A MODERN-DAY

MEDICINE SHOW

by ROBERT L. ALBRECHT,

Control Data Corp.,

Denver, Colorado

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During the summer of 1962, the Denver, Colorado, office of Control Data Corporation gave a course in the use of computers to a group of gifted mathematics students from Denver's George Washington High School (GWHS). Emphasis was placed on the use of a computer as a computational tool to assist students in solving mathematical problems. We had so much fun that we continued the course at GWHS throughout the 1962-63 school year, and extended the program to eight other schools in Denver and Jefferson counties. So far, more than 200 students have been introduced to the hardware as a handy device for getting answers to mathematical problems.

On March 24, a CONTROL DATA 160A and a Flexowriter were moved to GWHS and placed in charge of four students. For the next four days, these students put on a computer demonstration which had many of the characteristics of a "Medicine Show". The show was promoted, produced, and directed by the four students, who were also the stars.

The medicine show at GWHS was the high point of a computer educational program which began quite by accident. In the spring of 1962, I acquired a new neighbor, Irwin Hoffman, a mathematics teacher at GWHS. Irwin invited me to speak to the Math Club at his school on the use of computers for the solution of mathematical problems. Following this talk, several students inquired about the possibility of receiving computer training. I conferred with Irwin and we decided to organize and teach a course during the summer.

In this initial course, 35 students from GWHS met every Wednesday evening from 7 to 10 P.M. at the Control Data Denver office. We spent the first few meetings discussing computer fundamentals and describing the FORTRAN programming language for the 160A. By mid-summer, the students had become reasonably proficient at writing programs and operating the computer. For the rest of the summer, the Wednesday evening meetings were used primarily for the analysis, programming, and computer solution of mathematical problems. Of the 35 students who began the course, 25 were still going strong at the end of the summer.

The summer course was merely an appetizer for many of the students. They clamored for more training. During the fall semester we set up an advanced course for 12 students. (The rest had graduated.) A bleary-eyed mathematics teacher (Hoffman), a bleary-eyed Control Data instructor (me), and 12 bright-eyed young scholars met every Thursday morning from 7:30-8:30 A.M. before regular school hours. This course was conducted on a seminar basis, using the algebra of polynomials as the mathematical subject. The instructors posed problems. The students did the required mathematical analysis, developed problem solving procedures, programmed their solutions in FORTRAN and ran their problems on the 160A. Introductory courses were set up for beginners. The courses were conducted on an auto-instructional basis with seminar students serving as instructors.

In March, we decided to put on a medicine show at
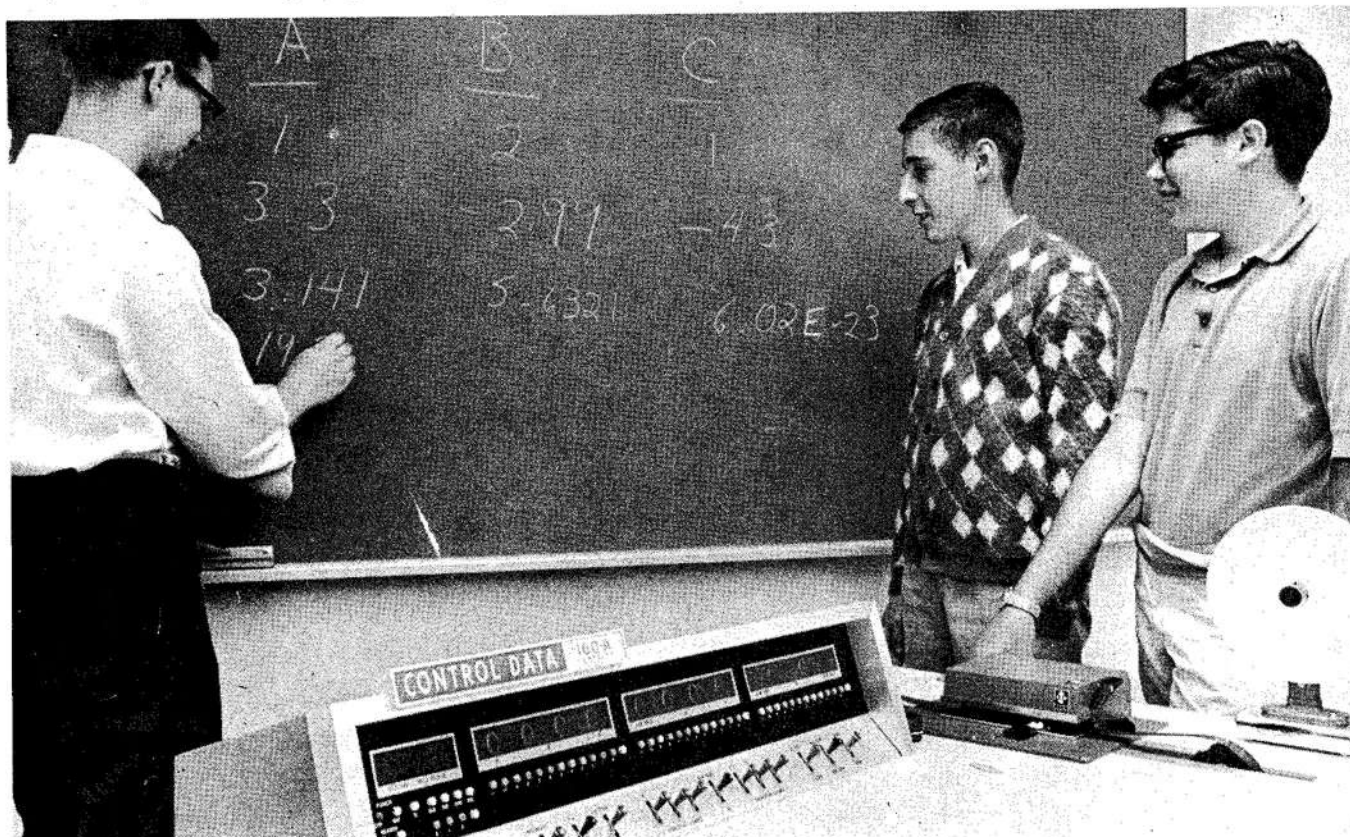
GWHS. We decided that it would be done entirely by students without any adult supervision. By this time we had about 40 students at various levels of proficiency. We picked Bob Kahn, Al Nelson, Randy Levine, and Fred Ris to run the show. (Bob, Randy, and Fred were juniors, Al was a senior.) We outlined our project to the students and sat back to watch the fireworks.

During the week before the show, the four students arranged for the use of a room, obtained the equipment and supplies needed, and began an intensive promotional campaign. They drew up a master schedule for the 20 math classes which were to attend, and distributed the schedules to the teachers who were responsible for the classes. After some haggling, they agreed upon a demonstration program, wrote the source program, and checked it out after the 160A had arrived at the school.

Figure 1

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C            GWHS TEACHER DEMO PROGRAM
C            PROGRAMMED BY RANDY LEVINE
1            FORMAT (45Hi ;have ;heard ;you ;do ;not ;like ;assistance ;. ;. ;.)
2            FORMAT (36Hhere ;is ;your ;iddy ;biddy ;answer. ;. ;. ;)
3            FORMAT (50Hhere ;is ;ye ;olde ;easy ;answer ;. ;. ;. ;lazy ;tiger ;. ;. ;.)
4            FORMAT (38Hi ;will ;be ;a ;more ;courteous ;gw ;patriot.)
5            FORMAT (27Hname ;the ;new ;baby ;after ;me.)
6            FORMAT (39Hyou ;coach ;. ;. ;. ;let ;me ;teach ;the ;class.)
7            FORMAT (45Hwhan ;that ;aprille ;with ;his ;shoures ;shoote. ;. ;.)
8            FORMAT (43Hwhen ;i ;consider ;how ;my ;light ;is ;spent ;. ;. ;.)
9            FORMAT (35Hi ;have ;to ;be ;excused ;from ;the ;room.)
10           FORMAT  (I5, 4E16.8)
11           FORMAT  (4E16.8)
500          READ 10, JWHICH, A, B, C
             GO TO (15, 25, 35, 45, 55, 65, 75, 85, 95, 105), JWHICH
15           PUNCH 1
             GO TO 105
25           PUNCH 2
             GO TO 105
35           PUNCH 3
             GO TO 105
45           PUNCH 4
             GO TO 105
55           PUNCH 5
             GO TO 105
65           PUNCH 6
             GO TO 105
75           PUNCH 7
             PUNCH 8
             GO TO 105
85           PUNCH 8
             GO TO 105
95           PUNCH 9
105          DSCRIM = (B'B) — (4'A'C)
             IF (DSCRIM) 100, 200, 200
200          X1  = (—B + SQRTF(DSCRIM))/(2'A)
             X2  = (—B — SQRTF(DSCRIM))/(2'A)
             PUNCH 11, A, B, C
             PUNCH 11, X1, X2
             PAUSE 500
             GO TO 500
100          X1REAL = (—B)/(2'A)
             X2REAL = X1REAL
             X1IMAG = (SQRTF(DSCRIM))/(2'A)
             X2IMAG = —X1IMAG
             PUNCH 11, A, B, C
             PUNCH 11, X1REAL, X1IMAG, X2REAL, X2IMAG
             PAUSE 500
             GO TO 500
             END
             END
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Articles, plugging the show, appeared in the school paper, and daily spot announcements over the P.A. system reminded the student body of the forthcoming event. By opening day, our students were indeed prepared.

the medicine show

The 160A was moved in on the afternoon of Monday, the 24th, and turned over to the students the next morning. The demonstration program, chosen in the hope that it would be meaningful and entertaining to the attendees, was checked out. Their source program, shown in Figure 1, was a procedure to compute the real or complex roots of the quadratic equation, $AX^2 + BX + C = O$. However, it had a gimmick.

By means of a code number entered with the data, the computer could be directed to precede the answers with a Hollerith message. These messages were terms favored by the instructors in their classroom presentations, and which had become cliches familiar to students. During demonstrations, students were asked to provide data for processing; for these results, no Hollerith message was punched. Then the teacher was asked for a set of data; when his results were listed, he was confronted by a familiar phrase preceding the answers. Some samples are shown in Figure 2.

The formal demonstrations were held Wednesday and Thursday, about every half hour, from 8:45 to 3:30 P.M., with a few left over for Friday morning. Because many of the classes were discussing the quadratic formula, a frequently heard request was, "Would you please ask the computer to do the odd exercises on page 263 of our text?" Bob Kahn accommodated one class by running one night's homework on the 160A, and using the Flexowriter to cut a Ditto master of the output tape. He presented a copy to each member of the class.

When the hardware was not being used for demonstrations, it was in constant use by students in the computer educational program. They practically fought over it. In fact, they coerced Irwin Hoffman into arriving every morning at 6:30 to let them into the school, and the custodian had to practically throw them out every evening at 6:00 in order to lock up.

The four "barkers" were excused from classes during would have to move the computer to make room for a meeting. They rolled the 160A out of the room, down the hall, and set up shop in the main lobby, There, they were immediately surrounded by curious students, and ran informal demonstrations until the middle of the afternoon. At that time, a moving van rolled up to the front door, the gear was packed up, and the medicine show moved on to the next stop.

the show gets results

Well organized and conducted with imagination and showmanship, the performance was a tremendous success. It generated a great deal of interest in additional introductory computer courses. Anticipating this, the boys had already arranged for the use of our classroom facilities and the 160A during spring vacation. Sixty students were signed up during the show, the results of a flyer which they printed and distributed, inviting spectators to enroll in introductory FORTRAN classes.

Sessions began a week later, organized into four sections of 15 students each. The courses were run on an auto-instructional basis. We provided 60 copies of a workbook, *Introduction to FORTRAN Programming*, which we are writing and reproducing in our office to teach the use of computers for mathematical problem-solving in the secondary schools. For a week, the student instructors answered questions and tutored individuals. During the second week, spring vacation, the instructors brought each section to our office for a day of problem-solving on the 160A. Every student had executed at least one FORTRAN program by the end of the week, and several had run more. They chose their own problems, most of them coming from their mathematics text books.

At Washington High, as a result of this activity, we now have nearly 100 students who will be clamoring for additional training during the next school year.

plans for next year

We are sold on medicine shows. In fact, the second show was put on by five students at Denver's Abraham Lincoln High School, and more are anticipated during the next school year.

It will be a year of growth. In adjacent Jefferson

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4/9./0./-16./ ·                              Figure 2
6/5./4./3./
7/1./10./25./
i will be a more courteous gw patriot.
   .90000000e 01   .00000000e-32  -.16000000e 02
   .13333333e 01  -.13333333e 01
you coach . . . let me teach the class.
   .50000000e 01   .40000000e 01   .30000000e 01
  -.40000000e 00   .66332496e 00  -.40000000e 00   -.66332496e 00
whan that aprille with his shoures soote. . .
when i consider how my light is spent . . .
   .10000000e 01   .10000000e 02   .25000000e 02
  -.50000000e 01  -.50000000e 01
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most of the show. On Friday morning, Fred Ris rejoined his algebra class just as it began a discussion of the problem, "Given a set of N people in a room, what is the probability that two of them have their birthdays on the same day of the year?" The class set up some specific cases, and began hand computing the results. Fred jumped up, mumbled something about a computer, and dashed out the room. He ran downstairs, wrote a FORTRAN source program to tabulate the desired probabilities for N=2 to N=150, then compiled and executed the program. He managed to get back to his algebra class before the end of the hour to display his results.

Friday noon, the students were informed that they County, public school officials are making arrangements to train high school teachers in computer methods, and have invited several universities in the area to assist in implementing an extensive program in computer education. During the next school year, we expect to have courses there in computers and computing, as well as the present courses in problem-solving and answer-getting with FORTRAN. Recognized as a leader in evaluating and adopting new ideas, the Jefferson County public school system's program should provide us with some data for evaluation of several approaches to computer education in the secondary schools. ∎