SIU

Southern Illinois University at Carbondale
Carbondale, Illinois 62901-4308

Vice Chancellor for Student Affairs
Mailcode 4308
618–453–2461
FAX 618–453–1385

FACSIMILE TRANSMISSION

DATE: October 3, 1996

TO: Reid Kanaley
Philadelphia Inquirer

FAX NO: 215-854-5290

FROM: David Shinn

FAX NO: 618/453-1385

NUMBER OF PAGES (INCLUDING COVER SHEET): 6

If there are any problems receiving this transmission, or if you have difficulty sending a transmission to us, please call 618/453-2641.

MESSAGE:
Reid,
Here are the plans for PAPAC-00. Also, there is a page of an advertisement for the DIGICOMP I sold thru Edmund Scientific Catalog in 1967.

I hope this material is helpful to you. I have always been fascinated by computers but I have also been fascinated by history as well and it's been enjoyable to learn a bit of the history of the DIGICOMP I. I think that Rollin Mayer has affected more people with his efforts and the PAPAC-00 than he ever dreamed of!
Regards,

David

From the *Communications of the Association for Computing Machinery*, Vol 2, No 9, September, 1959. Article entitled "PAPAC-00, A Do-It-Yourself Paper Computer" by Rollin Mayer.

This kit is designed to:

Tell how to bring together community organizations with the same basic objective into a single program.

Promote self-evaluation and the recording of successful techniques and experiences useful to other communities throughout the nation.

Establish a pattern of nationwide effort without sacrificing the incentives and benefits of creative local action.

Here is what the kit contains:

A Guidebook for Local Action, suggesting general techniques adaptable to the needs and resources of your own community.

Examples of tested projects in other communities—relating how they began; how they are being carried out; their scope, financing and results.

Reference materials such as information on scholarships, improvement of science curricula, youth activities, etc.

A bibliography of selected materials, visual aids, organizations and publications helpful in your community program.

This kit was prepared for use in local programs for the improvement of science and mathematics education (not limited to computer education). It is available without charge to *groups*, not (for budgetary reasons) to individuals.

Interested individuals can get free copies of Local Action, the monthly news bulletin.

Editor's Note: Don't be misled by the price; this is good stuff.

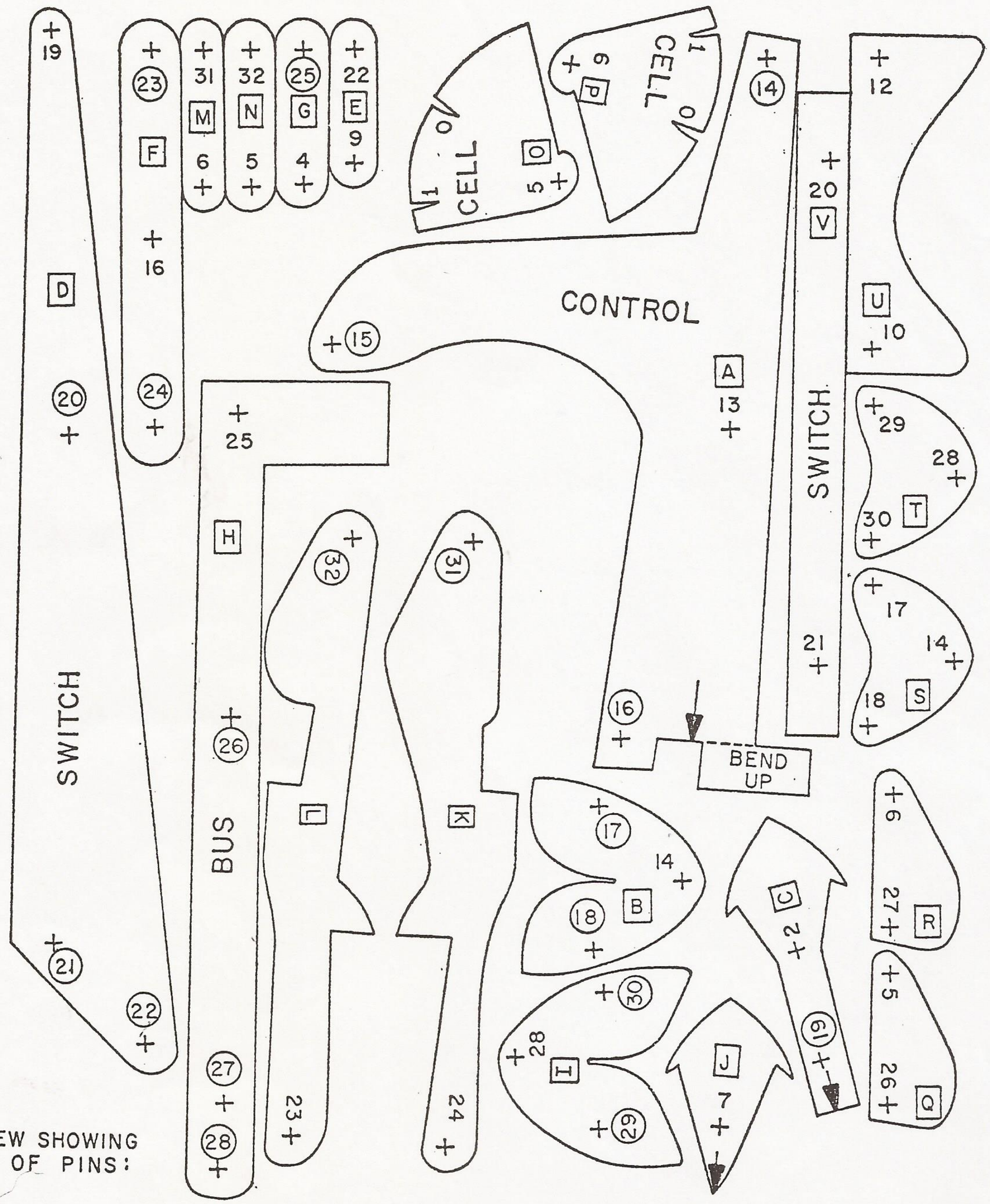
PAPAC-00, A DO-IT-YOURSELF PAPER COMPUTER

In less than an hour you can build the simplified digital computer shown in Figure 1, using only a pair of scissors, three dozen common pins, and the parts shown in Figures 1 and 2. This computer was developed from the model demonstrated in the Concord, Massachusetts, High School lectures on computers reported in SENEWS Volume I, Number 1.

From the discussion below, the computer expert will recognize that "*PAPAC double zero*" contains most of the units of a large-scale computer, but in simplified form. The *control unit* includes a counter and a system for controlling the parts of the computer according to the instruction being performed (in this model a simple fixed instruction is used; a large computer can draw from several instructions obtained from storage). The *storage unit* includes registers, bus, and selection switch; register contents are changed by hand rather than by the computer. The *arithmetic unit* can add. *Input and output units* have been eliminated by allowing the operator to deal with the insides of the computer directly rather than by way of complicated equipment. Proprietary rights are held by the author.

In *operation*, PAPAC-00 follows the same fixed instruction over and over again. This instruction is: "Read the number out of the currently-selected storage register and add it to the adder, then get ready to use the next storage register for the next time." The "Counter" keeps track of which storage register to use next; since there are only two registers, numbered "0" and "1," the counter alternates between them. The "Switch" is controlled by the counter and allows only the selected register to be operated. Each "storage register" contains only a single binary "cell"; when the register is operated, the cell is forced against the "Bus" if the cell is set to "1." If a "1" has been read out in this way, the bus actuates the "Adder," preparing it to add the "1." If the cell is set to "0," the bus and adder are not operated, and "0" is added to the adder. Binary sums are as follows: $0+0=0$, $0+1=1$, $1+0=1$, $1+1=10$. The adder forms these sums correctly except that in the last case it forms a sum of "0" because it can handle only one digit. The "Control," pushed back and forth by hand, performs this fixed instruction by operating the counter and switch, and by returning the bus to its "0" position (if it had read out a "1") causing the sum to be formed in the adder.

To *assemble* PAPAC-00, Figure 1 should be used as the base, and the shapes of Figure 2 should be fitted over it by following these steps:



NOTE: EDGE VIEW SHOWING ARRANGEMENT OF PINS:

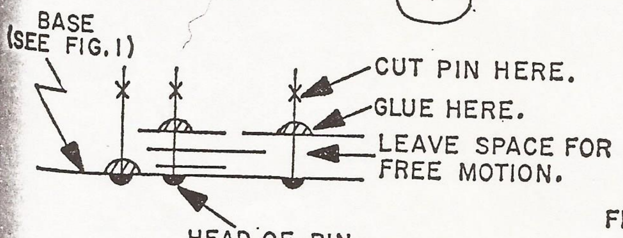


FIG. 2

PARTS FOR PAPAC-OO

(ROLLIN P. MAYER, JULY 14, 1958)

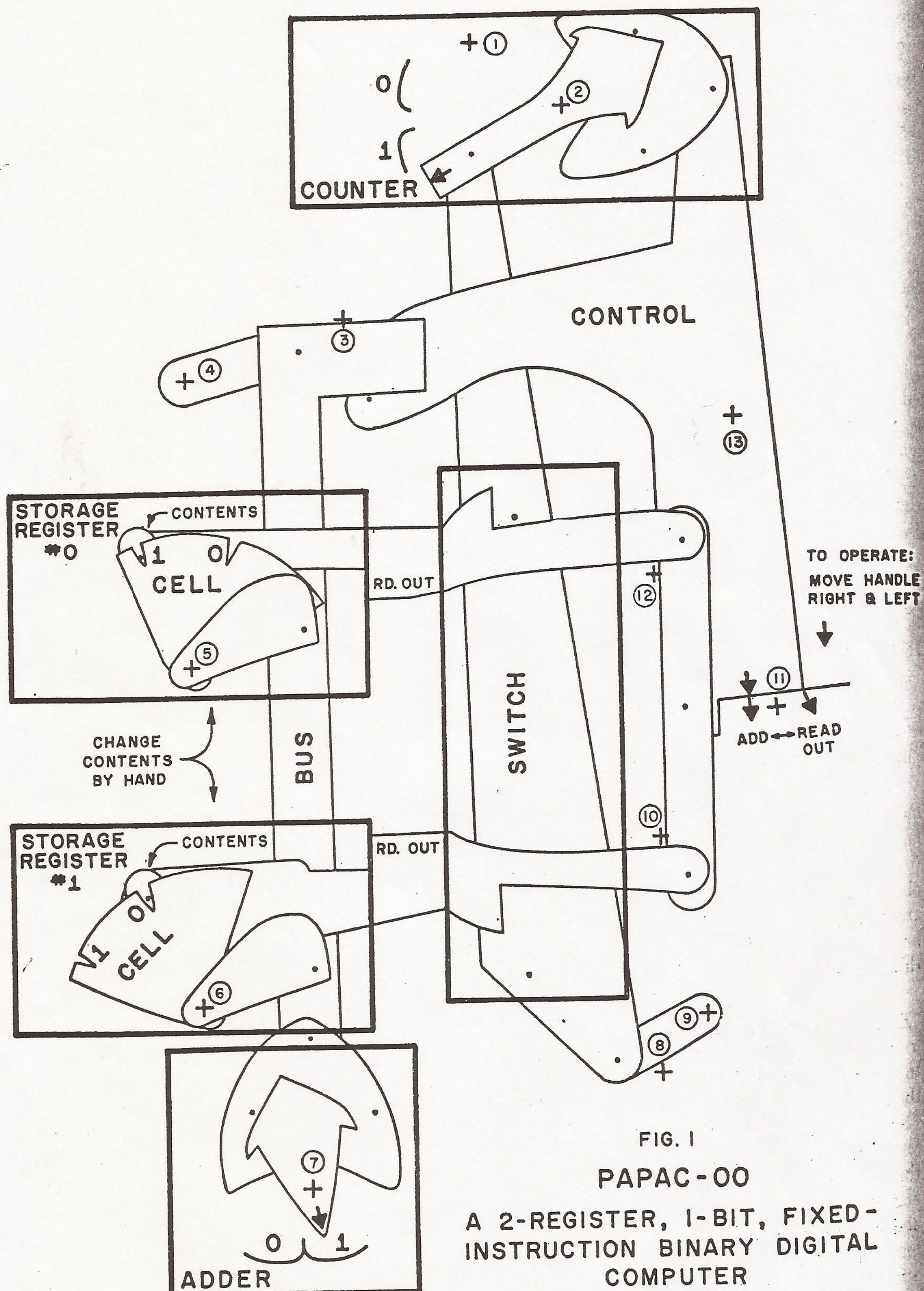


FIG. 1

PAPAC-00

A 2-REGISTER, 1-BIT, FIXED-INSTRUCTION BINARY DIGITAL COMPUTER

(ROLLIN P. MAYER, JULY 14, 1958)

A-87379

1. Punch a pinhole exactly through the intersection of each cross (+) in Figures 1 and 2 (but not the dots in Figure 1).

2. Cut out exactly on the lines, the parts in Figure 2, in any order. They are marked with a letter in a square box, from $\boxed{A}$ to $\boxed{V}$, and the next steps will be easier if you place each piece on the table in alphabetic order as you cut it out.

3. Place a pin up through each hole with a circled number (from *1* to *32*).

4. Taking each part of Figure 2 in alphabetic order, place its *un*circled number holes down over the correspondingly numbered pins.

5. In first operating the computer you may find that some parts jam because the upper piece is down too far on the pins: pry such pieces up a little to provide space for free motion.

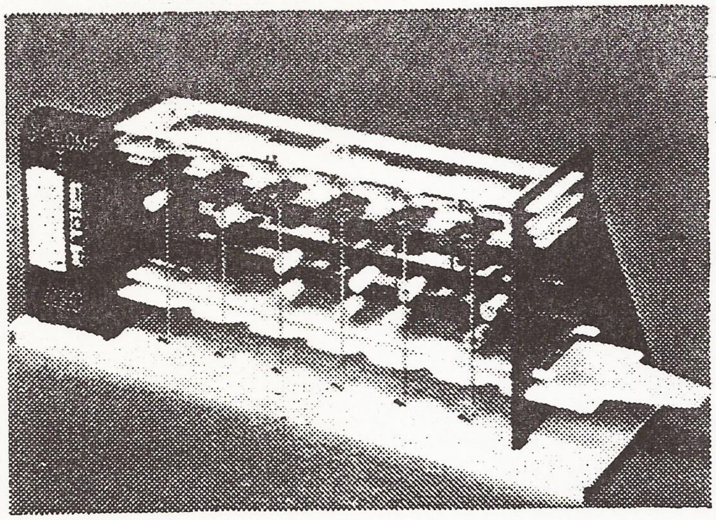
6. The construction can be refined by cutting the pins and gluing the uppermost part to the remaining length. Caution:

   (a) Don't cut the stop pins too short.

   (b) Glue only *one* moving part to the same pin.

Rollin P. Mayer

MARCH 1967, POPULAR SCIENCE



NEW MODEL DIGITAL COMPUTER

Solve problems, tell fortunes, play games with miniature version of giant electronic brains! Adds, subtracts, multiplies, shifts, complements, carries, memorizes. Colored plastic parts easily assembled. 12"x3½" x4¾". Incl. step-by-step assembly diagrams, 32-p. instruction book covering operation, computer language (binary system) programming, problems & 15 experiments. $5.98 Ppd. Order Stock #70,683N. Edmund Scientific Co., Barrington, N.J. 08007.

GIANT FREE CATALOG

Completely new 1967 Catalog. 148 pages packed with nearly 4,000 unusual bargains. Exciting new categories. Many new items. 100's of charts, illustrations. Many hard-to-get war surplus bargains. Enormous selection of telescopes, microscopes, binoculars, magnets, magnifiers, prisms, photo components, etc. For hobbyists, experimenters, workshops. Shop by mail. No salesman will call. Write for Catalog "N" to Edmund

JOINT COMPUTER COMMITTEE

SENEWS

SCIENCE EDUCATION SUBCOMMITTEE NEWSLETTER

VOL. 1 NO. 1 July 1958

WHAT IS SENEWS?

A newsletter addressed to computer oriented members of IRE, ACM, AIEE, to help them promote computer interest and knowledge among high school age students.

WHO IS RESPONSIBLE?

The Science Education Subcommittee under sponsorship of the Joint Computer Committee. C. W. Farr, MIT, Lincoln Laboratory is Chairman of the Subcommittee and Acting Editor of SENEWS.

WHY IS IT?

Computers are here to stay. High school students are already showing a budding curiosity about computers. Professional computer people are showing wide interest in helping the kids get started. All over the country computer educational activity is springing up. A rallying point is needed for sharing ideas and results.

SEND US A COMPUTER STORY—

—of your local high school activity. If there is no news story—guess you need to go out and *make* some news. Let's challenge the youngsters to reach their potential strength in the data processing world of tomorrow. Watch SENEWS for ideas, and send us your success stories!

Write to:

C. W. FARR
JCC Science Education Subcommittee
MIT Lincoln Laboratory
Lexington 73, Massachusetts

HAVE DESIGN, WILL BUILD

A high school junior and perennial regional science fair winner from Cedar Falls, Iowa, named David Ecklein, has designed and is building a thirteen hundred vacuum tube digital computer, using surplus market tubes and sockets and adapting office shelving for use as chassis and cabinet material. He has designed the mathematical logic and circuitry with essentially no assistance other than normal instruction in high school science and what he has been able to learn from books and from his own experiments. Part of the circuitry has been assembled, with the help of a high school sophomore friend whom he, in turn, has helped on another science project. [continued on next page..]

In the early 2000's I found Mr. Ecklein's email and sent him a note asking what happened after high school. Graciously replying, he wrote that he went to work with IBM. (So sorry, but I have lost the email correspondence.)
David Shinn, Quincy, IL (ddshinn@pm.me); note made Jan 2023.

In the early 2000's I found Mr. Ecklein's email and sent him a note asking what happened after high school. Graciously replying, he wrote that he went to work with IBM. (So sorry, but I have lost the email correspondence.) David Shinn, Quincy, IL (ddshinn@pm.me); note made Jan 2023.

The point of the story is that the ability and motivation for a budding computer engineer can spring up in the middle of Iowa or in the suburbs of Boston or Los Angeles, for example. There is one big difference: in the coastal industrialized areas, computers and computer engineers abound, and a youngster finds it is easy to obtain local adult professional help in the pursuit of his project.

JCC Science Education Subcommittee heard of this boy by way of Washington, D. C. (the President's Committee on Scientists and Engineers), and is proud to have brought him to the attention of JCC members who have set the wheels in motion to give him well deserved counsel and encouragement. (Ed. note: David has sold over 500 Bibles to raise money for his science project. At last report he was flying to New York on a Saturday—Tuesday visit as guest of IBM.)

LOW BUDGET HIGH SCHOOL COMPUTER

In Buffalo, N. Y., Aaron Buchman, Mathematics instructor at the Hutchinson Central Technical High School, has been conducting a course in computer programming and coding open to college preparatory seniors. Under his direction members of the Tech Math Club constructed a tape activated automatic digital computer for use in the course.

The one semester course consists of theory and laboratory work. After 30 classes in theory, the students get two laboratory and three theory periods per week. Included in the theory are number systems, drill in binary system arithmetic operations, elements of Boolean algebra, and computer logic.

The computer is an electromagnetic relay machine which operates in the binary number system. Tapes are punched out of pressboard nine inches wide, and carry ten channels. Each of the six registers of the storage section holds a six digit binary number. Panel lights indicate the contents of each register at all times. With two operator registers and one output register, the arithmetic unit performs direct addition, subtraction, and multiplication. Division is accomplished by a taped routine.

Before completing the course, each pupil must program and code an approved program which requires branch points, cycling routines, a minimum number of orders, and which must run without trouble on the computer.

Among the problems successfully programmed and now a part of the library of routines are those to:

- find the total surface area of a rectangular solid
- find the average of two signed numbers
- evaluate a second degree polynomial using successive integer values of the variable
- solve simultaneous linear equations
- evaluate a two-rowed determinant
- evaluate various formulas from mathematics and physics for sets of values of the variables involved by having the computer order the machine to take a new value of one of the parameters with each pass of the tape.

A description of the machine and the mathematics course in which it is used was presented by Mr. Buchman at the ACM meeting in August 1956. "Mathematics Teacher" carried the story in March 1958. The course now includes three weeks of IBM 650 programming.

Here, a teacher's initiative and a forward looking school system have combined to challenge the abilities of bright high school students with a solid introduction to the technological revolution taking place within their time.

STUDENTS STUDY

Concord, Massachusetts, High School Mathematics Department experimented in the 1958 spring term with a six week curriculum unit on computers—15 students participated—Norton Levy, Concord High School Mathematics Department, designed the curriculum unit, assisted by MIT Lincoln Laboratory staff acting as consultants, arranging computer facilities tours* and furnishing a demonstration-lecture team for a major part of the course—lectures include number systems, computer principles (slanted away from electronic circuitry), simple programming theory, study of actual coding of two programs for the IBM 704 computer, a follow-up visit to a computer facility while the programs are being run, computer plications—course evaluation was by written examination. This curricular experiment guided by a acher-engineer team is sponsored by the Ford Foundation's School and University Program for Research d Development, under grant to Harvard's School of Education.

An interesting sidelight of this story is the "cardboard computer," a mechanical model made from rdboard and common pins, by R. P. Mayer in one evening and used in a high school lecture-demon- ation. This is an outgrowth of the effort described by Mayer in his paper, "A Proposal for Training ungsters in Digital Computing Techniques," presented to ACM in Los Angeles in August 1956. The rdboard computer" was a binary unit 8½" by 11", comprising a manually activated pulse input capable producing either a "zero" or a "one" pulse, a counter, control element selecting between two one-bit rage registers, and a one-bit adder.
ee photo)

DO TEACHERS

high school teacher computer course consisting of seven lecture and workshop meetings is describeg Introduction to Arithmetic Computers", a report to the Hughes Aircraft Company by ten participatind h school science and mathematics) teachers, Los Angeles School-Industry Science Program, December 6. (Copies available from Dr. L. C. VanAtta, Head, Technical Information and Education, Hughes raft Company, Culver City, California.) The report is intended for use as a syllabus for a teachers' hour workshop. The lectures reviewed computer history, binary arithmetic, elementary computer c, and included visits to a mechanical differential analyzer, to the Hughes REAC (analog) and IBM (digital) and to the Bureau of Standards SWAC (digital) computer facilities. One lecture was devoted WAC programming; homework called for completion of the coding of a fifth degree polynomial problem pendix to the report contains detailed flow diagram and coded program).

his computer activity is only one phase of a well organized community program** in which the school em employs a full time school-industry coordinator who works with a Council; the Council board rectors includes representatives of secondary schools, universities, industry and the professional so- es; the Council publishes a newsletter, organizes industrial demonstration-lecture teams for high ols, coordinates an industrial summer work program for high school teachers, and in July 1957 partici- d in an industry-education conference financed by Hughes Aircraft Company and held at the Lake whead facilities of the University of California. For information write to J. H. Cooper, Executive tary, Southern California Industry-Education Council, 954 West 37th Street, Los Angeles 7.
e "Physics Today," September 1957, "The Los Angeles School-Industry Science Program," by tta.)

Did YOU HEAR—

The one about the computer programmer who couldn't balance his checking account. He knew that [redacted]; but the bank took a narrower view.
177 + 1 = 200

ACM, AIEE

hard W. Melville (Computer Development Group, Stanford Research Institute), is Chairman of GEC Student Relations Committee, and IRE representative on the SENEWS Editorial Board. al Chairman of JCC Science Education Subcommittee, he was appointed when its charter was a of swirling hot gases; he explored and charted the unknown and has been a valued consultant in shing the present subcommittee policy and program and in bringing forth our newsletter.

fessor George E. Forsythe, (Mathematics Department, Stanford University) is Chairman of the Secondary School Educational Committee; (actually ACM has two other education committees; sity-Education and Industry-Education). Professor Forsythe is ACM representative on the WS Editorial Board and has furnished valued criticism and encouragement. Those interested write him for his Bibliography on High School Mathematics Education, which includes 10 books ital computers. Professor Forsythe has earnestly questioned our editorial policy of confining WS to *computers*; this question has probably arisen also in the minds of many of our readers; while ue that *computer engineers* as individuals can be broadly helpful in high school science education, CC Science Education Subcommittee finds many other groups at work in the field and has focused