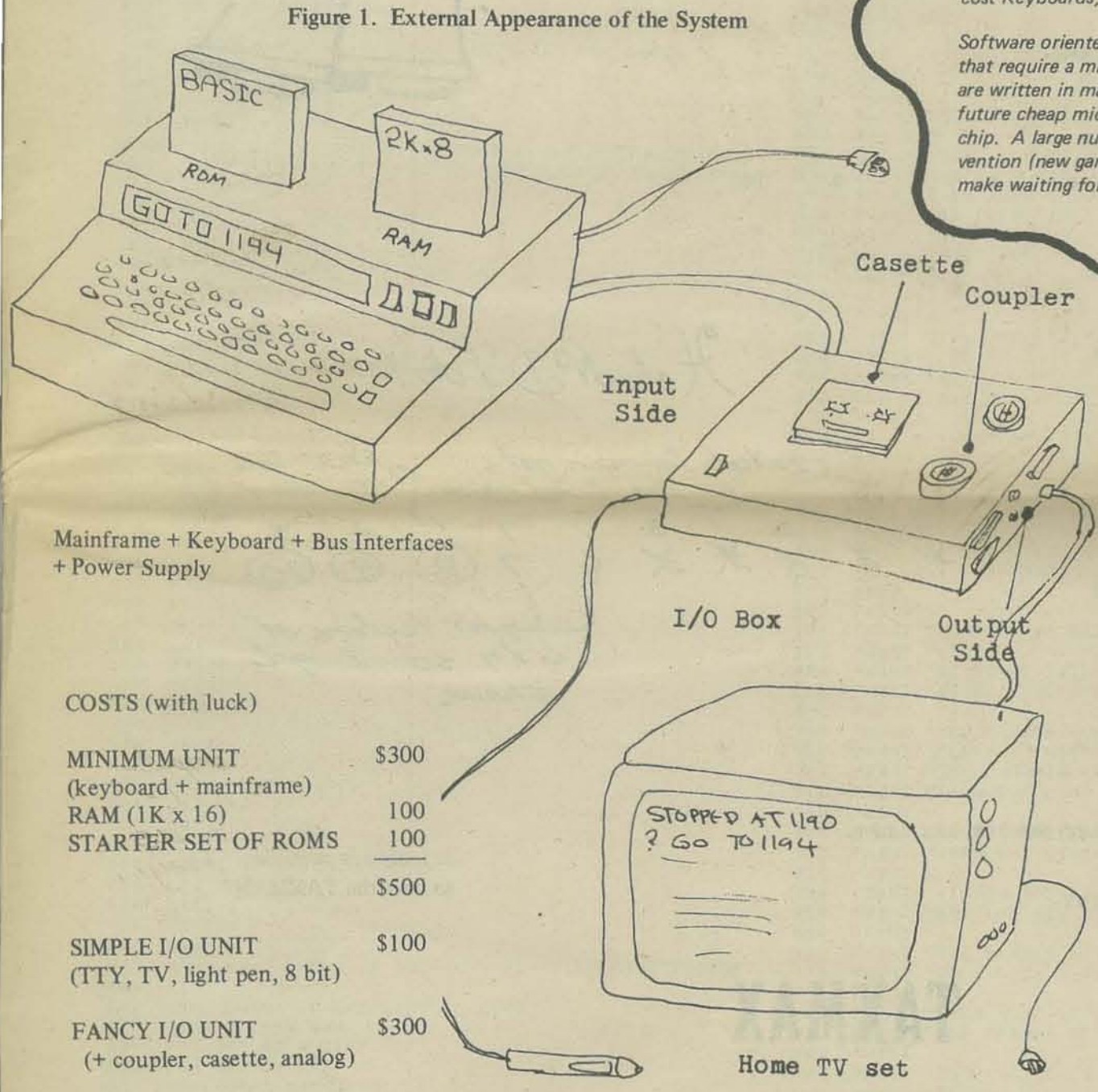
At the present time, most computers are owned by groups of people. Design efforts have been geared towards either (1) as much generality as possible or (2) performance of a single task. The result is that access to a computer is usually through some kind of organization, and that effective usage of a general purpose machine becomes a highly technical skill. The special purpose machines remain inaccessible except to the specialists responsible for their maintenance.

These tendencies clash with the "dream" of a computer in every home. This proposal suggests the design and construction of a computer for use by the general public without the need for any technical training. If the retail price of such a system is less than $500, there are large marketing possibilities.

The external view of the system may look like this: (Figure 1). The diagrammed system is not the minimum unit. The smallest unit could be the CPU + Memory + Keyboard.

The user plugs in the memory-rom suitable for these needs. Many of the roms could be low-cost, due to the simplicity of the programs.

Figure 1. External Appearance of the System



Mainframe + Keyboard + Bus Interfaces + Power Supply

COSTS (with luck)

MINIMUM UNIT (keyboard + mainframe)	$300
RAM (1K x 16)	100
STARTER SET OF ROMS	100
	$500
SIMPLE I/O UNIT (TTY, TV, light pen, 8 bit)	$100
FANCY I/O UNIT (+ coupler, casette, analog)	$300

KEY IDEAS –

(1) Separate the memory from the mainframe.
(2) Standardize the I/O bus between mainframe and the memory (implies standard machine language).
(3) Standardize the I/O bus between the mainframe and the "outside."

These ideas have been highly successful in the recorded music industry.

List of Accessories (plug into I/O box)

TV game controls, light pen, music generator, light show, automotive sensors, burglar and security sensors, "automated house" controls, tape casettes, acousticouplers, mass bubble memory, . . .

"We are on the verge of a major revolution in the computer field. This will occur as LSI microcomputer chips become widely available at a cost of $25 or so within the next several years. Intel has an 8 bit microcomputer chip now but both chip and support costs are still too high for widespread amateur use. The best advice for anyone who wants to build a home computer is to wait for the costs of such chips to drop. This should not take too long. We can also expect to see better chips for home use announced. Both computer and memory chips can be expected with a combined cost under $100. Once the computer and memory chips are available, various I/O attachments will be within the capability of most home builders. Right now the design, construction, and debug of a non-trivial computer using cheap TTL chips could be completed successfully by relatively few people. By the time they developed suitable software for one of a kind machines the low cost microcomputer chips will be available. These will also have the advantage of a certain amount of free software support by the manufacturer. Home builders will also be able to exchange programs and I/O device designs which is not possible with one of a kind computers.

While waiting for microcomputer chip availability hardware oriented types could be playing with suitable I/O device designs. For example, the following articles describe methods for recording data on standard audio tape recorders that are suitable for home use:

"Putting Data On an Ordinary Audio Recorder," The Electronic Engineer, May, 1972, page DC-9.
"Ratio Recording for Lower Cassette Recorder Cost," Computer Design, Dec. 1972, page 76.

Homemade keyboards are also possible (re: Don Lancaster, "Low cost Keyboards," Radio-Electronics, Feb. 1973.)

Software oriented types should be thinking about interesting programs that require a minimum amount of memory (say 1K to 2K bytes) and are written in machine code. For this purpose it could be assumed that future cheap microcomputers will have the power of the current Intel chip. A large number of such programs are possible but most need invention (new games, light show control, etc.). This takes time and can make waiting for the new hardware less frustrating.

It would be misleading to encourage attempts at building non-trivial home computer prematurely. It will only frustrate the majority of amateurs and yield disappointments with resulting machine capability since suitable computer and memory chips are right around the corner. The situation is similar to that of a year or so ago with calculators. If someone had started to design and build a 4 function calculator with cheap TTL chips, he would probably just be finishing something not quite as good as a current $10 LSI calculator. With a computer this sort of mistake is compounded since the builder will have to develop all his software singlehandedly."

Joe Weisbecker

Joe Weisbecker

List of Desirable I/O Plugs

ROM	address, data, clock, Vcc
RAM	address, data, clock, Vcc
INPUTS	teletype 10, 20, 30 cps keyboard
	X and Y + switch sense (light pen)
	8 bit asynchronus
	analog
OUTPUTS	teletype (or printer)
	CRT display (home video output)
	8 bit asynchronus

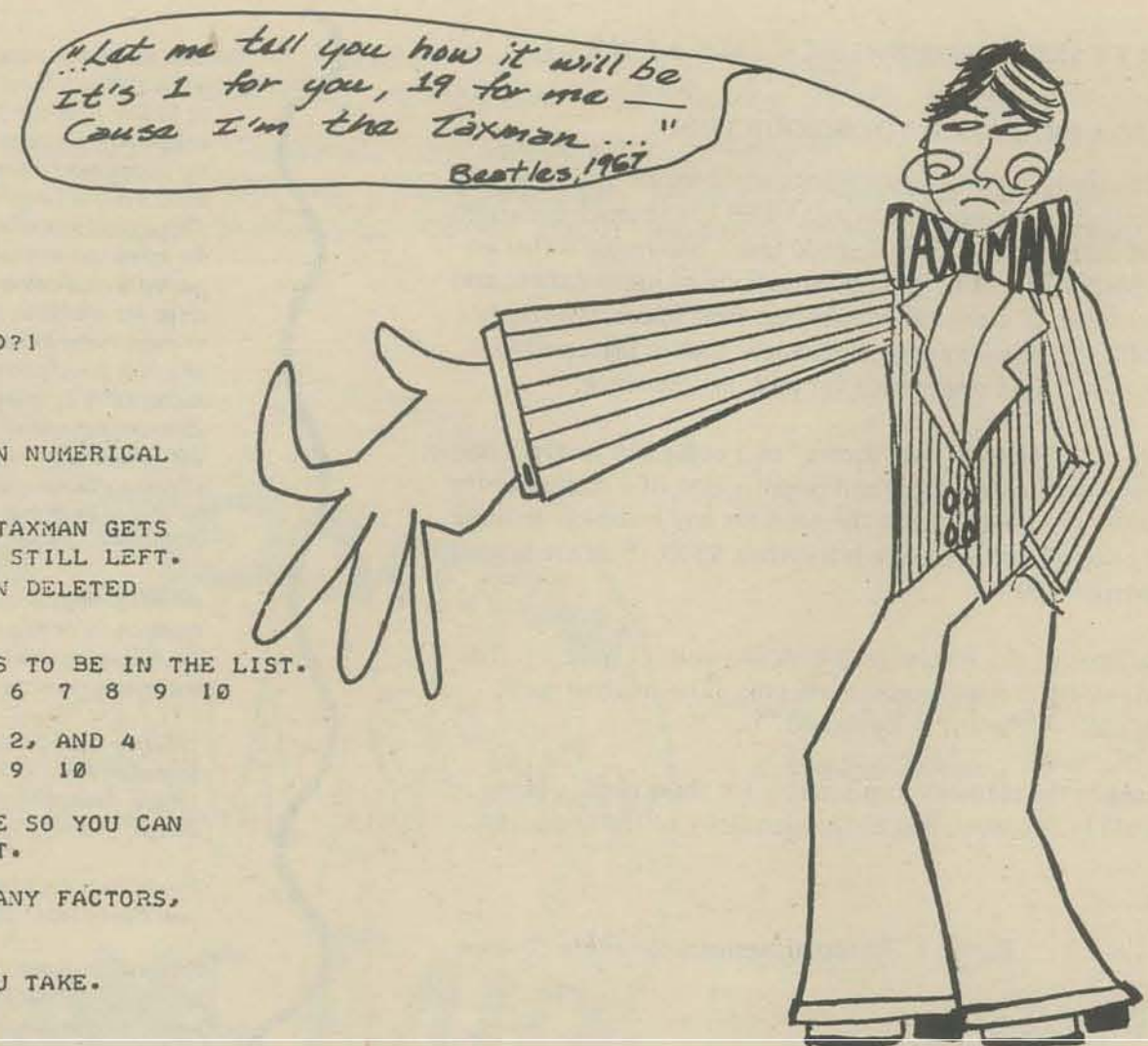
List of Possible ROMs (there will be thousands available)

Languages	BASIC, ALGOL, PILOT, LOGO
Games	TV games (i.e., Oddessy), Bagels, Conway Life Game, Racetrack
Home Applications	Auto tune-up, Form 1040, checkbook balance, calculator, (business and scientific) Teletype simulator, burglar alarm, automated house, home studies courses
Others	General laboratory monitor, medical monitoring, heart pacer check up, schools science lab

I would be most interested in discussions or other arrangements towards the realization of this idea.

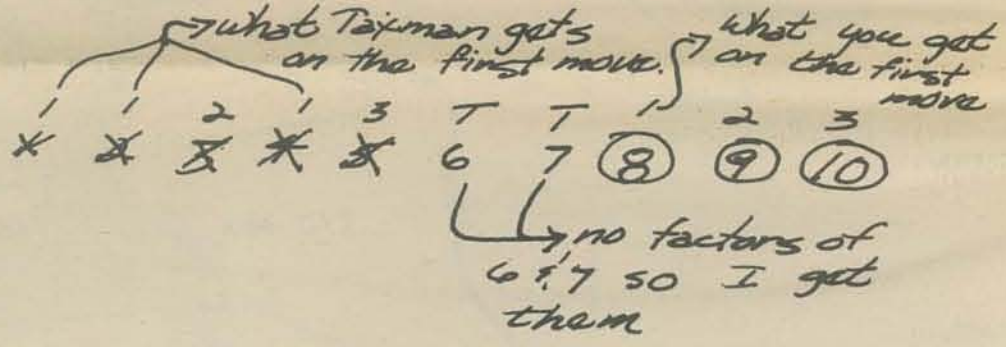
Gregory Yob
2296 Bryant
Palo Alto, Ca. 326-4039

TAXMAN

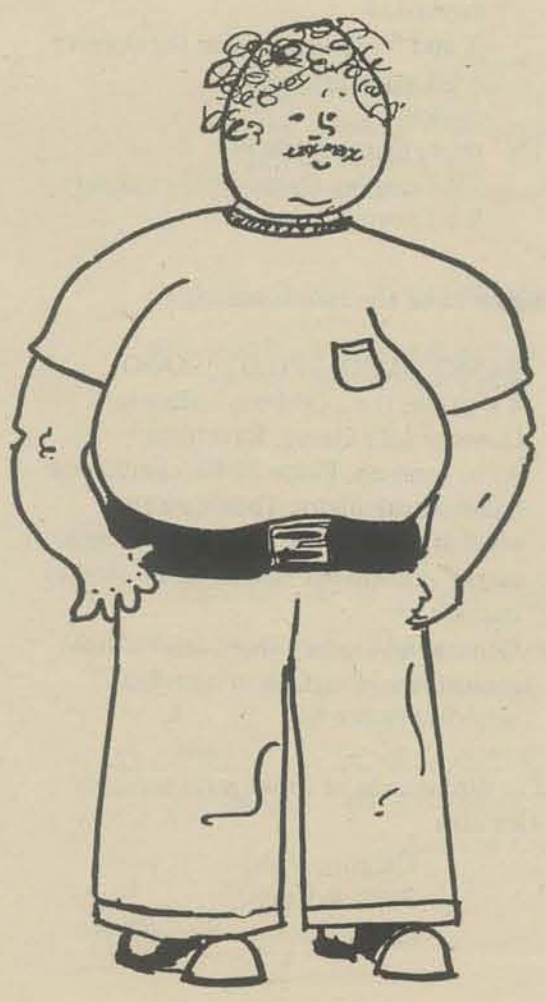



```
RUN
TAXMAN


HI, I'M THE TAXMAN.
DO YOU WANT THE REGULATIONS (1=YES,0=NO)?1

YOU TRY TO BEAT THE TAXMAN.

WE START WITH A LIST OF WHOLE NUMBERS IN NUMERICAL
ORDER (YOU DECIDE HOW MANY).

YOU TAKE A NUMBER FROM THE LIST -- THE TAXMAN GETS
ALL THE FACTORS OF YOUR NUMBER THAT ARE STILL LEFT.
YOUR NUMBER AND ALL ITS FACTORS ARE THEN DELETED
FROM THE LIST.

FOR EXAMPLE, SUPPOSE YOU WANT 10 NUMBERS TO BE IN THE LIST.
THEN THE LIST WOULD BE:  1  2  3  4  5  6  7  8  9  10

IF YOU TOOK 8, THE TAXMAN WOULD GET  1, 2, AND 4
AND THE NEW LIST WOULD BE:  3  5  6  7  9  10

THE TAXMAN MUST GET SOMETHING EVERY TIME SO YOU CAN
ONLY PICK A NUMBER THAT HAS FACTORS LEFT.

WHEN NONE OF THE REMAINING NUMBERS HAS ANY FACTORS,
THE TAXMAN GETS THEM!!

YOUR SCORE IS THE SUM OF THE NUMBERS YOU TAKE.
IF YOU WANT TO GIVE UP, TAKE 0.
GOOD LUCK!

HOW MANY NUMBERS DO YOU WANT IN THE LIST?10

THE LIST IS: 1     2     3     4     5     6     7     8     9     10


YOU TAKE?8
YOUR TOTAL IS 8
I GET 1     2     4
MY TOTAL IS 7

NEW LIST: 3     5     6     7     9     10

YOU TAKE?9
YOUR TOTAL IS 17
I GET 3
MY TOTAL IS 10

NEW LIST: 5     6     7     10

YOU TAKE?6
THERE ARE NO FACTORS OF 6     FOR ME.
ARE YOU TRYING TO SHORT-CHANGE THE TAXMAN?

YOU TAKE?8
 8     IS NOT IN THE LIST  --  TRY AGAIN.

YOU TAKE?10
YOUR TOTAL IS 27
I GET 5
MY TOTAL IS 15

NEW LIST: 6     7
I GET  6     7     BECAUSE NO FACTORS OF ANY NUMBER ARE LEFT.
MY TOTAL IS 28

TAXMAN 28      YOU 27      THE TAXMAN WINS.
```

HANDTAX

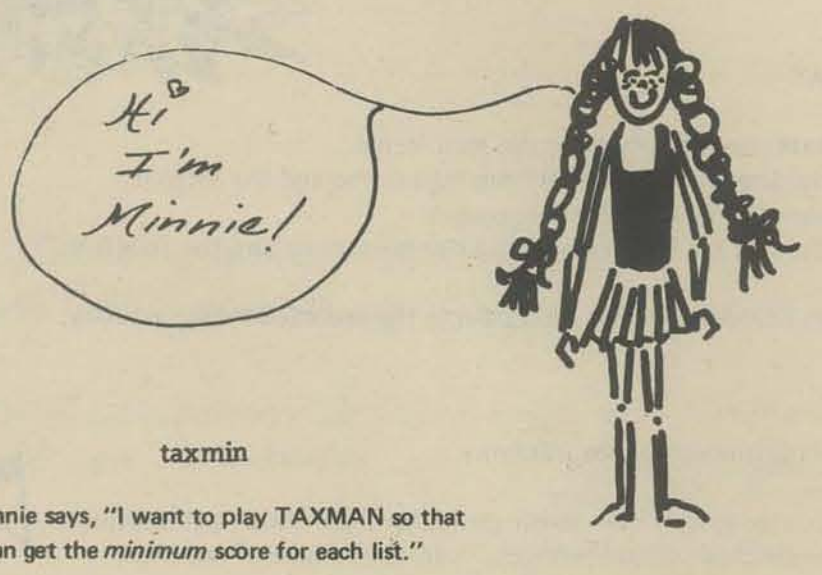


Is it always possible to beat the TAXMAN?



TAXMAX

Max says, "I want to play TAXMAN so that I can get the *maximum* score for each list."



taxmin

Minnie says, "I want to play TAXMAN so that I can get the *minimum* score for each list."

TAXMAN *See p. 20 if you want to buy a tape but don't tell the TAXMAN!*

```
100  PRINT
102  PRINT
104  PRINT "HI, I'M THE TAXMAN."
106  PRINT "DO YOU WANT THE REGULATIONS (1=YES,0=NO)";
108  INPUT R
110  IF R=1 THEN 900
120  REM *** INITIALIZATION
122  GOSUB 800
124  REM *** THE HUMAN TAKES A NUMBER
126  GOSUB 500
128  REM *** COMPUTE THE HUMAN'S AND TAXMAN'S TOTALS
130  GOSUB 570
132  REM *** PRINT THE NEW LIST
134  GOSUB 600
136  REM *** CHECK IF ANY NUMBERS STILL HAVE FACTORS
138  GOSUB 650
140  IF M=1 THEN 126
142  REM *** FIND THE WINNER
144  GOSUB 700
146  REM *** AGAIN?
148  GOTO 750
496  REM
497  REM  ***  THE HUMAN MOVES
498  REM
500  PRINT
502  PRINT
504  PRINT "YOU TAKE";
506  INPUT K
508  LET K=INT(K)
510  IF K <= 0 THEN 750
512  IF K <= N THEN 518
514  PRINT K;"IS NOT IN THE LIST  --  TRY AGAIN."
516  GOTO 502
518  IF L(K)=0 THEN 514
520  REM  FIND ALL THE FACTORS
522  IF K>1 THEN 530
524  PRINT "THERE ARE NO FACTORS OF";K;"FOR ME."
526  PRINT "ARE YOU TRYING TO SHORT-CHANGE THE TAXMAN?"
528  GOTO 502
530  LET M=0
532  FOR I=1 TO K/2
534  IF L(I)=0 THEN 544
536  IF K <> I*INT(K/I) THEN 544
538  LET M=M+1
540  LET T(M)=I
542  LET L(I)=0
544  NEXT I
546  REM  CHECK WHETHER THERE WERE ANY FACTORS
548  IF M=0 THEN 524
550  LET L(K)=0
552  RETURN
566  REM
567  REM  ***  COMPUTE THE HUMAN'S AND TAXMAN'S TOTALS
568  REM
570  LET Y=Y+K
572  PRINT "YOUR TOTAL IS";Y
574  PRINT "I GET";
576  FOR I=1 TO M
578  PRINT T(I);
580  LET Z=Z+T(I)
582  NEXT I
584  PRINT
586  PRINT "MY TOTAL IS";Z
588  RETURN
596  REM
597  REM  ***  PRINT THE NEW LIST
598  REM
600  PRINT
602  PRINT "NEW LIST:";
604  LET M=0
606  FOR I=1 TO N
608  IF L(I)=0 THEN 614
610  PRINT I;
612  LET M=1
614  NEXT I
616  RETURN
646  REM
647  REM  ***  CHECK IF ANY NUMBERS STILL HAVE FACTORS
648  REM
649  REM  CHECK IF THE LIST IS EMPTY
650  IF M=0 THEN 690
652  FOR I=N TO 4 STEP -1
654  FOR J=2 TO I/2
656  IF L(J)=0 THEN 664
658  IF I <> J*INT(I/J) THEN 664
660  LET M=1
662  RETURN
664  NEXT J
666  NEXT I
668  REM  THE TAXMAN GETS THE REST OF THE NUMBERS
670  PRINT
672  PRINT "I GET ";
674  FOR I=1 TO N
676  IF L(I)=0 THEN 682
678  PRINT I;
680  LET Z=Z+I
682  NEXT I
684  PRINT " BECAUSE NO FACTORS OF ANY NUMBER ARE LEFT."
686  PRINT "MY TOTAL IS";Z
688  LET M=0
690  RETURN
696  REM
697  REM  ***  FIND THE WINNER
698  REM
700  PRINT
702  IF Z>Y THEN 708
704  PRINT "YOU";Y;"   TAXMAN";Z;"      YOU WIN !!!"
706  RETURN
708  PRINT "TAXMAN";Z;"   YOU";Y;"      THE TAXMAN WINS."
710  RETURN
746  REM
747  REM  ***  AGAIN?
748  REM
750  PRINT
752  PRINT
754  PRINT "AGAIN (1=YES,0=NO)";
756  INPUT R
758  IF R=0 THEN 999
760  GOTO 122
796  REM
797  REM  ***  INITIALIZATION
798  REM
800  PRINT
802  PRINT "HOW MANY NUMBERS DO YOU WANT IN THE LIST";
804  INPUT N
806  LET N=INT(N)
808  IF N <= 0 THEN 999
810  IF N <= 50 THEN 816
812  PRINT "AT THIS TIME, REGULATIONS ALLOW A MAXIMUM OF 50 NUMBERS."
814  GOTO 800
816  DIM L(50),T(10)
818  LET Y=0
820  LET Z=0
822  PRINT
824  PRINT "THE LIST IS:";
826  FOR I=1 TO N
828  PRINT I;
830  LET L(I)=1
832  NEXT I
834  IF N>1 THEN 844
836  PRINT
838  PRINT "HOW VERY GENEROUS OF YOU TO FORFEIT ALL TO THE TAXMAN."
840  PRINT "TAXMAN  1     YOU  0        THE TAXMAN WINS."
842  GOTO 750
844  RETURN
896  REM
897  REM  ***  INSTRUCTIONS
898  REM
900  PRINT
901  PRINT "YOU TRY TO BEAT THE TAXMAN."
902  PRINT
904  PRINT "WE START WITH A LIST OF WHOLE NUMBERS IN NUMERICAL"
906  PRINT "ORDER (YOU DECIDE HOW MANY)."
908  PRINT
910  PRINT "YOU TAKE A NUMBER FROM THE LIST -- THE TAXMAN GETS"
912  PRINT "ALL THE FACTORS OF YOUR NUMBER THAT ARE STILL LEFT."
914  PRINT "YOUR NUMBER AND ALL ITS FACTORS ARE THEN DELETED"
916  PRINT "FROM THE LIST."
918  PRINT
920  PRINT "FOR EXAMPLE, SUPPOSE YOU WANT 10 NUMBERS TO BE IN THE LIST."
922  PRINT "THEN THE LIST WOULD BE:  1  2  3  4  5  6  7  8  9  10"
924  PRINT
926  PRINT "IF YOU TOOK 8, THE TAXMAN WOULD GET  1, 2, AND 4"
928  PRINT "AND THE NEW LIST WOULD BE:  3  5  6  7  9  10"
930  PRINT
932  PRINT "THE TAXMAN MUST GET SOMETHING EVERY TIME SO YOU CAN"
934  PRINT "ONLY PICK A NUMBER THAT HAS FACTORS LEFT."
936  PRINT
938  PRINT "WHEN NONE OF THE REMAINING NUMBERS HAS ANY FACTORS,"
940  PRINT "THE TAXMAN GETS THEM!!"
942  PRINT
944  PRINT "YOUR SCORE IS THE SUM OF THE NUMBERS YOU TAKE."
946  PRINT "IF YOU WANT TO GIVE UP, TAKE 0."
948  PRINT "GOOD LUCK!"
950  GOTO 122
999  END
```

$$$

Your Turn!

```
AGAIN (1=YES,0=NO)?1

HOW MANY NUMBERS DO YOU WANT IN THE LIST?18

THE LIST IS: 1     2     3     4     5     6     7     8     9     10

 11    12    13    14    15    16    17    18

YOU TAKE?
```

Support Max and Minnie in their struggle with the TAXMAN. Show them that they are not forgotten — remember to play TAXMAX and TAXMIN so that you can send advice. Mail numerical results, hints, strategies, whatever, to

TAXMAN
c/o PCC
P.O. Box 310
Menlo Park, Ca 94025

✻ this page is number 7 ... (lucky #) for you! (we hope)

Book Reviews

A GUIDE TO TEACHING ABOUT COMPUTERS IN SECONDARY SCHOOLS ... the Most up-to-date and thorough guide to the use of computers in Secondary Schools
written by DONALD SPENCER
Abacus Computer Corporation, 1973

A STUDY OF REGIONAL COMPUTER NETWORKS, Feb. 1973
University Computer Center
University of Iowa
Iowa City, Iowa 52242
Price $2.25

Sounds like a dull text for Mickey Mouse Ed 1A, doesn't it? Look inside and it **LOOKS** like a dull book from the same course. But **READ** it ... and the book says a lot that will appeal to the neophyte computer educator . As a matter of fact it packs one hell of a lot of good information into its 135 pages. If you're looking for all the "gizmo" words and rationale, etc. to convince your administration you need a computer **OR** if you suddenly have a system and don't know what to do with it, you should get this book.

Don Spencer has apparently read all that 10 years worth of computer education has provided in journals, etc. and crunched it into this book. I chuckled as I read his paraphrase of an old article that **EVERYONE** uses in speeches and articles. He did a good job. My main concern is that for all his knowledge, Don never took a stand in this book on any contemporary issues in Computer Education. For instance, one current debate is over which languages to use in secondary schools. PCC has taken a stand (in case you missed it, we **LOVE BASIC**) and documented our position and reasons. Why didn't Spencer give more details and take a position? He also didn't even mention who the primary hardware vendors are that educators should deal with ... matter of fact, with the exception of IBM and DEC, he didn't even mention any hardware suppliers.

"The perfect text for methods courses on teaching about secondary school computer science ... " (is there such a course somewhere), says the jacket. That objective caused the author to devote two chapters to "The Teacher and the Student", and "Planning the Class Sessions". Both chapters read like a bad Education Course text ... The First Day ... Lesson Plans ... Bah. Forget these two but do go on.

Chapter 3 devotes 8 pages to **HOW** to use a computer in Algebra, Geometry, Trig, etc. classes. One sample program is used with each. But no real rationale is used for using computers instead of the old manual way other than the old cliche that "computers are here to stay" and everyone should know something about them. No factual data documenting improved learning. No data supporting the notion that it turns kids on to learning. I shouldn't blame the author since no one I know of has documented either point. Isn't it about time **SOMEONE DID?**

Games - ? ... hardly mentioned at all except that junior high kids like to write game programs!

On to the good stuff. Chapters 6, 8 and 9 offer a huge resource list of free and inexpensive materials, films, and textbooks. I doubt that Spencer reviewed them all before he included them in his book. Some are oldies, some goodies and many that are new and fresh. Certainly the neophyte will get a lot of value from these lists. IBM and other listed resources will go bananas if you write for all the materials listed.

Conclusion: This is a nice straight book that can be used and enjoyed by traditional classroom teachers. I like to think that we computer teachers are not traditional by any sense of the imagination and thereby we have a dichotomy, as regards this book. If you're a beginner, you NEED this book. If you're teaching a methods course that touches on computer education, this is the ONLY book around. Either way, the book only gives you good general information. If you want Fact, Figures, experienced Opinion, keep up your subscription to PCC!

I wish they would have printed it softbound so it would sell for $1.95 or so . . . *LF*

Everything you ever wanted to know about computer networks is contained in this 257 page volume. Look at this table of contents:

This study, financed by NSF funds,"undertook the study of regional computer networks serving institutions of higher education." The investigators gained first hand knowledge of about ½ of the 20 regional networks in existence. After going through the ritual of defining a "regional computer network" they provide an in-depth analysis (100 pages) of five such centers (see Table of Contents). Even though this report is oriented to college users, we think it provides excellent information for anyone contemplating a computer purchase, be it for a local school, a school district, or a school consortium (group of schools).

The authors have detailed all the *why's* of going with a regional center. They discuss the economic advantages, the geographic problems to consider and offer some interesting insight into financial and organizational structure.

One thing we enjoyed was the lack of "moral persuasion." The authors discussed both sides of the issues ... problems and advantages ... and made no "recommendations" regarding the choice of hardware one will have to face. The installations discussed in-depth tended to be BIGGIES ... IBM 370/165, CDC 6600-style, full service capability, to large numbers of users. They do mention a DECSYSTEM 10 installation in California, with some details. Still ... the questions raised, the points brought up will apply to you, too, even if you're just looking to buy a little Edusystem 10.

Get this report ... it's good.

DESIGN OF MAN-COMPUTER DIALOGUES
Written by James Martin
Price $15.95
559 pages, illustrated
Prentice-Hall Series in Automatic Computation

This book gives a very thorough overview of the kinds of human-computer interactive systems and languages available. The table of contents shows that the book (which is mostly examples of such systems/languages, with a moderate amount of philosophy and psychology added) is divided and subdivided well, so you shouldn't have any trouble finding your area of specialty and digging right in. The references seem to be for those systems used as examples.

Martin writes for the industry audience, in particular the people who're deciding what type of computer storage and retrieval system to build/buy.

There's not a large amount of detail on how such systems are build. It's mostly the outlines and general considerations that are given.

I came across a few sections that I though were fun, like –

an excellent introduction to APL (an unusual and fascinating computer language)

at least two conversations with ELIZA, the computer program that impersonates a rogerian psychonanalyst

several excellent chapters on what to remember while you're designing your own system

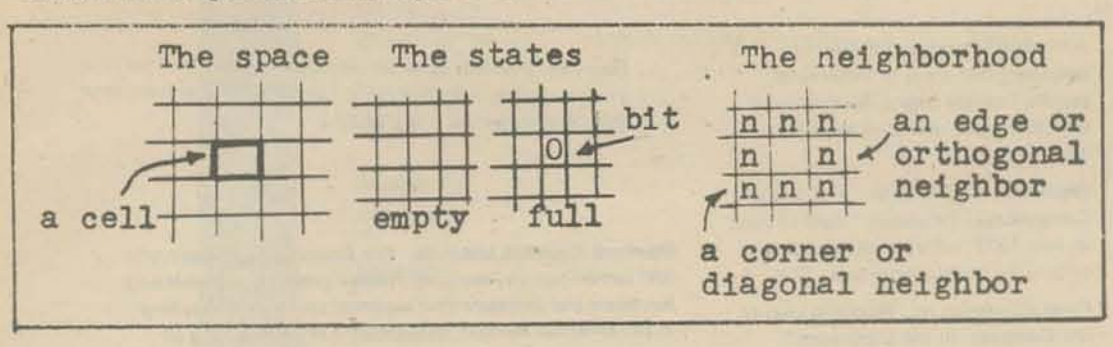
a fictitious cable TV hookup that connects you to a travel agency's computer where, for free, you can preview likely (or just plain flight-of-fancy) vacation spots

My recommendation – For the reader that wants to know about a variety of interactive systems or to see someone else's summary of "important points to keep in mind."

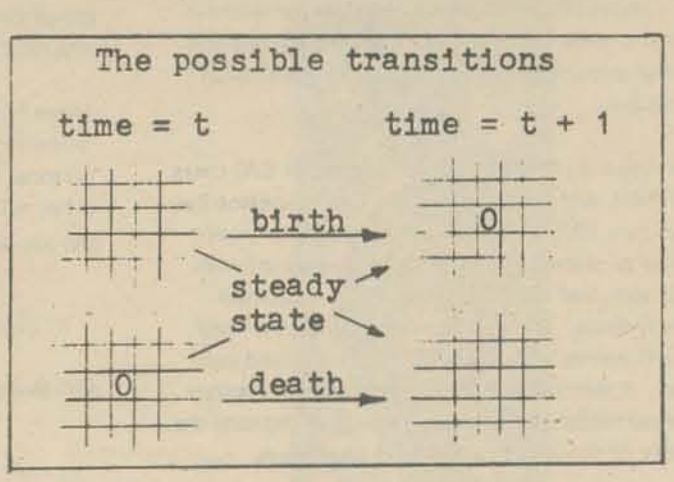
Robert T. Wainwright – Editor and Publisher
1280 Edcris Road
Yorktown Heights, NY 10598

LIFELINE is a quarterly newsletter about John Horton Conway's incredible game, LIFE. Here is a sample from LIFELINE #5, Sept. 1972.

LIFE is based on cellular automata theory and uses the two-dimensional square *space* which is simply a matrix or grid. Each square or cell within this grid has two possible *states*: either empty or full (that is, occupied with a 'bit'). Each cell has a set of eight surrounding *neighbor* cells that can influence its own state.



A cell's state will change according to a set of *transition rules* that apply simultaneously to every cell in the space. These rules are based on both the current state of the cell and also the collective state of its neighbors and need only consider and be defined for a cell going from empty to full (birth) or from full to empty (death). These possible combinations of state change are shown here.

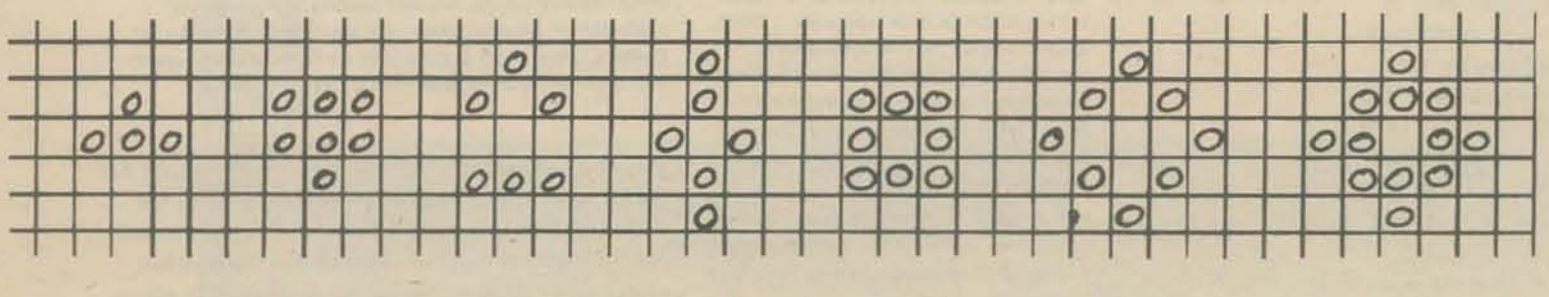


Conway's specific rules are the key to LIFE and will now be described:

Births: each empty cell with exactly 3 neighbors whose cells are full (contain a bit) is a birth cell. A bit is placed in it for the next move.

Deaths: each full cell (containing a bit) requires 2 OR 3 neighbors to survive for the next move. Every bit with four or more neighbors dies from overpopulation and every bit with one or no neighbors dies from isolation.

When Conway originally stated his rules, he presented a third rule for survivals but here we have included it with the death rule since it is implied by same. It is very important to understand that all births and deaths occur simultaneously. Together they constitute a single move, or as we shall call it, a *generation*, in the complete Life history of an initial pattern which may be constructed of cells occupied with any arrangement of bits. Any given pattern will then change its state in discrete steps by recursively applying Conway's rules.



Carry on! What's next?

As CAI usage grows, face-to-face contacts of persons in the field are needed to foster program exchanges, diverse pedagogical approaches, and software/courseware compatibility. While formal CAI conferences minimally serve such functions, more frequent and informal gatherings can better stimulate a flow of information.

These views led to an informal meeting of CAI users, researchers, and developers in the San Francisco Bay area in July 1972. A proposal for a monthly get together to discuss topics of interest was met with enthusiasm, and the CAI Seminar has conjoined regularly since. The still-growing mailing list[1] has over 100 names; about 40–60 persons attend each session. A summary of the professional affiliations of the participants is given in Table 1 to indicate the diversity of groups attracted to the meetings.

Subjects discussed at the seminars are based on results of an August 1972 interest survey. Participants were asked to rank 14 CAI topics to indicate areas of interest, Some ranked several items as first or second choice, some ranked all 14 items, and others merely marked items without ranking. Table 2 summarizes the data for ranks 1–3 of all topics. As the table indicates, the CAI subjects of teaching and curriculum development are of most concern to participants. This interest is demonstrated in seminar discussions. Author languages are another topic of concern, particularly with reference as to how they facilitate or hinder curriculum development.

A questionaire distributed in February attempted to determine the range of educational uses of computers and the variety of author languages used by the CAI researchers in the Bay Area. A large percentage of the group has been developing versions of PILOT (PYLON, NYLON, MINIPILOT) or of BASIC in order to teach computer programming to young children. Other programming languages commonly used for instructional purposes include APL, Coursewriter, IDF (Hewlett-Packard), LISP, LOGO, SMALLTALK, (Xerox), and SNOBOL. The general use of BASIC and PILOT-like languages has encouraged a swap-shop of programs stored at SRI.

Many seminar participants are with organizations able to host the seminar and have volunteered to do so. Thus the structure of the seminar is informal: the host group notifies the members and plans the format of the next meeting.

There have been 10 seminar meetings to date. The following summary does not reflect the important personal contact aspect of the sessions, but lists other main activities.

SRI (Menlo Park)	Attendees introduced themselves, described CAI areas of interest/research. Possible topics, formats, and sites for future meetings were discussed.
SRI (Menlo Park)	Report on workshop on "The Use of Computers in Education" held in Italy in July 1972, informal discussion on criteria for author languages.
Creative Teaching Center (Mt. View)	Panel discussion on "Realistic Uses of the Computer in the Classroom." Change to examine commercially available materials, such as math games and books.
Lawrence Hall of Science (UC Berkeley)	Survey of the major computer-educational activities at the Hall, including games, robot, simulations, plotter scope, and tone box. Followed by an open disucssion.
Institute for Mathematical Studies in the Social Sciences (Stanford U)	Many demonstrations, including courses in math, logic, problem-solving, reading, calculus, and music theory (an organ is connected to their PDP-10).
SRI (Menlo Park)	Speakers addressed 4 types of languages for use as CAI author languages: LOGO, BASIC, PILOT, and ALGOL-like or assembly languages. Discussion focused on comparing and contrasting the different types of languages from the viewpoint of users such as programmers, teachers, and students.
SRI (Menlo Park)	Marvin Minsky of the Artificial Intelligence Lab at MIT spoke on the contributions of Computer Science concepts to theories of learning.
Hewlett-Packard (Cupertino)	Overviews of HP's activities were given by staff members; demonstrations of the HP9830, the HP author language IDF, and a variety of courses.
UC Med Center (San Francisco)	Overviews of the Center's CAI concerns were followed by demonstrations of courses dealing with medical diagnosis, training nurses in decision making principles, etc.
People's Computer Company (Menlo Park)	Participants had a chance to explore the variety of games and simulations available to the public at a nominal fee. *[Editors Note: And drink beer and rap with people and generally mill around.]*

[1] Bay Area people wishing to be included on the mailing list should notify Phyllis Cole, J203, Stanford Research Institute, Menlo Park, CA. 94025. (415)326-6200 X3669

Future meetings are scheduled at the Education Research and Development Center at Stanford University and Xerox Research Center in Palo Alto.

In general, the activities of the participants focus on providing campus or "store front" facilities at which people of all ages can interact with a computer. In order to provide some details of the kinds of things the seminar participants are doing, we have attempted to sketch the work of six representative groups.

DeAnza College. *DeAnza College's CAI activities involve staff from the Art department as well as the data processing division. Currently four teletypewriter terminals linked to the IMSSS PDP-10 at Stanford University are being used to teach computer programming. A grant from the Northern California Computer Network supports research on programming computer graphics and the use of the PYLON language. By the end of summer, 1973, courses in design, art appreciation and art history, as well as a program for generating fabric designs, will be abailable.*

Hewlett-Packard. *HP designs and builds mini-computer systems for education. At present HP offers computers with time-sharing BASIC for up to 32 terminals. These systems offer CAI programs for mathematics drill and practice as well as curriculum distributed by Computer Curriculum Corporation. HP has also implemented the Instructional Dialogue Facility, an interactive authoring capability, and has formed a user group to encourage program exchanges.*

Institute for Mathematical Studies in the Social Sciences. *IMSSS has developed CAI instructional systems for teaching elementary arithmetic, logic, computer programming, problem-solving, reading, foreign languages (Russian, German, French and Bulgarian), and language arts for the deaf. These systems were designed to run on teletypewriters; they are programmed in SAIL, LISP, or assembly code for a DEC PDP–10. Basic CAI research is also carried out in designing dialogue-tutorial systems for elementary mathematics; analyzing the speeck of English, French, and Chinese children; synthesizing speech; and analyzing the cost-effectiveness of CAI.*

Lawrence Hall of Science. *The people at Lawrence Hall teach kids to use and program computers including a Nova 800, HP2000B, HP3000, and a Wang 3300. Time on these machines is rented to groups such as the Langley Porter Institute (UC Medical Center) and the Golden Gate Montessori School in San Francisco. There are also open houses and classes for young children on Saturdays. Lawrence Hall has a large library of games, simulations and general purpose languages written by and for these children to use.*

[See Page 3 of this issue for info on Computerland for Time Travelers – A Computer Fair to be held at Lawrence Hall, September 20 – 23, 1973.]

Stanford Research Institute. *The Education Laboratory at SRI carries out an internally funded program in developing hardware and software that supports research in teaching in the affective domain, experiments in the teaching of abstract concepts, the establishment of a library of CAI materials, and the development of methods for reducing CAI costs. Curricula running on teletypewriters are written in PYLON or BASIC using terminals from Tymshare, Incorporated and the Lawrence Hall of Science. CRT display programs, written in Euclid, an SRI Algol-like compiler, were designed to facilitate development of inductive reasoning.*

University of California Medical Center. *The staff of the office of Information Systems provides consultation and assistance to faculty in the schools of medicine, dentistry, nursing and pharmacy. Using PILOT, which was developed at UC Medical Center, course material is being prepared in dental history-taking, decision-making in nursing, self-evaluation in pharmacology, and psychiatric consultation training. Most work is done with an IBM 360/50; experiments are being conducted with a Datapoint 2200.*

Regional CAI seminars of the nature we have just described serve as an informative meeting ground for educators and computer scientists. The enthusiasm for the monthly seminars stems from the fruitful exchange of ideas among people interested in educational uses of computers. We are interested in hearing from people who wish to start CAI seminars or who have already done so.

Table 1: Professional Affiliations of Seminar Participants

Private Companies
- *Behaviordyne*
- *Call Computer*
- *Computer Curriculum Corporation*
- *Creative Teaching Center*
- *Data General*
- *Datamation*
- *Dean Hall Associates*
- *Dymax*
- *Hewlett-Packard, Cupertino*
- *Honeywell*
- *Interaction Associates*
- *Tymshare, Incorporated*
- *Westinghouse Learning Press*
- *Xerox Research Center*

School Districts and Schools other than College level
- *Golden Gate Montessori School*
- *Palo Alto Unified School District*
- *Ravenswood Unified School District*
- *Woodrow Wilson HS, EDP Resource Center*

Private or Nonprofit Research Institutes
- *Institute for the Study of Human Knowledge*
- *Langley Porter*
- *People's Computer Company*
- *Resource One*
- *Stanford Research Institute*

Universities and Colleges
- *California State, Hayward*
- *DeAnza College*
- *Diablo Valley College*
- *College of Marin*
- *Pacific Union College*
- *Sonoma State*
- *Stanford University*
  - *Chemistry Department*
  - *Computation Center*
  - *Computer Science Department*
  - *Education R & D Center*
  - *Ed. Psych Department*
  - *IMSSS*
- *University of California*
  - *Berkeley CS and EE Depts.*
  - *Berkeley Radiation Lab*
  - *Berkeley, University Extension*
  - *Institute of Human Learning*
  - *Lawrence Hall of Science*
  - *San Francisco Medical Center*
  - *Santa Cruz*
- *University of Manitoba*
- *University of the Pacific*
- *University of Washington*

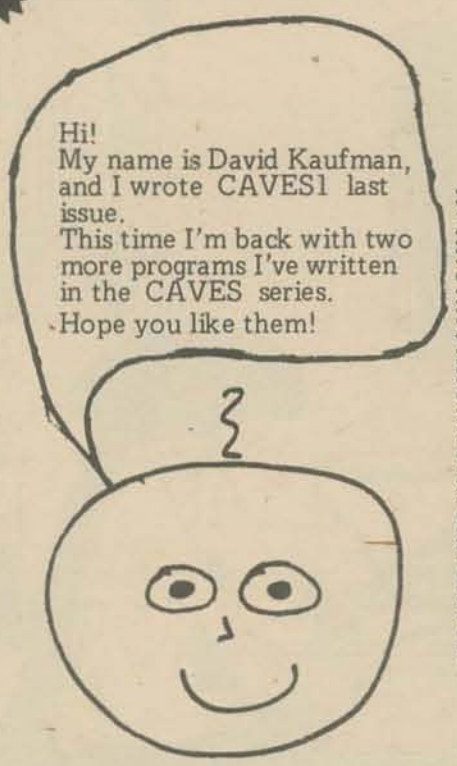
Topic	Rank 1	Rank 2	Rank 3	Rank > 3 unspecified	Total
Author languages	xxx	xx	xxxx	xxxxxxxx	17
Biofeedback and CAI	x		xxx	xxxx	8
CAI and affect	xxxx	xxxx	x	xxxx	13
CAI & the handicapped	x		xxxx	xxxx	9
CAI systems design	xx	xxxxx	xx	xxxx	13
Curriculum development	xxxxxxxxxxx	xxxxxx	xxxxx	xxxx	27
Learning styles	xx	xxx	xx	xxxxxxxxx	16
Marketing, costs, etc.		x		xxxx	5
Modeling	x	xxx	x	xxxxxxxxxx	15
Natural languages	xxxx	xxx	xx	xxxxxxx	16
Peripherals		x	x	xxxxxxxxx	11
Problem solving	xxxx	xxxx	xx	xxxxxxxxxx	20
Simulation	xx	xxxx	xxxx	xxxxxxxxxxx	21
Teaching	xxxxxxxxxxxx	xxxxx	x	xxxxxxxx	27

Table 2: Summary of CAI Interest Survey Data*, August 1972

* 51 forms (70% of the August mailing list) were returned.

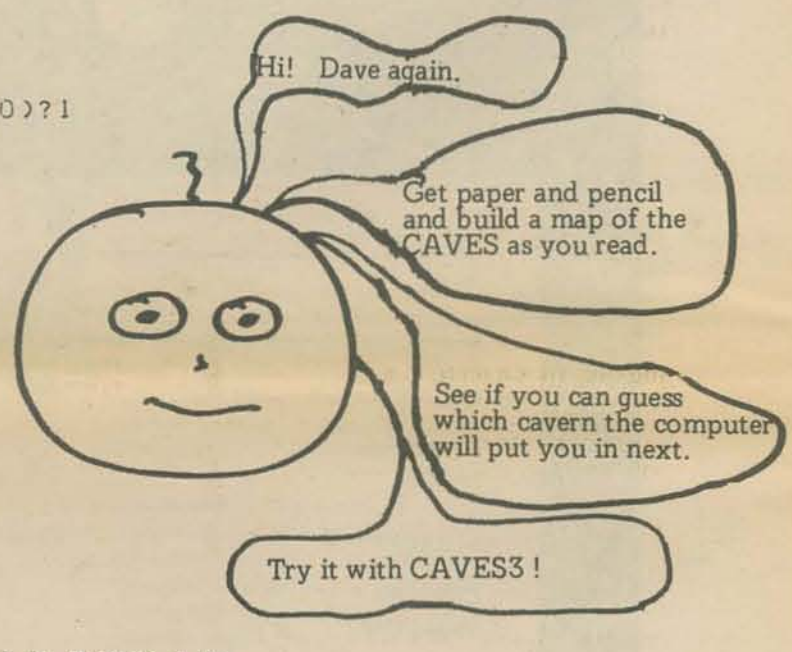
– CAVES – CAVES – CAVES – CAVES –

– CAVES – CAVES – CAVES – CAVES –



Caves2:

```
WELCOME TO THE CAVES

DO YOU WANT AN INTRODUCTION (1=YES, 0=NO)?1

THIS GAME IS JUST LIKE CAVES1,
EXCEPT YOU SET UP THE CAVES

THEN, YOU CAN EXPLORE THEM,
OR ASK A FRIEND TO FIND HIS WAY OUT

A GOOD IDEA IS TO MAKE A MAP
AS YOU GO ALONG, SO YOU CAN SEE
WHAT YOUR CAVES LOOK LIKE

EACH CAVERN HAS A NUMBER OF TUNNELS
LEADING TO OTHER CAVERNS - 0 TUNNELS
MEANS A DEADEND CAVERN.  OTHERWISE,
YOU CAN HAVE 1,2,3,4 OR 5 TUNNELS
```




```
YOU'RE IN CAVERN # 1
HOW MANY TUNNELS?5
THEY LEAD TO # 2    # 3    # 4    # 5    # 6

YOU'RE IN CAVERN # 2
HOW MANY TUNNELS?2
THEY LEAD TO # 7    # 8

YOU'RE IN CAVERN # 7
HOW MANY TUNNELS?1
THEY LEAD TO # 9

YOU'RE IN CAVERN # 9
HOW MANY TUNNELS?0

YOU'RE IN CAVERN # 8
HOW MANY TUNNELS?2
THEY LEAD TO # 10    # 11

YOU'RE IN CAVERN # 10
HOW MANY TUNNELS?0

YOU'RE IN CAVERN # 11
HOW MANY TUNNELS?0

YOU'RE IN CAVERN # 3
HOW MANY TUNNELS?2
THEY LEAD TO # 12    # 13

YOU'RE IN CAVERN # 12
HOW MANY TUNNELS?1
THEY LEAD TO # 14

YOU'RE IN CAVERN # 14
HOW MANY TUNNELS?0

YOU'RE IN CAVERN # 13
HOW MANY TUNNELS?2
THEY LEAD TO # 15    # 16

YOU'RE IN CAVERN # 15
HOW MANY TUNNELS?0
```

Why did the program go down to # 2 first ?

For the same reason it goes to # 7 before # 8

Cavern # 8 ? Why did the program choose # 8 next ?

Back to the second level.

```
YOU'RE IN CAVERN # 16
HOW MANY TUNNELS?0

YOU'RE IN CAVERN # 4
HOW MANY TUNNELS?0

YOU'RE IN CAVERN # 5
HOW MANY TUNNELS?2
THEY LEAD TO # 17    # 18

YOU'RE IN CAVERN # 17
HOW MANY TUNNELS?2
THEY LEAD TO # 19    # 20

YOU'RE IN CAVERN # 19
HOW MANY TUNNELS?0

YOU'RE IN CAVERN # 20
HOW MANY TUNNELS?1
THEY LEAD TO # 21

YOU'RE IN CAVERN # 21
HOW MANY TUNNELS?0

YOU'RE IN CAVERN # 18
HOW MANY TUNNELS?0

YOU'RE IN CAVERN # 6
HOW MANY TUNNELS?0

THE CAVES ARE COMPLETE EXCEPT FOR ONE SMALL THING -
THEY NEED A ROOM THAT LEADS TO THE OUTSIDE.

WHICH ROOM # WILL THAT ONE BE?21
WHEN YOU'RE READY, TYPE ANY NUMBER
?99
```

Hey ! # 19 is a deadend !

And so is # 21 !

How does the program know the Caves are finished ?

GET A FRIEND TO TAKE OVER HERE

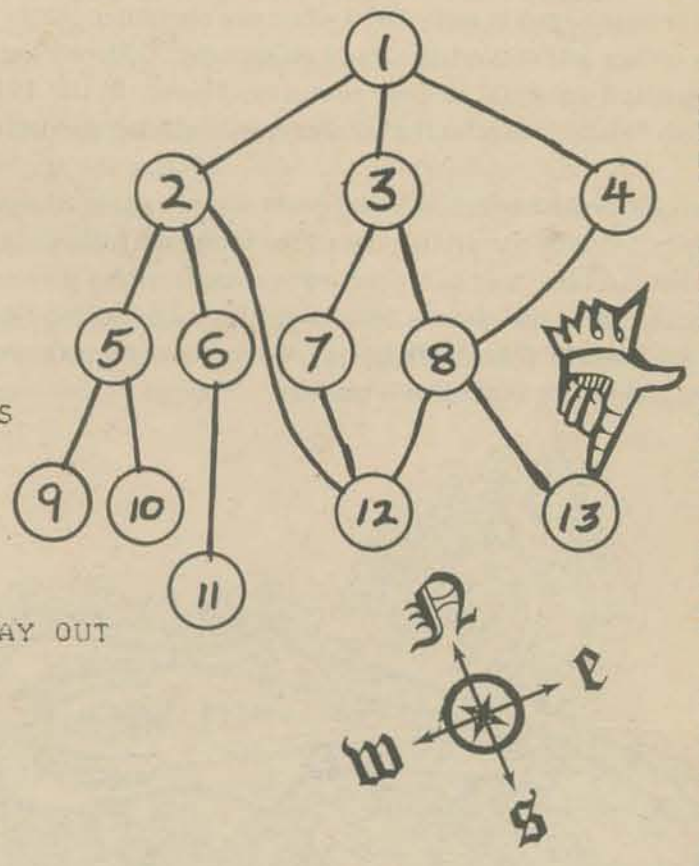
```
YOU'RE IN CAVERN # 1
# 2    # 3    # 4    # 5    # 6    ARE WHERE YOU CAN GO
WHERE NEXT?
```

... AND THE REST IS LIKE CAVES1 . .

– CAVES – CAVES – CAVES – CAVES – CAVES – CAVES – CAVES – CAVES –

– CAVES – CAVES – CAVES – CAVES – CAVES – CAVES – CAVES – CAVES –

Caves3:




```
WELCOME TO THE CAVES

INTRODUCTION (1=YES, 0=NO)?1

   THIS GAME IS LIKE CAVES1 AND CAVES2 EXCEPT YOU
CAN SET UP THE CAVES ANY WAY YOU LIKE.  DIFFERENT
TUNNELS CAN LEAD TO THE SAME CAVERN, OR YOUR CAVERNS
CAN FORM LOOPS LIKE #12 - #13 - #19 - #12

   EACH CAVERN HAS A NUMBER OF TUNNELS LEADING TO
OTHER CAVERNS - 0 TUNNELS MEANS A DEADEND CAVERN
OTHERWISE, YOU CAN HAVE 1,2,3,4 OR 5 TUNNELS

   WHEN YOU'RE FINISHED, ASK A FRIEND TO FIND HIS WAY OUT

   A GOOD IDEA IS TO MAKE A MAP AS YOU GO ALONG,
SO YOU CAN SEE WHAT YOUR CAVES LOOK LIKE

   GOOD LUCK!
```

```
YOU'RE IN CAVERN # 1
HOW MANY TUNNELS?3
ONE AT A TIME:
?2
?3
?4

YOU'RE IN CAVERN # 2
HOW MANY TUNNELS?2
ONE AT A TIME:
?5
?6

YOU'RE IN CAVERN # 5
HOW MANY TUNNELS?2
ONE AT A TIME:
?9
?10

YOU'RE IN CAVERN # 9
HOW MANY TUNNELS?0

YOU'RE IN CAVERN # 10
HOW MANY TUNNELS?0

YOU'RE IN CAVERN # 6
HOW MANY TUNNELS?1
ONE AT A TIME:
?11

YOU'RE IN CAVERN # 11
HOW MANY TUNNELS?0
```

```
YOU'RE IN CAVERN # 3
HOW MANY TUNNELS?2
ONE AT A TIME:
?7
?8

YOU'RE IN CAVERN # 7
HOW MANY TUNNELS?1
ONE AT A TIME:
?12

YOU'RE IN CAVERN # 12
HOW MANY TUNNELS?1
ONE AT A TIME:
?2

YOU'RE IN CAVERN # 8
HOW MANY TUNNELS?2
ONE AT A TIME:
?12
?13

YOU'RE IN CAVERN # 13
HOW MANY TUNNELS?0

YOU'RE IN CAVERN # 4
HOW MANY TUNNELS?1
ONE AT A TIME:
?8
```

LET'S GO!

```
YOU'RE IN CAVERN # 1
# 2    # 3    # 4    ARE WHERE YOU CAN GO
WHERE NEXT?4

YOU'RE IN CAVERN # 4
# 1    # 8    ARE WHERE YOU CAN GO
WHERE NEXT?8

YOU'RE IN CAVERN # 8
# 3    # 12   # 13   # 4    ARE WHERE YOU CAN GO
WHERE NEXT?12

YOU'RE IN CAVERN # 12
# 7    # 2    # 8    ARE WHERE YOU CAN GO
WHERE NEXT?2

YOU'RE IN CAVERN # 2
# 1    # 5    # 6    # 12   ARE WHERE YOU CAN GO
WHERE NEXT?1

YOU'RE IN CAVERN # 1
# 2    # 3    # 4    ARE WHERE YOU CAN GO
WHERE NEXT?3

YOU'RE IN CAVERN # 3
# 1    # 7    # 8    ARE WHERE YOU CAN GO
WHERE NEXT?8

YOU'RE IN CAVERN # 8
# 3    # 12   # 13   # 4    ARE WHERE YOU CAN GO
WHERE NEXT?13

!!!  SUNLIGHT  !!!
!!!  FRESH AIR  !!!
...  REPORTERS  ...
```

THE CAVES ARE COMPLETE EXCEPT FOR ONE SMALL THING-
THEY NEED A ROOM THAT LEADS TO THE OUTSIDE.

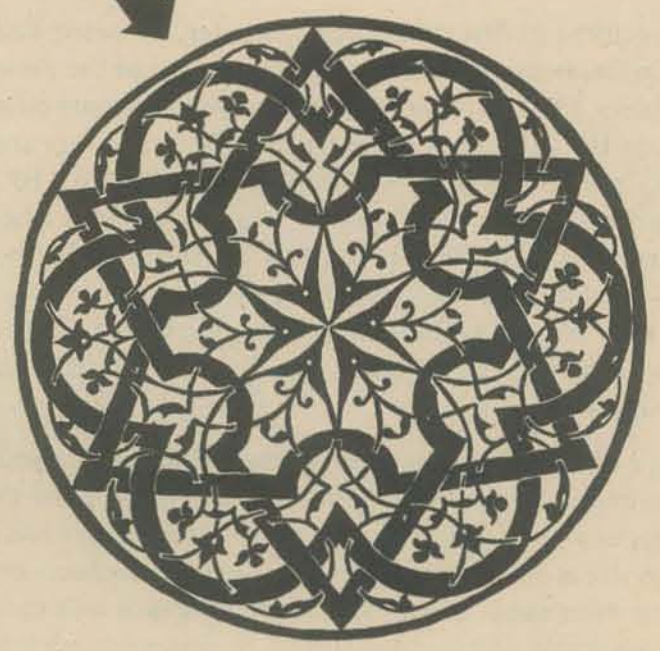
WHICH ROOM # WILL THAT ONE BE?13
WHEN YOU'RE READY, TYPE ANY NUMBER
?0

There will soon be a booklet available, called "USING CAVES 1,2 AND 3" with listings of the three programs, plus sample games and ideas for working with the CAVES. Price $1.50 .

A paper tape of each program is also available, in BASIC, guarranteed to run on any HP 2000 series machine. There are no string variables nor file statements, so with minor modifications, they should be understood by any other machine that speaks BASIC. Price $3 per tape.

Thanks for visiting THE CAVES !
I'll be back next issue with some more CAVES programs.
I also hope to start talking about how the CAVES programs are put together. They're all built out of a common core or subroutines called TREE SUBROUTINES
I'll be showing you how these work, and how *you* can design *your own programs* with them.
See you next issue !

BETCHA YA CAN'T SETUP A CAVE THAT LOOKS LIKE THIS

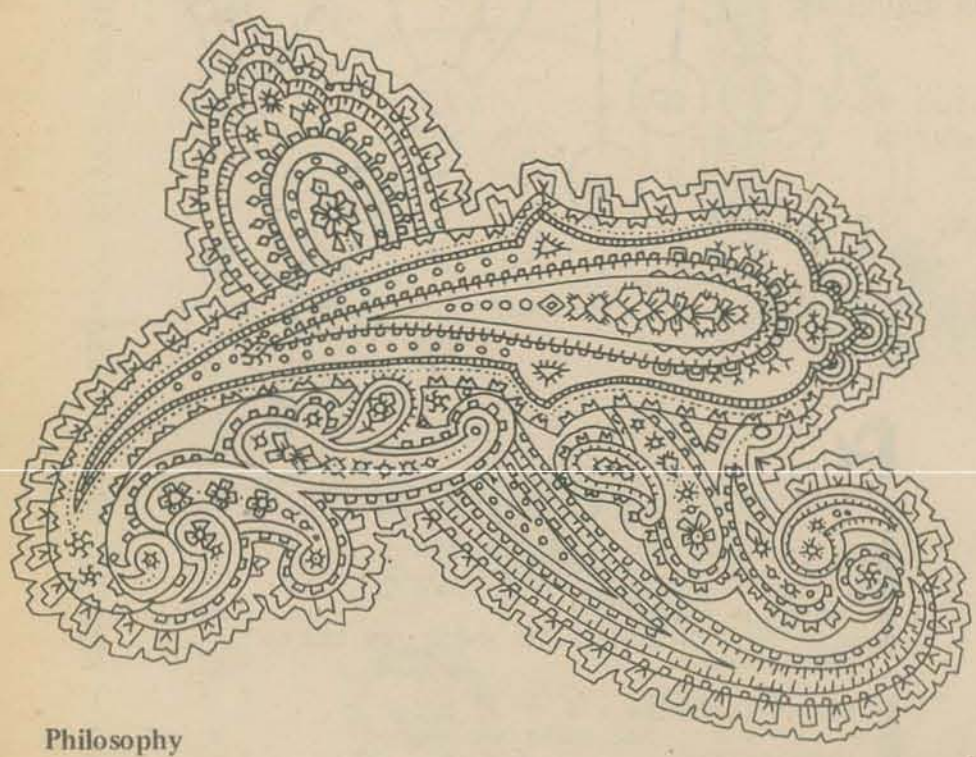


– CAVES – CAVES – CAVES – CAVES – CAVES – CAVES – CAVES – CAVES – CAVES – CAVES – CAVES –

LACE is a project of the University of Wisconsin — La Crosse Computer Center designed to bring computers to Wisconsin's college and secondary school classrooms. LACE stands for La Crosse Area Computers in Education, but geographically, the project now spans nearly a third of Wisconsin and reaches into Minnesota as well.

The project began in early 1970 when our computer center director, Jack Storlie, began to investigate the possibility of bringing computers into college and secondary school classrooms. Different techniques were examined, and it was decided that timeshared computing offered the greatest potential to these educational users. In late 1970 and early 1971, Jack Storlie and John Nierengarten began to promote such a system. Many area school administrators endorsed and supported the project.

When the project began, the university was not using timesharing and only a handful of high schools in the state used or had access to such systems. One of the prime reasons for forming LACE was to offer such facilities to smaller schools and districts. Since then, both large and small schools and colleges have become involved with the project. Currently ten UW - La Crosse departments are using 12 terminals on campus and 14 off-campus institutions are participating. A staff of two programmers, two operators, a User Relations Coordinator, under the direction of John Nierengarten, Computer Center Coordinator of Academic Services support the project at present. Growth has been rapid and future expansion is planned.



Philosophy

The LACE project was begun by the UW - La Crosse Computer Center to bring computing to the classroom. A basic belief is that the computer is an important part of modern society, and high school and college students should have some direct exposure to computers as a part of their education. Since they are likely to come into contact with the computer in many aspects of their daily lives, it is necessary that they become somewhat familiar with the nature and operation of these devices. As a result the major thrust of the program is to provide academic computing for students.

Aside from the "familiarity" aspect, the computer is an extremely powerful tool, and its application can be seen in nearly every academic discipline. The LACE project encourages the use of the computer not only in mathematics and the physical sciences, but in all high school and college academic disciplines.

LACE and its users have developed applications in biology, business, chemistry, mathematics, physics, agriculture, English, social studies, music, and other areas. While there are more applications in mathematics and the sciences, many applications have been and are being developed in non-mathematical disciplines. The LACE staff devotes considerable time and effort to developing new applications in these non-mathematical areas.

Hardware Systems and Communications Support

The center acquired its first timeshared computer, a Hewlett-Packard HP 2000A, in December 1971 and official operation of the network began in January 1972. At that time there were ten remote terminals serving six UW - La Crosse campus departments and four area high schools. A year later, the HP 2000A was upgraded to a HP 2000C, a machine with nearly double the capacity of the A model. After converting to a HIgh Speed HP 2000C in August 1973, the system became capable of serving terminals with speeds from ten to thirty characters per second, in addition to having nearly ten million bytes of storage on line. Of the 32 ports available on the C model, 28 are now in operation.

LACE serves a very large area in which academic timesharing was not available previously. This contribution is unique. Many think that to have access to a timeshared machine, an acoustic coupler and telephone dial service is always used. However, when many users are nearly 100 air miles away, as with LACE, long distance tolls cost a fortune and a suitable alternative to dail-up communication must be found. Most LACE subscribers use leased-line communications to the central site computer in La Crosse. In addition to keeping costs at a minimum, this method has the advantage of low noise and no dialing is required. Portability is sacrificed, but this can be compensated for by locating multiple telephone jacks in the school building. The standard terminal for most LACE users, the ASR-33 teletype, keeps the cost down.

Some additional devices can be hooked up by arrangement with LACE's communications carrier, the Wisconsin Bell Telephone Company. Because La Crosse and much of the surrounding area is served by independent telephone companies, Wisconsin Bell has aided LACE immeasurably by serving as the "communication's coordinator" with these companies in addition to providing the necessary communications.

Applications

LACE subscribers use the terminal for a wide variety of applications. A summary of these follows.

Computer and Programming Instruction. This is LACE's largest application area. Most LACE high schools teach one or more courses in computing or incorporate computing units in their math curriculum. The university's computer science department makes extensive use of LACE terminal facilities for course work, and the secondary education department provides nearly all of its graduates with some instruction on the computer.

Teacher Computing Aids. Many teachers use systems programs to average grades and to do general calculations. Some experimentation is also being done with computerized record keeping.

Enhancement of Instruction and General Problem Solving. Hand computation is frequently "dog work" that prevents a student from seeing concepts. Once the student learns to do the necessary calculations, it is often best to free him of this burden. For example, the UW - La Crosse Chemistry Department has programmed the computer to do the laboratory calculations for some courses, freeing the students for additional experimental work.

Another example is the UW - La Crosse Secondary Education Department's extensive use of Flander's Interaction Analysis, a teacher evaluation technique that would be very difficult to do by hand.

Simulation. With simulation, a teacher uses a role-playing "game" in which the students "simulate" some real life process. A laboratory experience can thus be created where none could otherwise exist. Computer simulations are available in business, social studies, biology, chemistry, physics and other areas.

Because of the wide subject range of these tools and their use by a team of students, computer use is extended to many more students than could actually sit at the terminal at one time. Since this medium is an important one, LACE has made an extensive effort to make good simulations available to its users. All of the Huntington II programs are available on the systems as well as a large number from other sources. *(Ed. For info on Huntington II see PCC Vol 1 No 1.)*

Computer Assisted Instruction (CAI). Interest in CAI started when the project began. Users have written many stand-alone CAI programs in BASIC in such areas as gymnastics and tumbling, on-line statistical tests, elementary mathematics, spelling, sentence structure and others. At present LACE is developing applications with Hewlett-Packard's standard CAI packages. Work is being done with the Instructional Dialogue Facility and one user, the Onalaska School District, is making use of Mathematics Drill and Practice in an experimental summer program.

Administrative Uses. Although the terminal is not suitable for certain administrative uses, especially those involving large volumes of data, users can benefit from a package of administrative programs that includes salary schedule simulation (costing) and enrollment projections.

PARTICIPATION IN THE LACE PROJECT

Preparation of Teachers and Staff

University of Wisconsin - La Crosse, through the LACE project, provides a full program toward staff preparation. Workshops in the use of terminals, some at user schools, are conducted to get schools started on the program. Frequently, schools have one or more teachers with a computer background who are able to provide the necessary leadership for their school's program. These are usually adequate to start the program, but to insure its ulitmate success, more extensive training is needed.

From LACE's beginning the university has supported the project with various course offerings. Most significant is ED 475/SEC ED 675, "Computers in Education", a one-semester, three-credit course that can be taken for undergraduate or graduate credit. It has been offered on campus nearly every semester (at times accessible to teachers) and will soon be offered through extension. Prerequesites are minimal. It has been specifically designed for the LACE project and similar programs and is intended to be *not* merely a computer programming course, but a comprehensive survey of the use of computers in eduaction. It is strongly recommended that teachers from participating schools take the course, for leadership is even more necessary than technical knowledge.

In addition, the UW- La Crosse Computer Science Department offers several courses. Most directly connected with the project is Computer Science (CPTS) 124, "Conversational Computing", which can be taken for two undergraduate credits. In cooperation with the Secondary Education Deaprtment, Computer Science will offer a graduate course in "Computer Assisted Instruction (CAI)" in winter semester 1973-74.

Continuing Support

Once a school has joined the system, LACE continues its support by providing pamphlets and a system newsletter, PUNCHLINE, which is now circulated nationally. Schools are also entitled to belong to the Hewlett-Packard Educational Users Group and can thus receive the user group newsletter plus valuable reference manuals.

At the time a school joins LACE, the school is asked to identify a coordinator. He provides the necessary liaison between LACE and his school on all matters pertaining to instruction. In addition, he provides some indispensable leadership in implementing the program. In most schools he is assisted by a local implementation-evaluation committee in the early stages.

LACE also offers new workshops on the UW - La Crosse campus each semester, and will present in-service training at participating schools whenever possible. LACE users also host forums, or informal users' meetings, at which items of mutual interest are discussed.

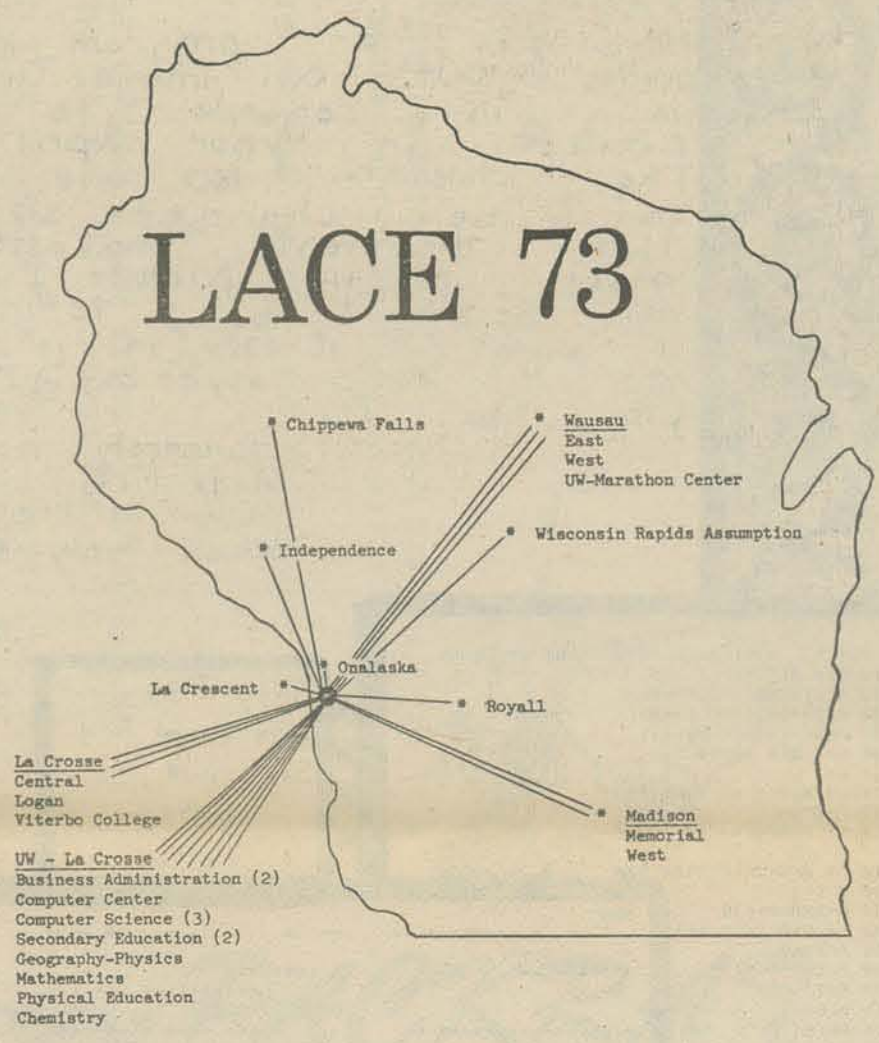
Communications are possible through the computer and subscribers make use of this to keep in touch and request available services. The UW - La Crosse Computer Center maintains program libraries for the LACE computer and will perform certain utility tasks on request.

Costs

Cost information follows. Two noteworthy items should also be mentioned. First, a free three-month trial period is available for schools considering participating in the program. Second, since LACE is a *service*, costs incurred by public schools can be partially reimbursed under the Wisconsin state aid program.

A dedicated port provides the users with access to the machine 24 hours a day, except for periods of system maintenance. With two-port sharing or another sharing agreement the users involved share the resources of one dedicated port.

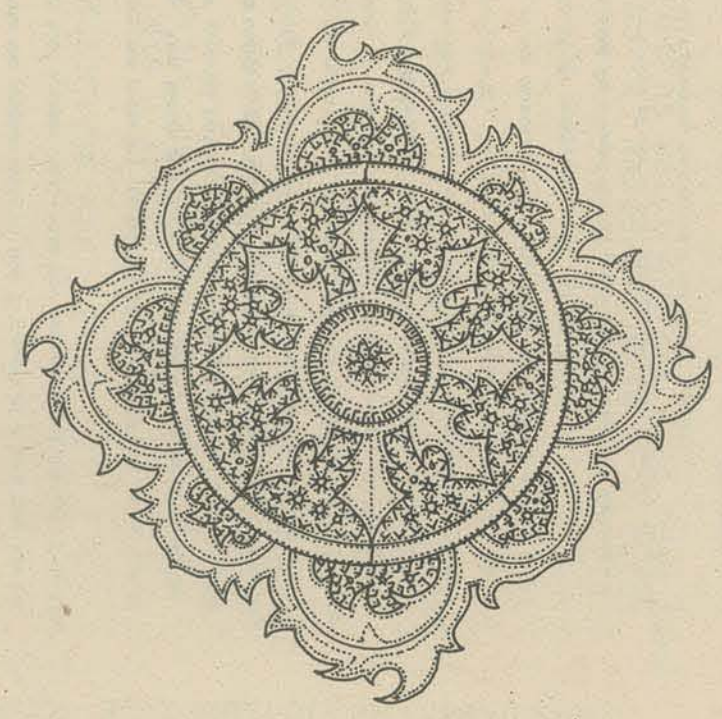
One-time connect charge of one-hundred thirty-six dollars ($136) is charged to each new user to cover the cost of installing terminals and telephone lines. This charge is not repeated unless there is a disconnect/re-connect.



The LACE Project is administered by the Academic Services Section of the University of Wisconsin - La Crosse Computer Center.

The LACE Projcet is administered by the Academic Services Section of the University of Wisconsin - La Crosse Computer Center. If you would like further information, write to *John Nierengarten* or *John Storlie* at:

Computer Center
University of Wisconsin - La Crosse
La Crosse, Wisconsin 54601



JOEL & ANDY'S PAGE 16

1104 Royal Ann
Sunnyvale Ca.
94087

peoples computer company

Dear Sirs:

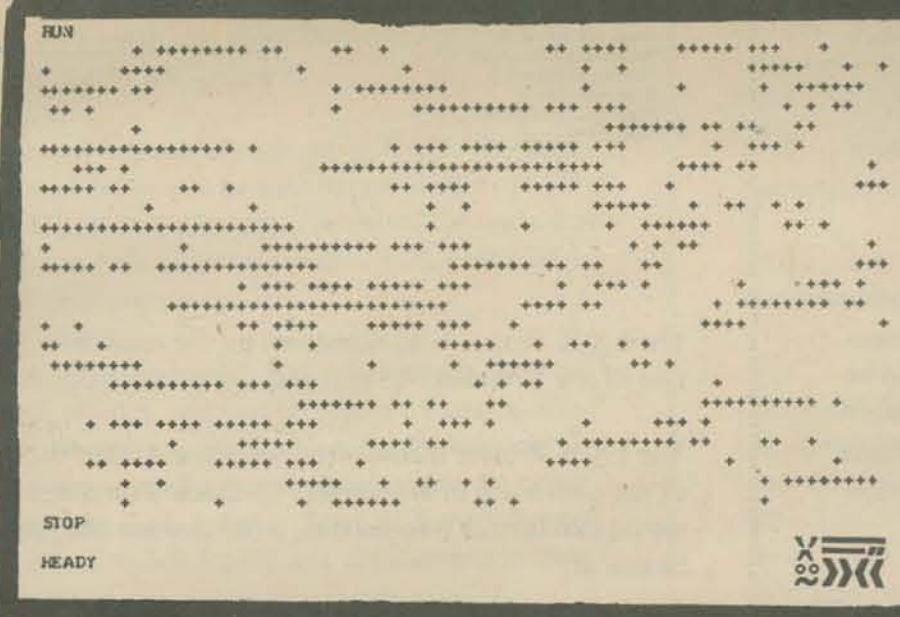
Here is a program which prints out an image. This is in regards to the contest in your april issue. The statements 160 and 190 can be changed so that different characters make up the picture. I will not spoil it by telling now it works (if it does, it is meant for H.P. 2000 super Basic) I hope you like It.

Sincerely
Andy Fire,
Student at Fremont High School Sunnyvale, Calif

```
 5 REM   ANDY FIRE PRINTS OUT AN IMAGE
 10 DIM A(75)
 20 A(1)=INT(RND(0)*2)
 30 A(2)=INT(RND(0)*2)
 40 A(3)=INT(RND(0)*2)
 50 FOR B=4 TO 75
 60 C=1
 70 IF A(B-1)=0 THEN 90
 80 C=C+4
 90 IF A(B-2)=0 THEN 110
100 C=C+2
110 IF A(B-3)=0 THEN 130
120 C=C+1
130 D=RND(0)*10
140 IF C>D THEN 180
150 A(B)=0
160 PRINT " ";
170 GOTO 200
180 A(B)=1
190 PRINT "+";
200 NEXT B
210 GOTO 20
220 END
```

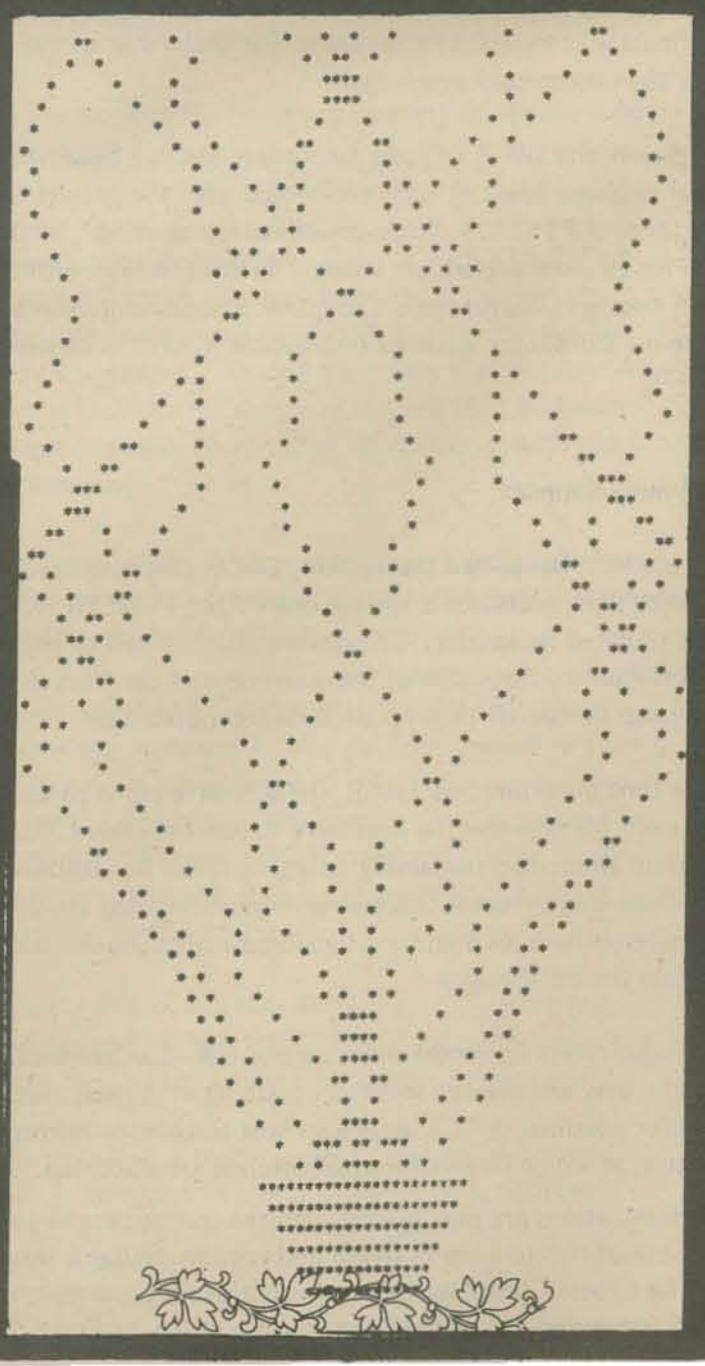

Andy Fire
1104 Royal Ann
Sunnyvale, Ca.
94087


```
RUN
```



```
STOP

READY
```

```
0210  REM  FLOWER  BY JOEL MCCORMACK  (4/2/73)
0220  REM  PRINTS A PICTURE OF A FLOWER.  MAKES LINES BY USING TRENDS
0230  REM  ***COPYRIGHT 1973***BY JOEL MCCORMACK***
0240  DIM A$(72),J(5),P$(24),T(2,5),W(5)
0250  REM  DECIDE HOW MANY *'S
0260  A=3+INT(2.5*RND(-1)+.5)
0270  REM  INITIALIZE TREND VARIABLES (J + T) AND POSITIONS OF *'S
0280   FOR I=1 TO A
0290   T(1,I)=.3
0300   T(2,I)=.7
0310   W(I)=32+INT(14*RND(-1))
0320   J(I)=5
0330   NEXT I
0340  P$="************************"
0350  PRINT ""
0360  REM  PRINT FLOWER POT
0370   FOR I=1 TO 6
0380   PRINT TAB(31-I);P$(1,12+2*(I-1))
0390   NEXT I
0400   FOR Z=1 TO 54
0410   A$(1,72)=" "
0420    FOR I=1 TO A
0430    REM  SET TREND VARIABLES TO BOUNCE IF NECCESARY
0440    IF W(I)<5 THEN 290
0450    IF W(I)<70 THEN 320
0460    T(1,I)=.9
0470    T(2,I)=1
0480    GOTO 360
0490    T(1,I)=0
0500    T(2,I)=.1
0510    GOTO 360
0520    REM  RANDOM RESETTING OF TREND VARIABLES
0530    IF RND(-1)>.09 THEN 360
0540    T(1,I)=.3
0550    T(2,I)=.7
0560    IF RND(-1)>.175 THEN 360
0570    J(I)=5
0580    J=RND(-1)
0590    IF J>T(2,I) THEN 490
0600    IF J>T(1,I) THEN 580
0610    REM  INCREASE PROBABILITY OF * GOING LEFT
0620    T(1,I)=SQR(T(1,I))
0630    T(2,I)=SQR(T(2,I))
0640    IF RND(-1)>J(I) THEN 470
0650    W(I)=W(I)-1
0660    GOTO 640
0670    W(I)=W(I)-2
0680    GOTO 570
0690    REM  INCREASE PROBABILITY OF * GOING RIGHT
0700    T(1,I)=T(1,I)+2 MAX .225
0710    T(2,I)=T(2,I)+2 MAX .225
0720    IF RND(-1)>J(I) THEN 560
0730    W(I)=W(I)+1
0740    J(I)=SQR(J(I))
0750    GOTO 570
0760    W(I)=W(I)+2
0770    J(I)=J(I)+2 MAX .225
0780    A$(W(I),W(I))="*"
0790    REM  MAKES THE PICTURE SYMETRICAL
0800    A$(73-W(I),73-W(I))="*"
0810    NEXT I
0820    FOR I=72 TO 37 STEP -1
0830    IF A$(I,I)="*" THEN 850
0840    NEXT I
0850   PRINT A$(1,I)
0860   NEXT Z
0870  PRINT ""
0880  END
```



5/16/73
3411 Eleanor Place
National City, CA 92050

People's Computer Company
Box 310
Menlo Park, CA 94025

Dear People:

I hope the pictures enclosed aren't too late to (hopefully) get published. I should have sent in this stuff a long time ago but I had some changes I wanted to make in the program.

I wrote the program using an idea I thought of a long time ago but never put into program form. When you announced your contest, I decided to try it.

The program picks six (probability .2), eight (p=.4), or ten (p=.4) asteriks. Even though it may not appear that way on the picture, the number of asteriks is constant throughout a program run. The asteriks sometimes overlap, creating less than the actual amount of asteriks in the printout. The program also picks the direction the asterik will move, and the magnitude of the move. To keep the printout from looking like a bunch of asteriks, the program creates trends. In the case of an asterik's path becoming a near-certainty, the program includes a random resetting of the direction and magnitude (p-values of .09 and .175, respectively). The program also includes a provision for the reversal of the direction of an asterik in the event it gets to near the limits of its range.

I can send you a tape of this program if you want it, as long as you send me a tape of one of your picture programs. You may also sell tapes of this program, as long as I get fifty percent.

Sincerely,
Joel McCormack
Joel McCormack

THE PROGRAMMER'S TOOLBOX

by marc le brun

[Each issue we will present an "advanced" programming technique: with explanations, examples, programs and problems. We welcome suggestions for topics of interest to you.]

PACKRAT

IN THIS ARTICLE WE WILL EXPLORE WAYS IN WHICH WE CAN EXPRESS DATA IN VERY COMPACT WAYS INSIDE THE COMPUTER. BEFORE READING FURTHER RUN THE FOLLOWING PROGRAM ON YOUR COMPUTER :

```
 10 LET S=0
 20 LET M=0
 30 LET T=2↑S
 40 LET U=T-1
 50 IF T=U THEN 90
 60 LET S=S+1
 70 LET M=U
 80 GOTO 30
 90 PRINT "THE LARGEST INTEGER I CAN STORE IS ";M
100 PRINT "WHICH IS TWO TO THE ";S-1;" MINUS ONE."
110 END
```

WHEN WE RAN THIS PROGRAM ON THE COMPUTER WE USE WE GOT :

```
RUN
TEST

THE LARGEST INTEGER I CAN STORE IS  8.38861E+06
WHICH IS TWO TO THE  23    MINUS ONE.
```

THIS TELLS WHAT SIZE "BOXES" OUR BASIC SYSTEM USES FOR STORING NUMBERS. EVERY TIME WE USE A VARIABLE WE ARE USING A BOX OF THIS SIZE NO MATTER HOW LARGE A NUMBER WE ACTUALLY PUT IN THE BOX. WHEN WE USE AN ARRAY WE HAVE A WHOLE BUNCH OF BOXES OF THIS SIZE. MANY TIMES WE DO NOT "USE UP" ALL THE ROOM THAT IS AVAILABLE IN THE BOX. ON A MINI-COMPUTER, WHERE SPACE IS SCARCE, WE CAN VERY OFTEN USE THIS "EMPTY SPACE" EFFECTIVELY. IN THIS ARTICLE WE WILL EXAMINE TECHNIQUES FOR USING THE EXTRA SPACE IN THE VARIABLE "BOXES".

SUPPOSE WE HAD A LIST OF FOUR DIGITS : D(1),D(2),D(3),D(4) SUCH AS 1,9,7,3 . ONE WAY OF STORING THESE FOUR DIGITS WOULD BE TO KEEP THEM IN FOUR SEPARATE BOXES, FOR EXAMPLE IN AN ARRAY OF FOUR ELEMENTS. ANOTHER WAY, WHICH ONLY USES ONE BOX, IS TO THINK OF THE DIGITS AS FORMING A SINGLE NUMBER, IN THIS CASE THE NUMBER WOULD BE 1973. THIS IS A VERY USEFUL TECHNIQUE, WHICH IS CALLED COMPACTION, AND THE PROCESS OF TAKING SEVERAL THINGS AND STUFFING THEM INTO A SINGLE BOX IS CALLED PACKING.

LET'S TAKE A LOOK AT HOW THE LIST 1,9,7,3 IS PACKED INTO 1973. FIRST OF ALL, SINCE WE KNOW THAT THE NUMBERS IN THE LIST ARE DIGITS WE KNOW THAT THEY ARE ALWAYS LESS THAN 10. SINCE THIS IS TRUE WE KNOW THAT WE CAN THINK OF THEM AS FORMING A NUMERAL WRITTEN IN BASE 10. THEREFORE WE KNOW THAT WE CAN EXPRESS THE COMPACT NUMBER (N) USING THE FOLLOWING EQUATION :

```
N=10↑3*D(1)+10↑2*D(2)+10↑1*D(3)+10↑0*D(4)
```

IN FACT WE DO NOT HAVE TO RESTRICT OURSELVES TO BASE 10. IF, FOR INSTANCE, WE HAD TWO TWO-DIGIT NUMBERS : 19 AND 73 WE COULD THINK OF THEM AS FORMING A NUMERAL IN BASE 100 :

```
N=100↑1*D(1)+100↑0*D(2)
```

HOW TO BECOME A

WE CAN ALSO HAVE MORE THAN FOUR DIGITS, AS LONG AS THE RESULTING COMPACTED NUMBER DOES NOT EXCEED THE MAXIMUM VALUE PRINTED OUT BY THE PROGRAM GIVEN AT THE START OF THIS ARTICLE.

SUPPOSE WE HAVE A SET OF NUMBERS WHICH ARE ALL LESS THAN SOME VALUE B, AND WE WANT TO FIND THE MAXIMUM NUMBER K OF THESE VALUES THAT CAN BE PACKED INTO A SINGLE VARIABLE. THIS IS FOUND BY SOLVING THE FOLLOWING EQUATION FOR K :

```
B↑K <= 2↑S
```

WHERE S IS THE SECOND MAGIC NUMBER PRINTED OUT BY THE ABOVE PROGRAM. THE FOLLOWING BASIC STATEMENT WILL PRINT OUT K :

```
PRINT "K = "; INT(S*LOG(2)/LOG(B))
```

ON OUR SYSTEM S=23. FOR THE EXAMPLE ABOVE B=10 AND THE ABOVE STATEMENT PRINTS OUT K = 6, SO WE KNOW THAT WE CAN STORE UP TO SIX VALUES LESS THAN 10 IN A SINGLE VARIABLE. GIVEN THE VALUES OF B AND K THE FOLLOWING SUBROUTINE WILL PACK THE VALUES STORED IN A LIST D INTO A SINGLE VARIABLE N :

```
1000 REM *** PACKING ALGORITHM ***
1010 LET N=0
1020 FOR I=1 TO K
1030 LET N=N*B+D(I)
1040 NEXT I
1050 RETURN
```

OF COURSE WE ALSO NEED A WAY TO UNPACK THE VALUES AND THE FOLLOWING SUBROUTINE WILL DO THE TRICK :

```
2000 REM *** UNPACKING ALGORITHM ***
2010 LET T=N
2020 FOR I=1 TO K
2030 LET U=B↑(K-I)
2040 LET D(I)=INT(T/U)
2050 LET T=T-D(I)*U
2060 NEXT I
2070 RETURN
```

THIS TECHNIQUE IS ESPECIALLY VALUABLE IF THERE ARE LOTS OF SMALL NUMBERS USED AS DATA BY OUR PROGRAM, FOR EXAMPLE A MATRIX CONTAINING ONLY 0'S AND 1'S CAN BE REDUCED IN SIZE BY A FACTOR OF 23, PROVIDING WE ARE WILLING TO GO TO THE TROUBLE TO DO THE NECESSARY PACKING AND UNPACKING. IF WE HAVE LISTS THAT ARE LONGER THAN K SAY LENGTH L, WE COMPUTE M=-INT(-L/K) AND STORE THEM IN A LIST OF PACKED NUMBERS N OF LENGTH M. TO STORE OR FETCH SOME ELEMENT J IN THAT LIST WE FIRST COMPUTE P=INT((J-1)/K)+1 AND Q=J-P*K+K+1 . P IS THE ELEMENT OF N THAT THE VALUE IS PACKED INTO AND Q IS THE ELEMENT OF D THAT WILL CONTAIN THAT VALUE WHEN N(P) IS UNPACKED. IF WE WISHED TO ALTER ONE OF THE VALUES IN THE LIST THE PROCEDEURE WOULD BE : 1. FIND P AND Q ; 2. UNPACK N(P) ; 3. SET D(Q) TO THE NEW VALUE ; 4. PACK D BACK INTO N(P).

IT IS ALSO POSSIBLE TO PACK AND UNPACK VALUES WHICH ARE NOT ALL THE SAME SIZE (I.E. LESS THAN THE SAME B) AS LONG AS THE MAXIMUM VALUES FOR EACH ELEMENT ARE KNOWN, BUT IT IS TOO COMPLICATED TO DESCRIBE HERE, AND I WILL LEAVE IT AS AN INTERESTING EXERCISE.

HELP STAMP OUT BUGS: READ THIS COLUMN EVERY ISSUE!!!

Space Games

by Alister Macintyre

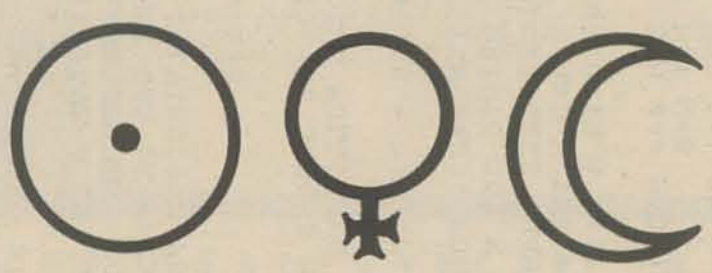
Somebody told me about Alister Macintyre so I wrote him & asked him for information about science fiction games – well, now I'm overwhelmed with new information and it keeps coming. Looks like we will have an Alister Macintyre *page every issue for awhile.*

b.a.

Thousands of humans from earth are exploring the Universe, developing the resources of distant solar systems, and resolving conflicts with alien beings. The space ships used to reach these far flung destinations are Space Travel Games enjoyed all over our planet. These games present an opportunity to gain insights into gravity, momentum, and multiple dimensions, but are played because they are so enjoyable. Excluding Time Travel and Fantasy Games, which are equally popular, the three major categories of Science Fiction Games are: *Tactical Space War Games* which delve into the mechanics of maneuvering individual space ships in a simple conflict situation; *Interstellar Diplomacy Games* which are enjoyable due to the inter-action of many players rather than the details of space travel; and *Campaign Strategy Games* which encompass both extremes and involve the economics of space.

Most major game companies manufacture Science Fiction Games, which are available at many toy stores, for example: *Countdown* (E. S. Lowe Co.) Children race to build a space ship. *Situation-7* and *Thunderbird* (Parker Brothers) Family games. *Ploy* (3 M) Strategy game for 2-4 players. However, many such games are very abstract or depend upon luck, because comercial companies must appeal to the mass public to successfully market their games in most retail stores. Space travel enthusiasts, and Science Fiction fans seeking challenging games with some relevance to space travel as we know or predict it, should look to the specialized or amateur game companies for intellectual stimulation.

Space ship pilots consult simple charts each game turn to see how much their ship directions are changed by gravity, causing an elliptical pattern after several moves, because each ship's momentum is altered only by acceleration, deceleration, or collision. This occurs on the circular game board of *Revolt!*, (Imperial inventors is currently seeking a manufacturer for this game.) in which the moon is revolving about the earth which in turn is revolving about the sun. The rules cover meters, construction of space stations, and astroblemes. *Revolt!* is enjoyed at many game conventions in the Midwest.



Raumkrieg is a popular little 3-D game for any number of players, featuring even more realistic rules for momentum and acceleration. Each player starts with one flagship, which can capture enemy ships, two battlecruisers with unlimited range parallel to the coordinate axes, and five scouts with very limited destructive ranges. The game requires an umpire and moves are usually made at one week intervals. *Raumkrieg* has been taken off the market, and will be replaced by a different tactical space game. For info, contact Flying Buffalo, Inc., P.O. Box 1467, Scottsdale Az 85252.

Columbus Ohio gamers have enjoyed a Star Trek game (*Starship Enterprise*) using AMT models for many years but now *Louis Zocchi (388 Montana, Victorville Ca 92392)* has developed a Star Trek game that can also be enjoyed on your home black & white TV set! Lou is selling his *Alien Space Battle Manual* for only $4.00 which includes the complete rules, Star Trek ships, and information on some of his other games. Spartan International plans to sell the TV attachment within a year. Meanwhile the TV version may be played at many Spartan Game Conventions across the country.

This game is far superior to the MIT *Space War* game on Computer video tube screens because in the computer game a blip leaving your screen at one side at a given velocity, immediately re-enters on the opposite side in a parallel direction at the identical speed. That is, the Computerized *Space War* game provides complete 360° spherical vision or 100% intelligence of what is happening. Most space game enthusiasts desire secret manuevers, or consider it unrealistic, for a pilot to be able to read all his instruments simultaneously all the time.

In Zocchi's TV game, you only see the portion of space directly ahead of you. Move your toggle switch and space swings in front, revealing new vistas. Proceed dead ahead and the 3-D images will disappear off the edges of the screen while more become brighter in the distance. Squeeze the switch and a phasar beam goes straight to the center of your screen damaging any opponent's ship or space station you may have sighted on.

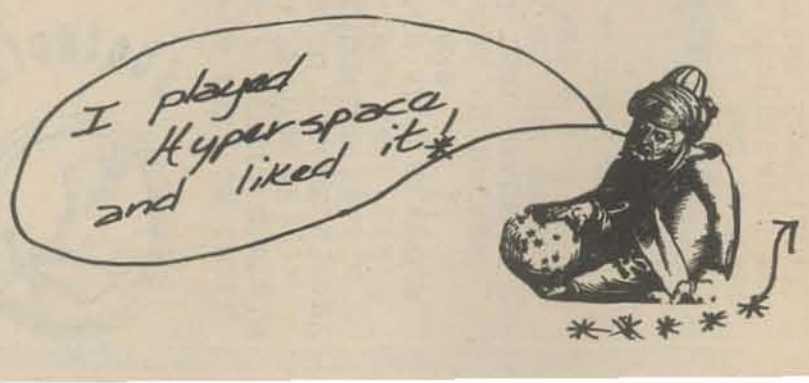
Cold War 2007 requires 6 players and a judge, and also includes interplanetary espionage and planetary revolutions (revolts). *Cold War 2007* costs $4.00 from the *American Designer's Association 17 Turner St Greene NY 13778.*

Lensman ($5.00 from Spartan International) is a multi-player game of exploration, economics, warfare and diplomacy with varying complexities for play-by-mail and face-to-face so you may enjoy the simpler versions while still learning the next level.

Space Centurians (by Ivan Travnicek, rules serialized in the Spartan magazine) is for the dedicated space wargames addict, requiring hours of player effort per turn to keep track of his ship repairs, economics on planets he controls, and movement of dozens of different types of ships, bases, and weapon systems.

In *War of Empires*, novice players join a team and work up to more prestigious positions on the basis of proven skills. The game requires a referee, who is usually the editor of a space game magazine.

Another Tactical Science Fiction game is *Hyperspace*, in which players explore a four dimensional world, racing to discover more resources than their opponent. *Hyperspace* costs $4.00 from *Allan Calhamer 501 N Stone La Grange Park Il 60585.* (Mr. Calhamer is also the designer of *Diplomacy*, one of the most popular multi-player wargames in existence.)



I know of no Interstellar Diplomacy games in print at present of a quality comparable with my other recommendations, although there is a thriving second hand market in the intellectual games hobby of such favorites as *Galactic Diplomacy* (Designed by Lenard Lakofka, president of the International Federation of Wargamers), *Galaxy* by Montgomery, and *Cosmic Diplomacy* by Trembly. Fortunately, hundreds of game designers are constantly producing new and interesting games which are quickly circulated to the members of the Space Game Societies of the major game clubs, and the subscribers of SF gamezines; but unfortunately specialized game companies usually print very limited volumes and most amateurs operate at a loss or break even (they are designing for fun). Thus there is a constant turn-over of available Space War Games. To keep abreast of the ever-changing hobby, I'd suggest membership in the game club of your choice, or a few random sample issues of representative game magazines.

The following are some of the most industrious centers of Science Fiction game activities in the U.S.A. today:

Supernova Magazine, 423 North Main St., Bellevue Mi 49021
(sample 15¢)

Spartan International, Box 1017, Bellflower Ca 90607
(e.g. Lensman games)

Conflict Magazine, Box 19096, San Diego Ca 92119
(Time travel games)

Many enthusiasts prefer to design their own games. This is an enjoyable game in itself. If you need information on balancing playability, realism, and fun, I suggest an amateur game magazine or game designer's club such as:

MOVES Magazine, 44 East 23rd Street, New York NY 10010
(sample $2.00)

Grundsteit Magazine – American Designer's Association (see Cold War game)

Battleflag, 465 Woodland Hills, Philadelphia Ms 39350
(1 year, 12 issues, $8.00)

Simulation Design Group PSC, Box 5387, Victorville Ca 92392
(informal)

Finally, if you have any difficulty finding opponents for Science Fiction games in your community, send a self-addressed stamped-envelope and a dime to Operation Contact, for a list of opponents. Operation Contact is building an opponent's matching service by geographical region and game category, but cannot yet guarantee opponents, as there are Operation Contact Volunteers in only 20 U.S. states and one Canadian province.

Operation Contact, 2729 Stratford Ave, Cincinatti Oh 45220

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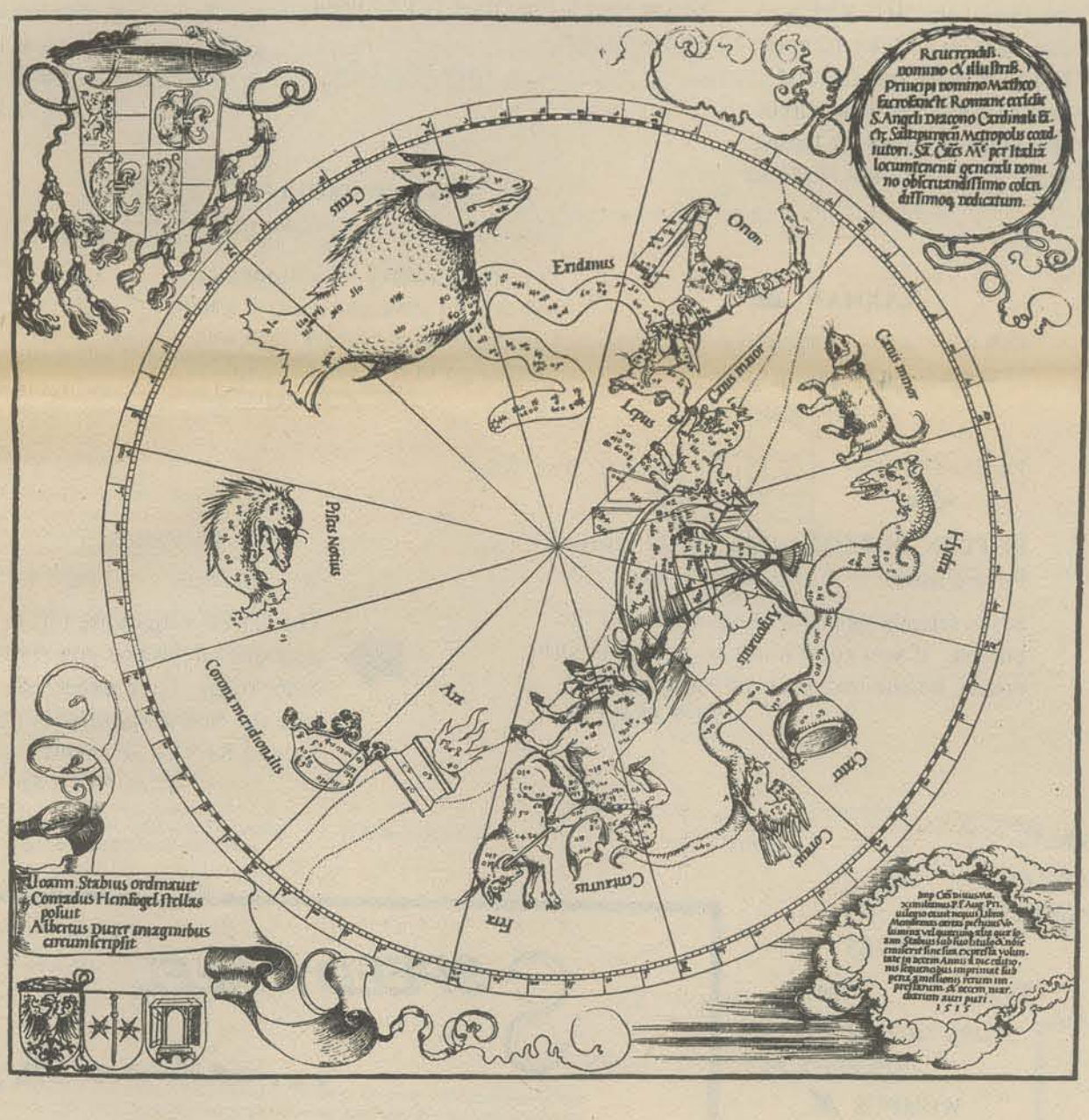


Alister Macintyre
2729 Stratford Avenue
Cincinatti, Ohio 45220

If you like to play science fiction games on your computer, get STTR1 from HP. Star Trek (STTR1) is available from the Hewlett Packard User's Library. Order from your local HP sales office, and ask for HP 36243B, Option K01 (paper tape), price: $10.00. You will receive the paper tape of STTR1 and complete documentation including a sample RUN and listing of the program. Or . . . if you have mag tape capability, you can order the complete HP BASIC Contributed Library (including STTR1) for $25.00. Order HP Part No. 02000-90029 for the HP 2000C or 02000-90060 for the HP 2000C/F.

If you want to try Hyperspace or Alien Space . . . come to People's Computer Company on a Thursday evening.

OUR GAMES

Past Present & FUTURE

HERE'S A RECAP OF ALL THE GAMES WE'VE PUBLISHED THIS PAST YEAR (AND SOME WE WILL PUBLISH SOON!). MOST ORIGINALLY APPEARED WITH A LISTING, SO YOU COULD TYPE IT IN YOURSELF.

FOR THE LONGER GAMES, YOU MIGHT PREFER TO BUY OUR PAPER TAPES. PRICE INCLUDES POSTAGE AND THE TAPE, READY TO BE FED TO YOUR OWN MACHINE!

HURKLE

April '73 issue Page 22

"The HURKLE is a happy beast . . . " and he lives on a 10-by-10 grid. Each time you guess his hiding place, you're told which direction to go for your next guess (Northeast, Southwest, etc.)

TAPE PRICE $2

SNARK

Future issue Page ???

The SNARK also lives on a 10-by-10 grid, and you hunt it by defining circles on the grid, and seeing if the SNARK is inside, outside, or on your circle. *TAPE PRICE $2*

CAVES1

May '73 issue Page 5

The computer creates a series of connected caverns and you try to find your way out into the sunlight. You can choose three levels of difficulty.

TAPE PRICE $4

CAVES2

This ish Page 12

SEE FOR YOURSELF!

TAPE PRICE $4

SUNSIGN

Future issue Page ???

WHAT'S YOUR NAME?
WHAT'S YOUR SUNSIGN?
Program then prints out a personalized pattern for you.

TAPE PRICE $3

CHOMP

February '73 issue Page 9

Any # of players take turns eating from a rectangular cookie until the last piece (the *poisoned* piece) is eaten. You choose the size of each bite.

TAPE PRICE $3

MUGWUMP

April '73 issue Page 3

The MUGWUMP is a close relative of the HURKLE and also lives on a 10-by-10 grid. For each guess, you're told how far (but not what direction) you are from his hiding place. *TAPE PRICE $2*

CAVES3

This ish Page 13

TURN TO PAGE 13

TAPE PRICE $4

WUMPUS

Future issues Page ???

The WUMPUS lives in a connected set of caves. You hunt him with crooked arrows and watch out for bottomless pits and *SUPERBATS!*

TAPE PRICE $4

STARS

December '73 issue Page 3

How close is your guess to the target? Well, the closer you are, the more stars (*******) get printed until

**********!!!
YOU GOT IT IN n GUESSES!!!

TAPE PRICE $2

TRAP

February '73 issue Page 8

Each turn, you give two numbers. You're told if the target is TRAPped between them.

TAPE PRICE $2

TAXMAN

This ish Pages 6-7

FIND OUT YOURSELF!!!

TAPE PRICE $3

BUTTON, BUTTON, who's got the button?

Future issue Page ???

Seven friends sit in a circle and one has the button. If you guess him/her, you win! Otherwise, he/she may pass the button.

TAPE PRICE $2

NUMBER

October '72 issue Page 8

Guess which number (1-100) the computer picked. You're told if your guess is lower or higher than the target.

TAPE PRICE $2

LETTER

October '72 issue Page 11

Can you guess which letter (A-Z) the computer has randomly chosen? For each guess you're told if you were higher or lower than the target.

TAPE PRICE $2

BEYOND BAGELS

Future issue Page ???

You try to guess a 3-digit number, and each of your guesses gets a score; 1 point for each correct digit, and another point if it's in the correct place. *TAPE PRICE $2*

REVERSE

May '73 issue Page 4

The lowest 9 digits are put in a scrambled list and you try to order them. Each move, you take the first n numbers in the list and REVERSE them!

TAPE PRICE $2

MAKE CHECKS OR MONEY ORDERS TO US:
PEOPLE'S COMPUTER COMPANY
P.O. BOX 310
MENLO PARK, CALIFORNIA 94025

Information on Propane and Methane Energy

prepared by Fred Moore

Information Network 1921 Menalto Ave, Menlo Park, Ca 94025 325-3330

Methane Production

Predicting Methane Production from Waste Chemical Composition:

$$C_nH_aO_b + \left(n - \frac{a}{4} - \frac{b}{2}\right)H_2O \rightarrow \left(\frac{n}{2} - \frac{a}{8} + \frac{b}{4}\right)CO_2 + \left(\frac{n}{2} + \frac{a}{8} - \frac{b}{4}\right)CH_4$$

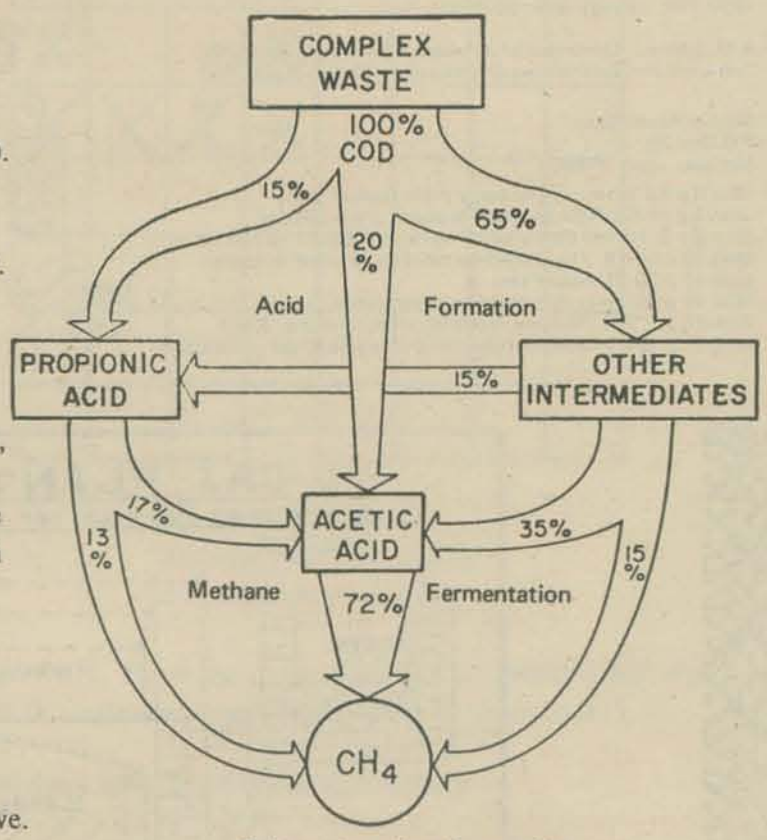
Predicting Methane Production from Waste Stabilization:

One pound BOD_L or COD stabilized = 5.62 cubic feet CH_4 (STP)

A few problems with methane generation and use as a fuel:

1. Obtaining and collecting sources of agricultural wastes in large volume (e.g., chicken manure).
2. Mixing of slurry, controlling rate of input, and breaking-up scum formations.
3. Heating and insulating digester to maintain chamber at 85 - 95 degrees F.
4. Start-up wait of two months. However, the sludge from another digester will lessen the time.
5. Collecting the bio-gas generated in a floating tank or other container.
6. Piping gas to burner or stove for cooking, heating water, etc.
7. For use as a fuel in internal combustion engines:

   A. Because bio-gas is approx. 70% methane, removal of the carbon dioxide, hydrogen sulfide, and water vapor makes for more efficient engine operation.
   B. Methane has a low fuel value (960 BTU per cubic foot). Compared to gasoline or propane a greater volume of methane is needed for equivalent engine performance. For vehicles, such a large tank may not be practical. Compressing the gas will reduce the volume, however:
   C. Compression to liquify methane requires a 5000 psi compressor designed for flammable gases, a fuel tank to withstand the high pressure, a pressure relief valve, and lock-off valve.
   D. A regulator, aircraft quality hoses, and a converter will be needed to make use of methane that is under high pressure.
8. Removal of sludge from digester and use as fertilizer or in algae ponds.
9. Safe engineering practices must be followed because as little as 12% methane in air is explosive.



Pathways in methane fermentation

Some information sources on methane gas production:

Methane Digesters for Fuel Gas and Fertilizer,
Spring 1973 Newsletter 3, 46 pages,, $3.
New Alchemy Institute - West
15 West Anapamu, Santa Barbara, Ca. 93101
(includes instructions for making two models)

The New Alchemy Institute - East
Box 432, Woods Hole, Mass. 02543

John E. Myhre, Maggies Farm
Palouse, Washington 99161
(John worked with Ram Bux Singh at a dairy farm in Vermont, building a bio-gas demonstration plant at a cost of $600 excluding labor. The gas is used to heat water.)

Methane generator built by Les Auerbach at Oxford Tract Student Garden corner of Walnut and Virginia, Berkeley, Ca.

Les will be teaching a class on building and operating a methane digester during the Fall term 1973.
Antioch College West
149 9th Street, San Francisco, Ca.

L. Auerbach, B. Olkowski, B. Katz
A Homesite Power Unit: Methane Generator
1973, 70 pages, about $3. available from
Bill Olkowski
1307 Acton , Berkeley, Ca. 94706

An experimental bio-gas digestor built by Steve Ridenour (now leaks and needs repair).
Contact: Steve Kafka, Chadwick Farm Manager
Physical Planning & Construction, Carriage House
U. C. S. C., Santa Clara, Ca. 95064

Compost Science
Rodale Press, Emmaus, Pa. 18049
Sept-Oct 1971 p 18 *Biological Treatment of Poultry Manure Reduces Pollution*
Jan-Feb 1972 p 20 *The Bio-Gas Plant: Generating Methane from Organic Wastes*
Jan-Feb 1972 p 6 *Anaerobic Digestion of Solid Wastes*
March-April 1972 p 12 *Building a Bio-Gas Plant*

Perry L. McCarty *The Biochemistry of Methane Fermentation Using C-14 Traces*
1965 Journal Water Poll. Control Fed., 37(2): 178-92

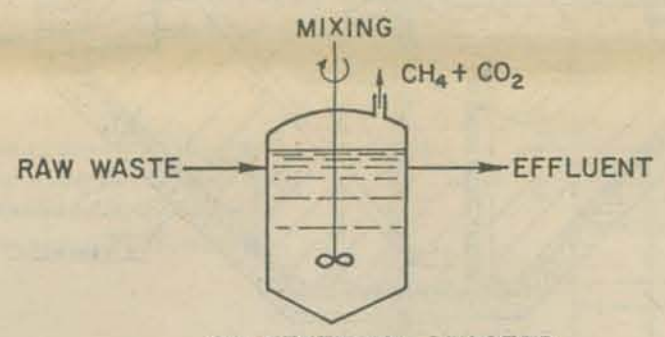
Perry L. McCarty *Anaerobic Waste Treatment Fundamentals*
Public Works v 95 n 9, 10, 11, 12.
Sept 1964 p 107-112
Oct 1964 p 123-126
Nov 1964 p 91-94
Dec 1964 p 95-99
(microbiology and chemistry)

Ram Bux Singh *Bio-Gas Plant*
1971, Gobar Gas Research Station
Ajitmal, Etawah, Utter Pradesh, India

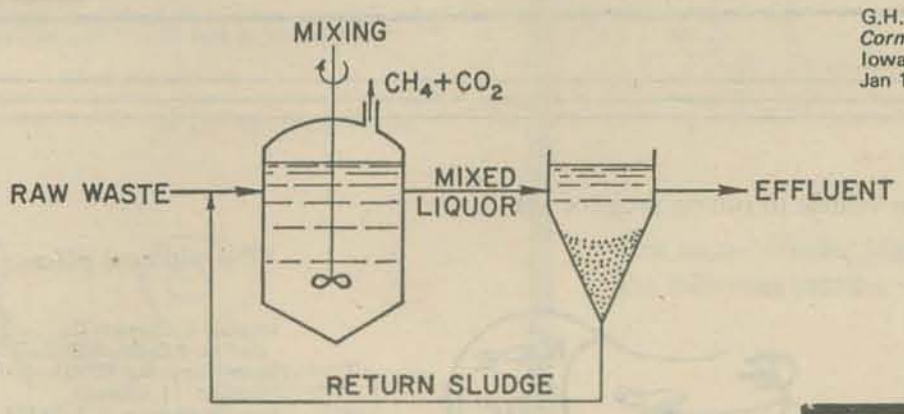
Ram Bux Singh *Some Experiments with Bio-Gas*
1971, Gobar Gas Research Station
Ajitmal, Etawah, U.P., India

Alternative sources of Energy
Don Marier Route 1 Box 36 B
Minong, Wisconsin 54859
(bi-monthy newsletter, short articles, some on methane generation)

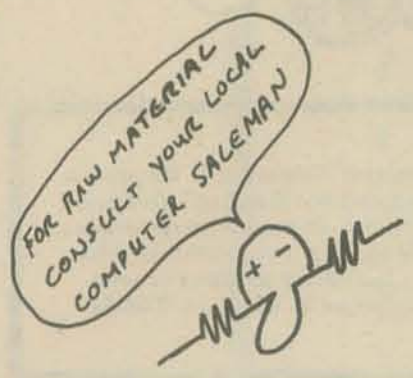
more on Page 22



CONVENTIONAL PROCESS



ANAEROBIC CONTACT PROCESS



Harold B. Gotaas 1956 *Composting*
World Health Organization
1211 Geneva 27, Switzerland
(out of print or not available in U.S. to our knowledge)

Use of Sewage Gas as City Gas
Sewage Works Journal
July 1930 p 424 *Use of Sewage Gas as City Gas*
V 8 n 1, 1936 p 57-62 *Operation of Sludge Gas Engines*
V 18 n 1, 1946 p 17 *Digester Gas for Automobiles*
V 20 n 5, 1948 *Commercial Utilization of Waste Digester Gas*

A.M. Buswell, et al. *Anaerobic Fermentations*
Illinois State Water Survey Bulletin 32 (1936)

L. Anderson *Energy Potential from Organic Wastes: A review of the quantities and Sources,* Bureau of Mines Information Circular 8549, U.S. Dept of Interior

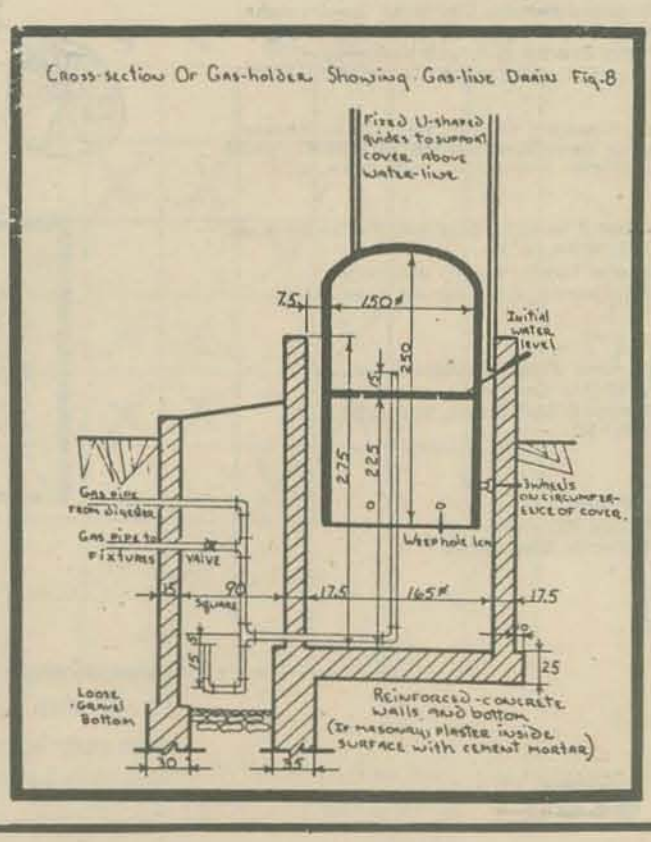
H.A. Barker *Biological Formation of Methane*
Industrial and Engineering Chemistry 48 p 1438-1442 (1956)

H.H. Hunt & W.N. Clarke, Sr. *Design and Operation of the First Digester Gas Turbine in the USA,* Presented at the Water Pollution Control Federation Meeting, N.Y. Oct 12, 1967

Ingersoll-Rand *Compressed Natural Gas*
Vehicular Duel Fuel System, Ingersoll-Rand Co. 1971

G.H. Nelson, et al., *Decomposition and Gas Production of Cornstalks Under Anaerobic Conditions at 28° to 30° C*
Iowa State College Journal of Science
Jan 1939 V 13, & Dec 1939 V 14.

11300.1 Methane Gas Plant $1.
includes info drawn from
C.N. Acharya *Preparation of Fuel Gas & Manure,*
Dr. S.G. Kasbekar *Gas From Animal Dung*
Ordance Factories, Calcutta,
and xerox copy of *Bio-Gas Plants Their Installation , Operation, Maintenance and Use by* M.A. Idnani & C.N. Acharya
Indian Council of Agriculture Research, New Delhi.
obtainable from VITA, Inc.
3706 Rhode Island Ave.
Mt. Rainier, Maryland 20822



C.E. Keefer and H. Kratz *Digesting Sewage Sludge at its Optimum pH and Temp.*
Engineering News-Record 102 p 103-105 (1929)

E.P. Taiganides *Anaerobic Digestion of Poultry Manure*
1963 World's Poultry Science Journal 19(4)

E.P. Taiganides, et al., *Anaerobic Digestion of Hog Wastes*
Journal Agriculture Engin. Research 8(4)

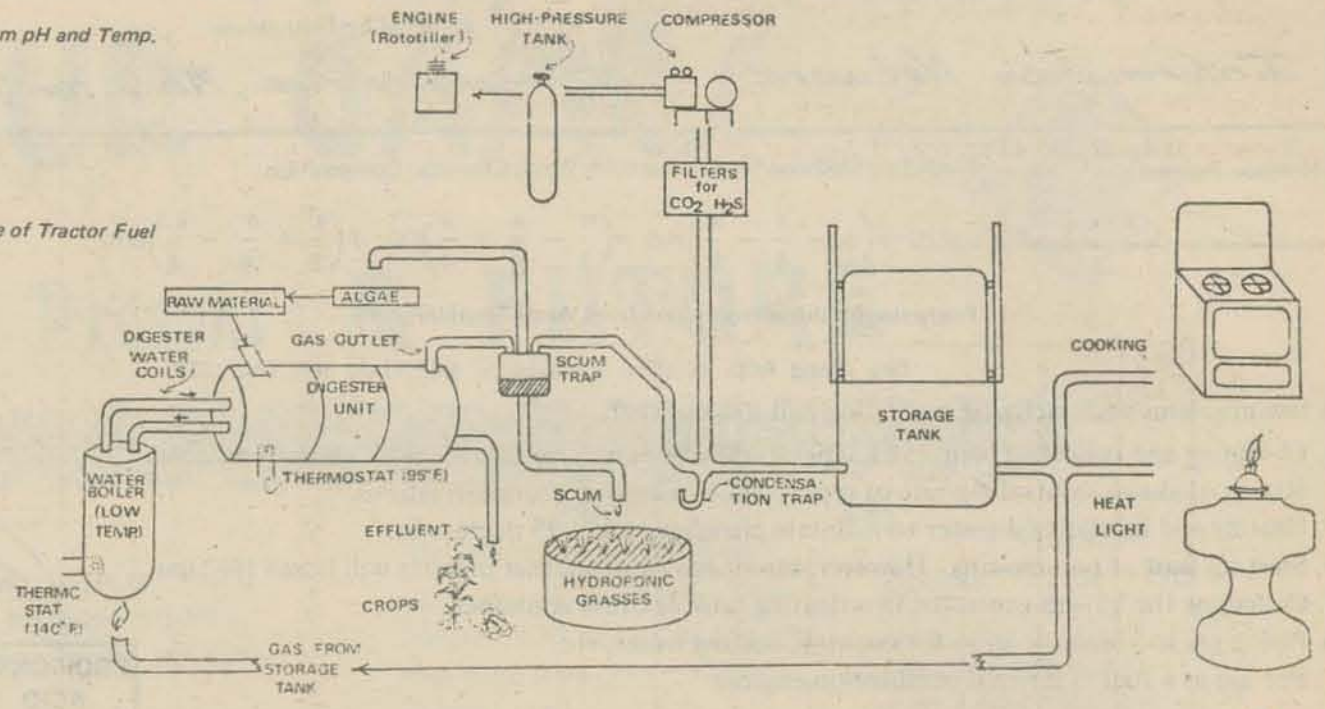
G. Rosenberg *Methane Production from Farm wastes as a Source of Tractor Fuel*
1952 J. Min. Agric. (england) 58:487-94

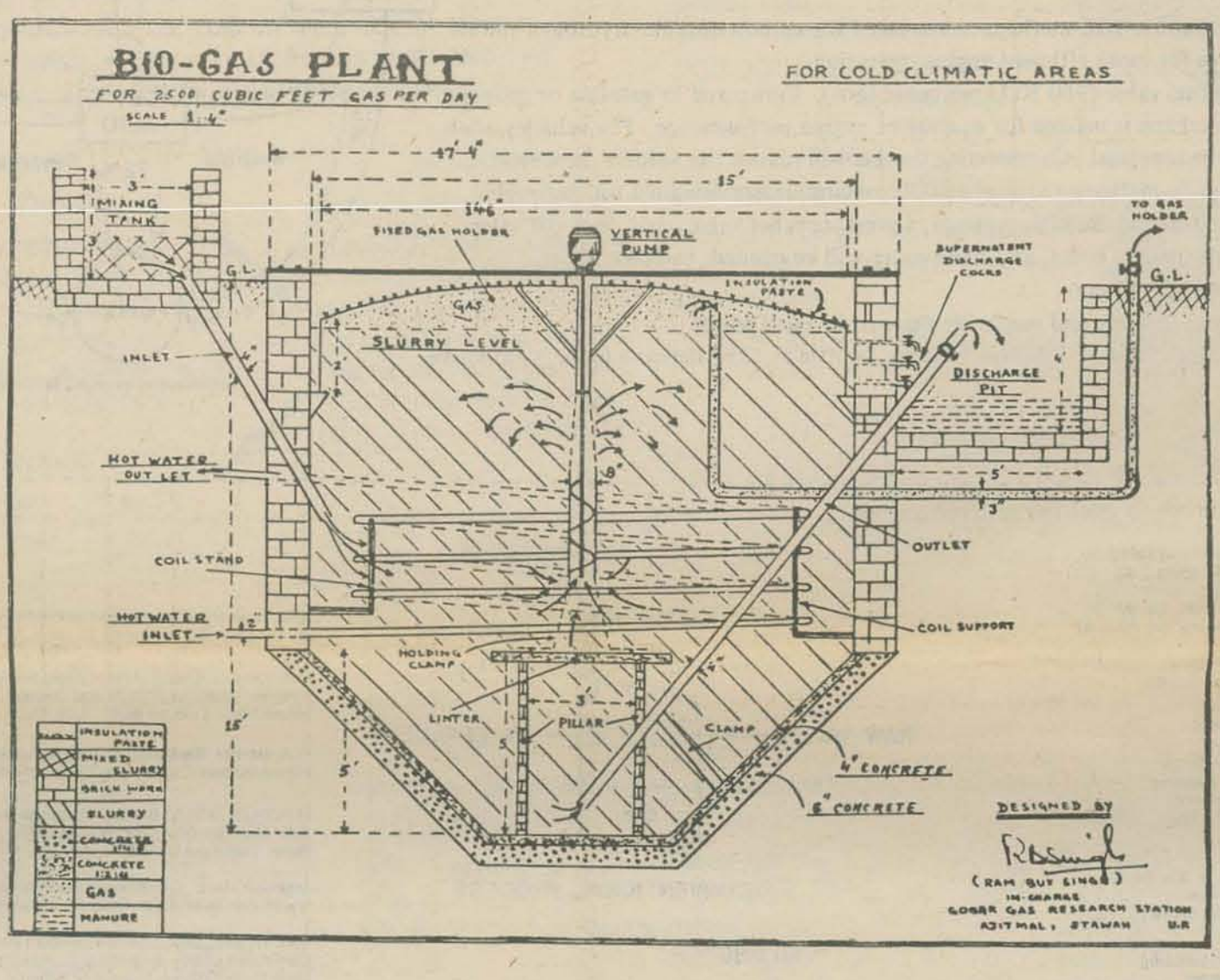
K. Imhoff & C. Keefer *Sludge Gas as Fuel for Motor Vehicles*
1952 Wat. Sewage Wks. 99:284

A.M. Boswell *Operation of Anaerobic Fermentation Plants*
Industrial and Engineering Chemistry, V 42 n 4 April 1950

Mother Earth News
P.O.Box 38
Madison, Ohio 44057

issue 3 p 44 *Now . . . Electricty from manure gases*
issue 3 p 45-53 *How to generate power from garbage*
issue 8 p 9 *Harold Bate and his marvelous chicken-powered car*
issue 10 p 14-19 *The marvelous chicken powered motorcar*
issue 12 p 28-31 *Gobar Gas*
issue 15 p 78 *Jerry Freidberg on Harold Bate*
issue 18 p 7 *The Plowboy interview with Ram Bux Singh*
issue 20 p 48-49 *Modest experiment in methane gas production*





Propane

Sources of information on converting a motor vehicle to run on propane gas:

R.W. McJones & R.J. Corbeil *Natural Gas Fueled Vehicles Exhaust Emissions and Operational Characteristics*
Society of Automotive Engineers, Inc.
Two Pennsylvania Plaza, New York, N.Y. 10001

JERRY KIT --contains a convertor, jet, hoses, fittings and manual. (No tank). Specify make, model, & horsepower of vehicle and send $70 to Jerry Friedberg, Arrakis Volkswagon, Box 531, Point Arena, Ca. 95468

Jerry Friedberg *Convert Your Car to Propane,*
Mother Earth News issue 15 page 78-82. $1.35
(installation instructions, costs, tools, etc.)

Storage & Handling Liquefied Petroleum Gases
1969 NFPA no. 58
National Fire Protection Association
60 Batterymarch St., Boston, Mass. 02110

Carl Abell *Butane-Propane Power Manual,*
The Chilton Company
Chestnut & 56th Street, Philadelphia, Pa.
p 300 $5.

Earth Move
P.O.Box 252
Winchester, Mass. 01890

The Information Network is in the process of putting together a listing of information sources on other alternative energy devices. If you have built (or know someone who has built) a low-cost windpower or solar energy unit, please let us know. Thanks.

LP equipment places:

Propane Equipment Co.
mail to: P.O.Box 236
Shrewsbury, N.J. 07701
location: 11 Apple St.
New Shrewsbury, N.J. 07724
tel. 201-747-3795

Sun Oil Co.
Dx Division - LP Gas
123 West Emma
Springdale, Arkansas
tel. 501-751-4771

National LP-Gas Association
79 West Monroe Street
Chicago, Illinois 60603

Teeco Products
1440 N. Burton Place
Anaheim, Ca. 92803

Propane Sales and Equipment Co.
2691 East 11th Avenue
Hialeah, Florida 33013
tel. 305-836-3200

Sun Oil Co.
Dx Division - LP Gas
517 South Wood
West Memphis, Arkansas
tel. 501-RE5-2313

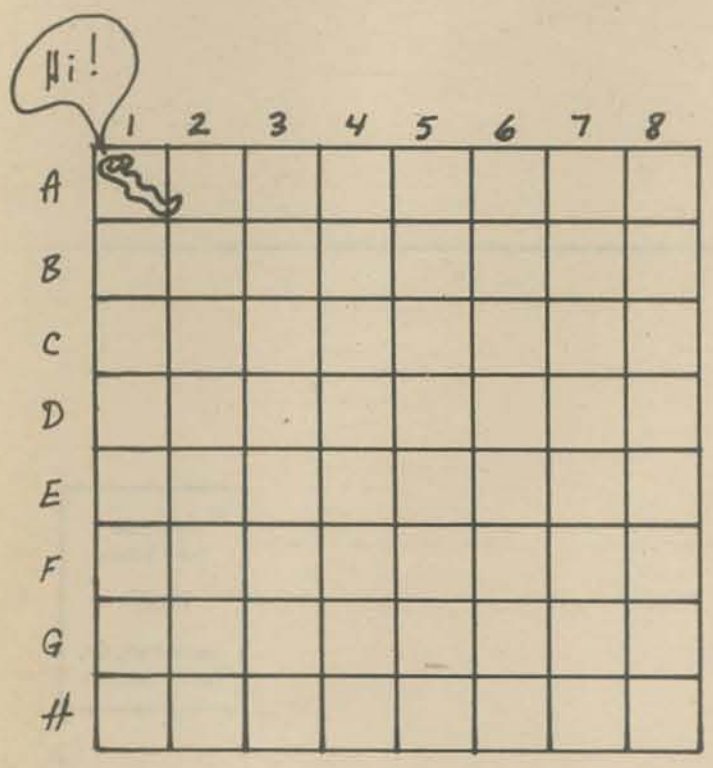
Pacific Gas Co.
8451 Gerber Road
Sacramento, Ca. 95828
tel. 916-682-2151

In some areas, propane is not as available to new customers as to established buyers. Check with your local propane dealer about this. Price of propane may be going up. Also only approved standard conversion on your vehicle will qualify you for the six cents per gallon tax rebate. For a list of over 8000 LP places, write:

Woodall Publishing Company
500 Hyacinth
Highland Park, Illinois

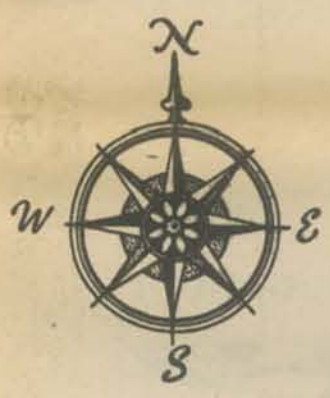
INCHWORM

Hi, INCHWORM fan. You recall, of course, that INCHWORM's home is in square A1 of an 8 by 8 universe, like this –



Our INCHWORM isn't just any old everyday run-of-the-mill inchworm. He is computerized! You can program him to move around the board under your control.

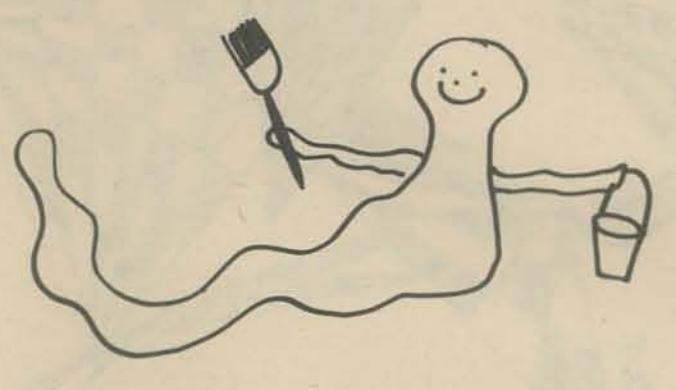
Here are the things he can do. He can more – one square at a time – NORTH or EAST or SOUTH or WEST.



To tell him to move one square NORTH, write N
To tell him to move one square EAST, write E
To tell him to move one square SOUTH, write S
To tell him to move one square WEST, write W

Well, since last time (PCC, May 73) INCHWORM has learned a new trick.

He can paint an  in the square he is in.

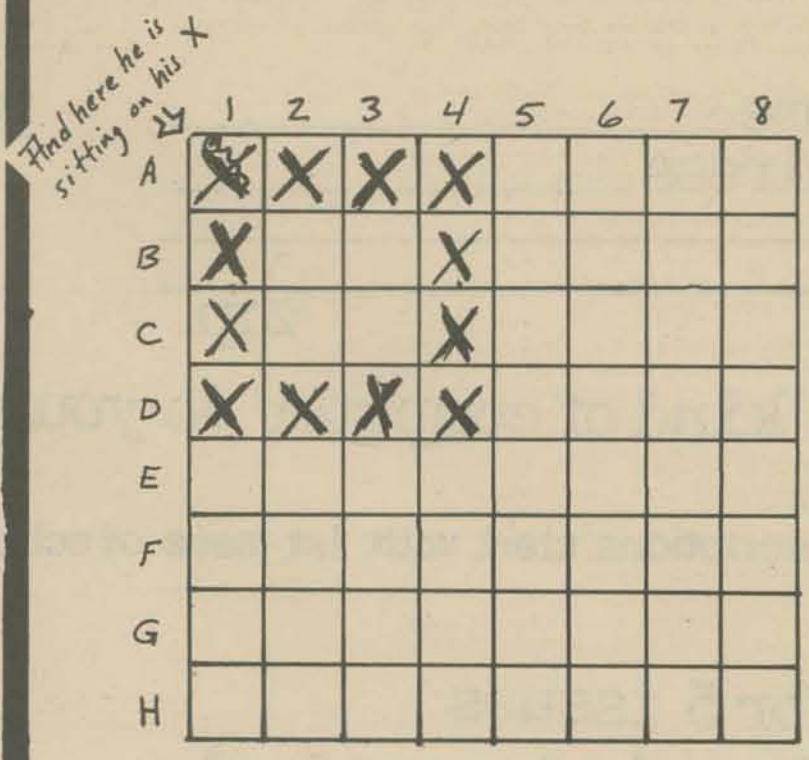


To tell INCHWORM to paint an  write X.

OK, suppose inchworm is at home in square A1. Here is a program to tell INCHWORM to "paint a box."

PROGRAM: XEXEXEXSXSXSXWXWXWXNXNXN

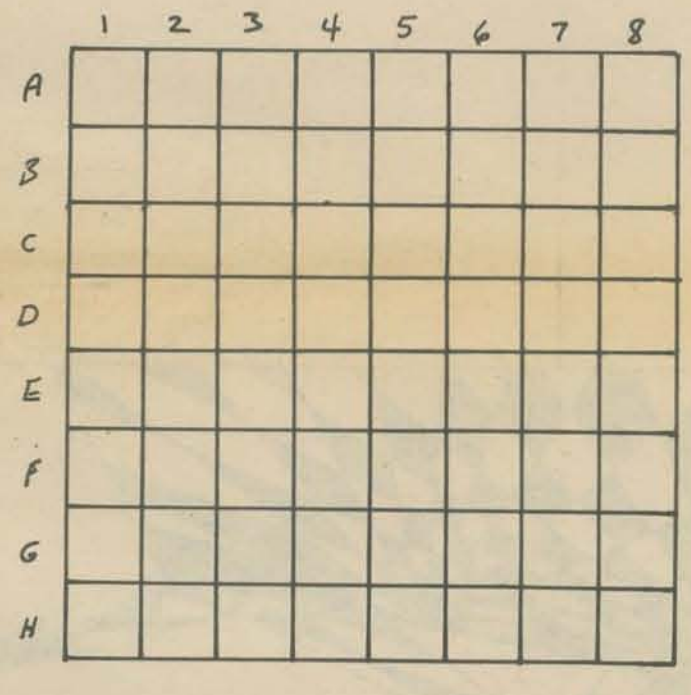
INCHWORM learned the program – then we told him to RUN it. He did and here is the result.



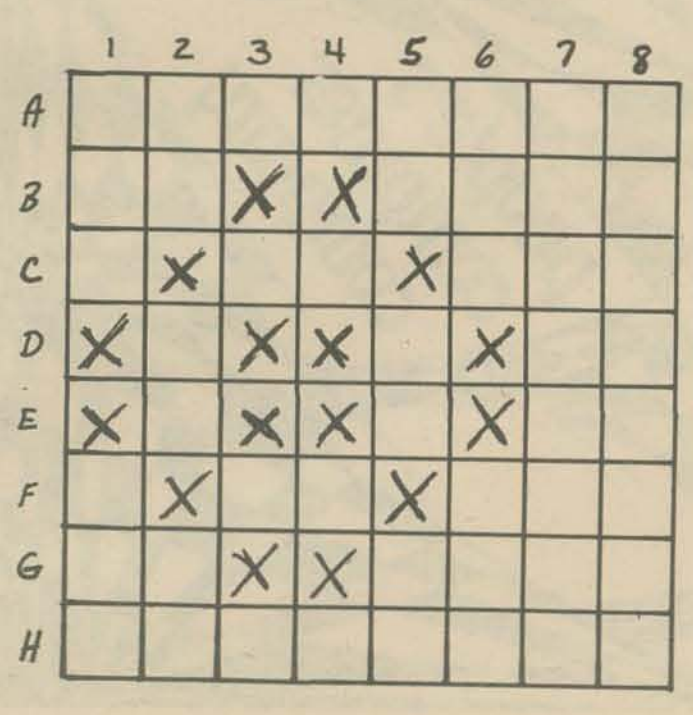
And INCHWORM, after "drawing" the box, ended up at home in square A1.

YOUR TURN. Show the pattern painted by INCHWORM after he does the following program (as usual, he starts in A1).

PROGRAM: XEXEXEXEXSWXSWXNWX



One more. Write a program to teach INCHWORM how to draw the following pattern. (He starts at A1.)



Well, that's all for now. INCHWORM will be back next issue and maybe bring a friend (LADYBUG or CRICKET or . . .).

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