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computers and automation

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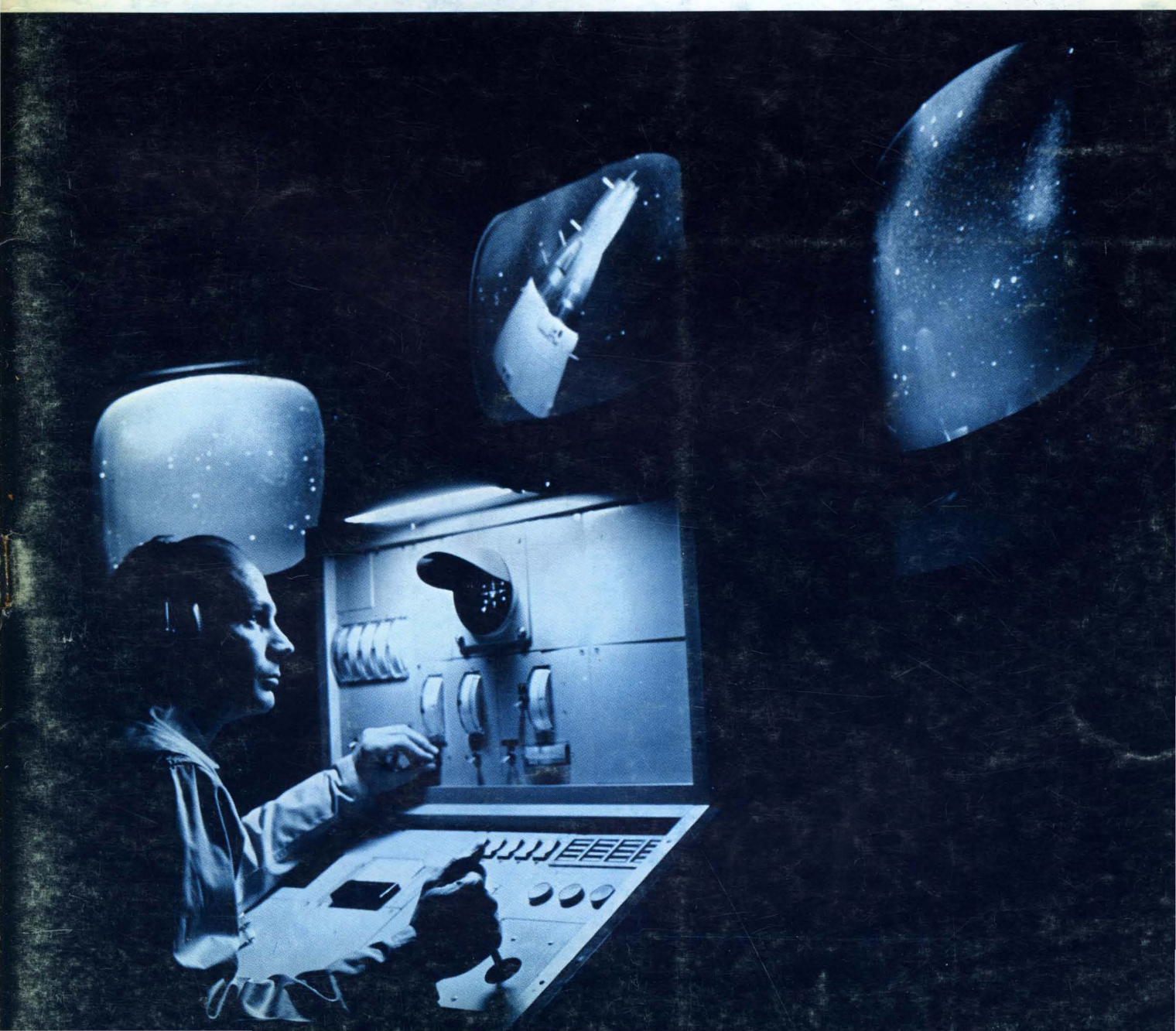

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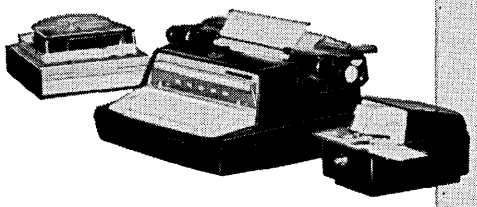

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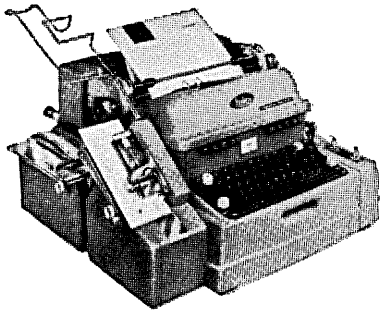

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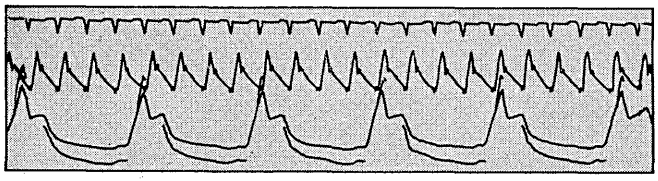

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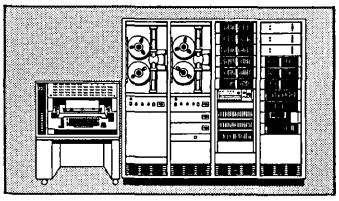

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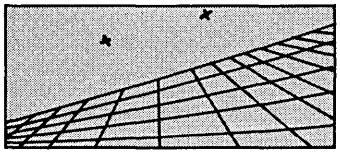

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For technical reports describing in detail these and similar AMBILOG 200 applications, write I. R. Schwartz, Vice President.

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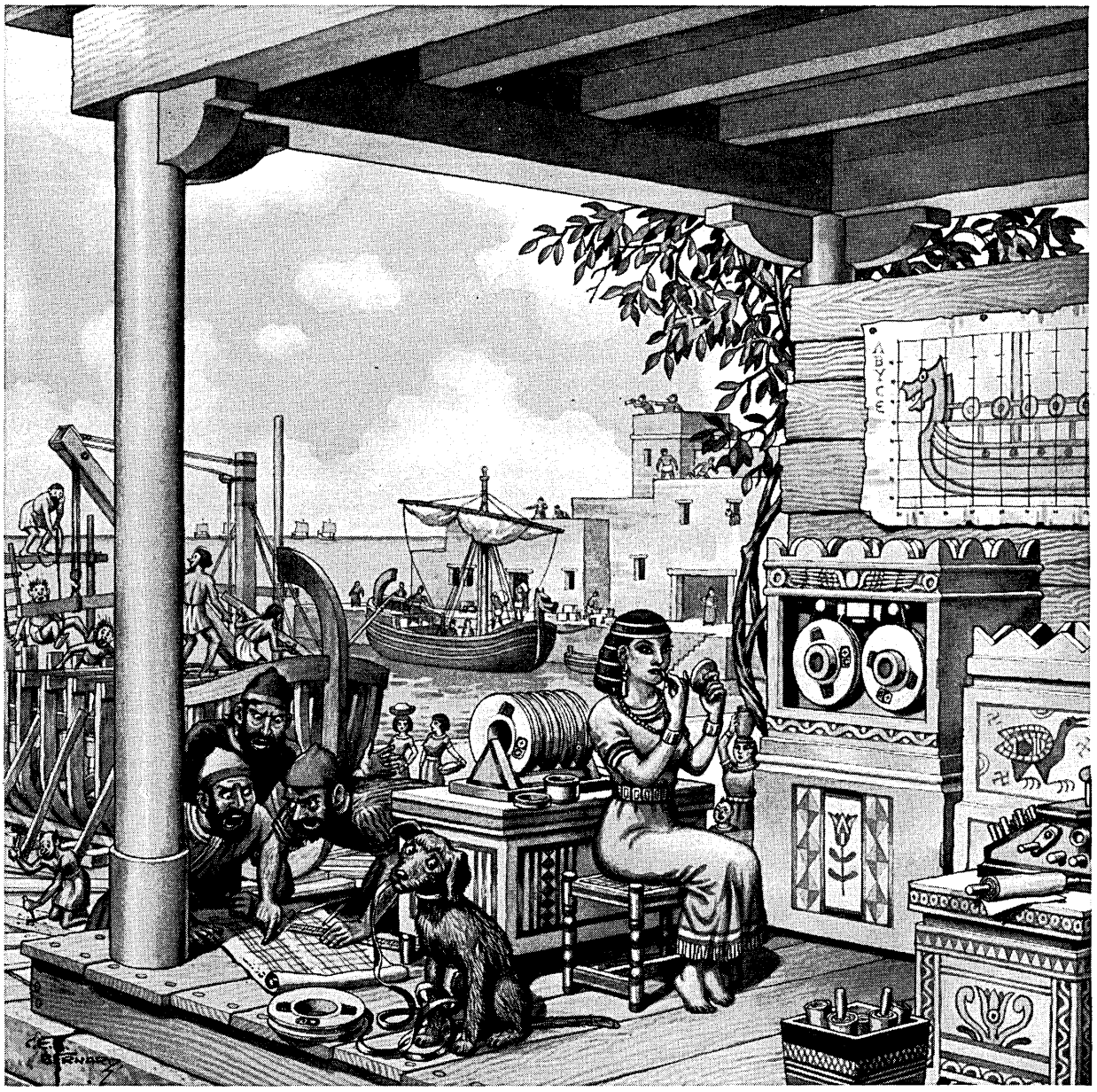
AN OFF-BIT HISTORY OF MAGNETIC TAPE... #5 of a series by Computape*



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The Phoenicians might have become the greatest naval power of their day if it hadn't been for Hermione.

Hermione was a Phoenician computer technician so dazzlingly beautiful she kept knocking men's eyes out. Unfortunately, she was so vain that all the time she was supposed to be tending to business, she'd be fooling around admiring herself, dreaming of a movie career and all that.

As a result, communications at the center kept going to the dogs, leaving the Phoenician ships very much at sea where the Persians and Greeks had an easy time picking them off.

As for the vain Hermione — well, you might know. The movie people lost no time in signing her up to star in the film version. It was all about a computer technician so dazzlingly beautiful she kept knocking men's eyes out and it was called "How to Make a Phoenician Blind".

But the dog stole the picture. He did his original bit-biting bit and the critics said he really got his teeth into the roll.

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Now — if Computape can write that kind of computer tape history — shouldn't you be using it?

*Reg. T.M. Computron Inc.

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computers and automation

MARCH, 1965 Vol. 14, No. 3

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Computer-Related Education Issue

In This Issue

In Every Issue

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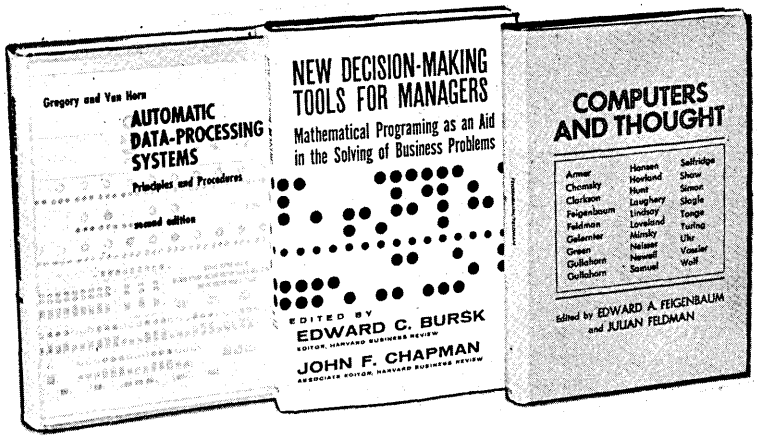

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The Automation-Unemployment Issue

In the January 1965 issue of *Fortune,* Charles E. Silberman, in his article "The Real News about Automation," advances an interesting position. He states:

> "Employment of manufacturing production workers has increased by one million in the last 3½ years . . . This turn-around in blue-collar employment raises fundamental questions about the speed with which machines are replacing men . . . Automation has made substantially less headway in the United States than the literature on the subject suggests . . . No fully automated process exists for any major product in the U.S. . . . Many people writing about automation . . . have grossly exaggerated the economic impact of automation. . . . In their eagerness to demonstrate that the apocalypse is at hand, the new technocratic Jeremiahs . . . show a remarkable lack of interest in getting the details straight, and so have constructed elaborate theories on surprisingly shaky foundations . . . The view that computers are causing mass unemployment has gained currency largely because of a historical coincidence: the computer happened to come into widespread use in a period of sluggish economic growth and high unemployment . . . Full automation is far in the future because . . . 'there is no substitute for the brewmaster's nose' . . . Man's versatility was never really appreciated until engineers and scientists tried to teach computers to read handwriting, recognize colors, translate foreign languages, or respond to vocal commands. . . . We don't have enough experience with automation to make any firm generalizations about how technology will change the structure of occupations . . . "

and in essence he asserts that vast unemployment due to automation is not to be expected.

There are a number of important defects in Silberman's argument, enough to make the whole argument unsound.

In the first place, Silberman makes a considerable point of the fact that he has investigated a number of situations where a large degree of automation was reported, and he has observed that a much smaller degree of automation was actually to be found there. For example, he has found men still at work personally guiding the movement of engine blocks from one automated machine to another. From these instances he concludes that the threat of automation in producing unemployment has been grossly exaggerated.

Basically, this is the argument that because something has not happened yet, it is not going to happen. Of course, as soon as we express the argument in this form, it is obviously not true. I am reminded of what was being said about automatic computers in the early 1950's by hard-headed business men: the machines would never be reliable enough or versatile enough to do any substantial quantity of useful business work.

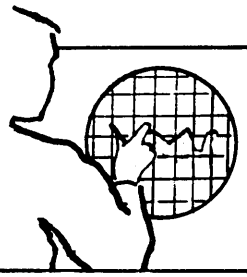
Second, Silberman refers to man's versatility, reading of handwriting, responding to vocal commands, etc. You will notice that he does not mention what would have been mentioned in this sentence if said some 15 years ago: "man's uniquely human ability to think, to solve problems, to play games, to create"—because now it is abundantly clear that these abilities are being shared by the computer, the programmed automatic computer.

But the versatility area also of man's capacities is rapidly being "threatened" by the computer, by such devices as the programmable optical reader, in which a computer applies clever programs to deciphering the precise nature of certain kinds of marks and thereby identifies them. A programmable film reader made by a firm in Cambridge, Mass., is able to read film at a speed 5000 times the rate that a human being can read it.

To assert that because of man's versatility, the computer will not be able to compete with man is a silly argument, because there are no logical, scientific, or technological barriers to this accomplishment. Silberman asserts there will be a cost barrier: it may be many years before a computer can economically displace the human driver of a school bus paid at the rate of $4 an hour. But developments in microminiature, chemically-grown, circuits are so amazing, that we can look forward to the time when a programmed computer equal to the brains of most men can be produced for say $1000 apiece. Certainly there is nothing magical or supernatural about the brain of a man; and certainly once the process of chemically growing brains is understood, much better materials than protoplasm can be found for making them.

Third, even if "no fully automated process exists for any major product in the United States" at the present time, is there really very much difference between a process which used to require 100 men and now requires 5 or 3, compared with a process which used to require 100 men and now requires zero? The important point here is the amount of displacement of employed persons—or persons who would have been employed if the processes had not changed. Typesetters lose their jobs because a punched paper tape replaces them. Skilled toolmakers lose their jobs because numerically controlled milling machines displace them. Elevator men lose their jobs because automatic elevators

(Please turn to page 17)



c & a MARKET REPORT

PROGRAM CONVERSION: A CRITICAL FACTOR IN COMPUTER REPLACEMENT

The announcement of "a compatible series of computers" was a step taken by most of the major computer suppliers during the past year. Control Data, GE, Honeywell, IBM and RCA all exposed compatible series of processors... recognizing that now that upwards of 70% of new computer orders are coming from current computer users, the computer replacement market has become of prime importance... and an upward compatible system offers the user a chance to expand his computing capacity without additional investment in programming.

However, none of the newly announced lines are themselves program compatible with the manufacturer's former equipment, so the question of efficient program conversion is currently one of primary importance in considering the replacement of an existing computer with one of the newer models.

There are three principal methods of converting programs written for one computer to a language useable on a non-compatible computer. These are:

(1) Manual reprogramming
(2) Simulation of one computer on another, and
(3) Automatic translation of programs from one computer language into another computer language.

Manual reprogramming is the surest method for getting efficient programs, but it is also the most costly in terms of time and dollars. For example, if we estimate it takes 12 man-days per program to reprogram, an average installation with, say, 150 active programs will require an investment of over seven man-years of reprogramming effort at a cost of nearly $87,000 (at $12,000 per man-year) to completely rewrite the active programs for use on a new computer.

To help alleviate this costly burden for the user, manufacturers have developed computer simulators which simulate the operations of older equipment on a newer, faster computer. These simulators take three forms: software packages, special memory devices, or a combination of both. The software simulators generally occupy considerable memory space and are very inefficient, often taking 20 to 30 instructions in the new computer to accomplish one instruction for the old machine. Most of these extra instructions are of the overhead type — dissecting the "old" instruction into several steps, obtaining data, etc.

Special read-only memory devices, frequently called "emulators", are supplied by several manufacturers to simulate one computer on another... for example, IBM supplies emulators for the 1400 and 7000 series on the System/360, GE offers a similar device for simulating the 1401 on its 400 series, and RCA offers a 301 and 501 emulator on its Spectra 70 series. Although the fast access time of these read-only memories improve the speed of simulation, they share the faults of the other approaches to simulation, namely, they fail to interpret many of the programming tricks employed by individual programmers, and they often cannot handle random access operation or special features contained on the replaced computer but not present on the new equipment.

The automatic translation approach seeks to produce a program in the language of the new machine by analyzing the instructions in programs written for the older computer. Outside of program conversion at the compiler level (programs written in FORTRAN, COBOL, etc.), nearly all program translators developed to date have proven to be too inefficient, have required too much manual editing, and have not translated nearly enough of the programming tricks to be useful.

One apparent exception to this is the "Liberator" program translation approach offered by Honeywell in the Series 200. This is no doubt due to the relative compatibility of the command structure of the Series 200 with IBM's 1400 series. Since Honeywell is currently landing 50-60% of its H-200 orders from 1400 series users, the operational success of the Liberator approach is of vital importance to the overall acceptance of the Series 200.

To find out how these users have fared with the Liberator conversion package our editorial staff interviewed 25 H-200 users who previously had a 1400 series machine. The users were selected at random from the International Data Corporation's market data file of computer installations which contains information on over 85% of the computer installations in the United States. The results of this survey were:

Q1: What percentage of your programs did you "liberate" to H-200 language rather than re-write?

An average of 80% of the programs were "liberated" while the rest were re-written, largely to improve their inherent efficiency and to take full advantage of the simultaneity of the H-200.

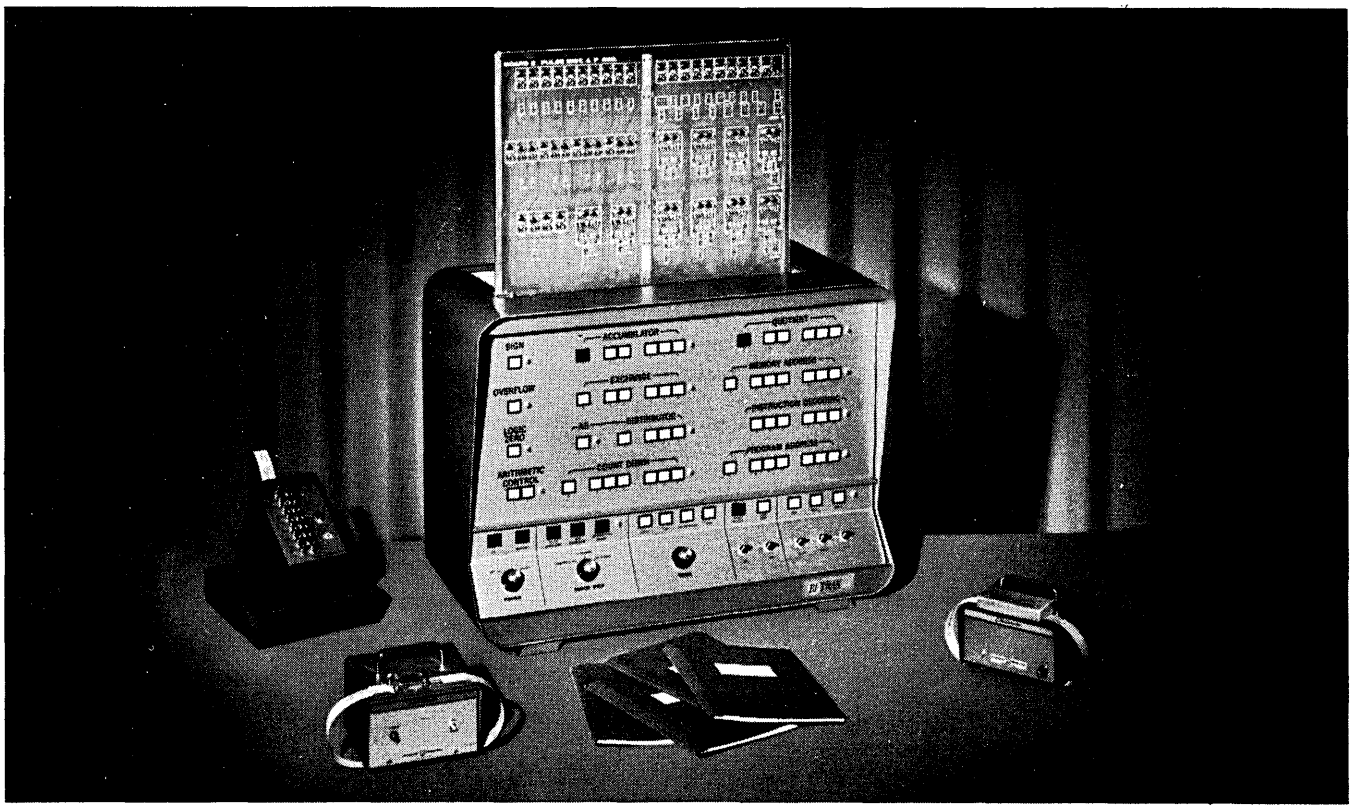
Q2: What method was used for liberation: EASY-TRAN for symbolic language translation or BRIDGE for machine language translation?

EASYTRAN was used almost exclusively because of the better documentation that resulted.

Q3: How much hand-coded patchwork was required to achieve complete conversion on the average program?

(Please turn to page 59)

This computer does absolutely nothing...



but teach

This computer system, complete with input-output equipment and "software," will never guide a moonshot, compile a payroll, or work out seven simultaneous equations.

It will change the way of life for many an educational system by taking the fear and mystery out of teaching and learning the fundamentals of digital computers.

Fabri-Tek Incorporated, leader in magnetic memory technology, has combined its knowledge of working computers with the thinking of experienced educators to evolve a basic computer fundamentals education system, designed exclusively to teach:

- Concepts of programming
- Computer organization
- Principles of logic design
- Principles of circuit design
- and, Principles and techniques of computer trouble-shooting and maintenance.

This system fills a critical need in industry today for training and retraining people whose responsibility is the operation and maintenance of large-scale, working computers. It provides the "hands on" teaching capability that simply cannot be duplicated with working computers because of the dollars and cents involved.

The heart of the system is a "large-scale computer in miniature"—the BI-TRAN SIX (center above). The BI-TRAN SIX has:

- Latest circuit techniques
- All solid-state components
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- Extra-large logic circuit cards (22″x17″) fully extendable with circuits in operation (without auxiliary extenders)
- Logic diagrams in exact correspondence with circuit card layout

Complementing the BI-TRAN SIX is a complete array of optional input-output equipment, specifically designed to teach. Available are: off-line paper-tape punch (upper left above), paper-tape reader (lower left above), paper-tape strip printer (right above), and octal-to-binary manual input keyboard (not shown). Comprehensive "software" consisting of a Technical Operations Manual, Teacher's Guide, and Student's Workbook are a part of the training system, prepared in conjunction with McGraw-Hill.

The complete training system provides a broad, versatile, and integrated course in basic computer technology which prepares trainees for full-scale computers *without intermediate steps.* Priced at $5,500, the BI-TRAN SIX has no competitors in the area of complete digital computer training. It has been design-limited to do only one job—to teach.

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COMPUTER MARKET: QUESTIONS FOR OUR READERS

Nicholas H. Dosker, Jr.
Da-Pex
Louisville, Ky.

An objective view of several important factors that are developing in the computer markets might be obtained from letters from C&A readers to the "Letters to the Editor" section on the following topics. These are phrased as questions to be contemplated by users.

1. What has been user experience in meeting estimated "Reprogramming Schedules" as they changed from "Tube Type" computers and card unit record equipment systems to "Transistor" computer systems? Have any significant number been able to meet the original schedule estimates? or have a significant number found that actual "Reprogramming time and expense" approached something like twice the original estimates by salesmen?

2. Much has been written about "computer languages" in the professional journals with emphasis on simulators, translators, and emulators in the context of the present major cycle of reprogramming now underway in many installations in preparation for initial deliveries of the latest model computer systems in mid-1965. The subject of computer language translators has received strong emphasis from IBM's principal competitors. There has been very little mention of the details of the new computer language programming in IBM 360 advertising. At this time in early 1965, what comments do users have to make about the relative ease or difficulty involved in the alternatives of either detailed reprogramming or use of translators in the present evolutionary cycle towards the IBM 360 series, Honeywell 200's, RCA 70's, GE late models and the others? What is their present estimate about meeting the original estimated schedules for reprogramming and proving the programs on a smooth-running daily operational basis?

3. What are user comments about the relative aid or additional ease offered in the present evolutionary situation by the "canned" or library type of standard programs for basic applications offered to them by the manufacturers?

4. How many feel that since they are now programmed and running smoothly in a "Transistorized" computer system that they might be well served in the present stage of the computer evolution by shopping the "Used Computer Market" for additional capacity needs for the next two to four years? During this time price adjustments for such additional capacity will reach levels of about the equal of two years' rent for 1400 series and much less than that for 7000 series equipment, (most can be sold subject to live maintenance contracts), while the first of the newest late model systems are delivered in 1965 and begin to be proved on the job. Bear in mind that present delivery lead times are of the order of two years at this time.

5. Are the undoubted near-future improvements in computer systems going to be substantial enough to justify extensive and detailed reprogramming repetitively on an approximate five-year model-change cycle, for several cycles to come? or do the users feel that with the present large changeover to the ASC II computer language (with many going to "Real Time" systems for the first time) that something close to a common "Computer Language" has evolved due to IBM's leadership and dominant position in the computer field? and that this may last longer than five years before another costly and detailed reprogramming cycle sets in?

I am sure that many **Computers and Automation** readers would be interested in user comments on these questions.

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"Syntax Languages," by Peter Z. Ingerman
"Statistical Analysis of Perception," by Joseph Campanella
"War Gaming: Infantry Company Level," by Walter Eckhard
"Self-Organizing Systems," by Michael J. Pedelty
"Tree-Structured Languages," by Dr. Ruth M. Davis, Dr. Anatol Holt, and Thomas E. Cheatham
"New Hardware Developments," by Dr. Gerrit A. Blaauw, Dr. Carl Hammer, and Dr. Thomas D. Truitt

Track B

"A Massive Study of ADP in the U. S. Government," by Carl W. Clelow
"USDA Brand Computer Applications," by C. C. Weaver
"Source Data Automation Trends," by Everett O. Alldredge
"Systems Reliability and Effectiveness for ADP-Communication Systems," by A. Eugene Miller
"AUTODIN for Non-Defense Agencies," by M. Lloyd Bond
"Standards for Data Processing" Vico E. Henriques and Harry S. White
"Project OVERLOOK" by Dr. Brian Carne
"ADP Experiences in Business Systems Design" by C. Robert McBrier, H. L. Spaulding, and Robert B. Curry

The topic at the luncheon, "The Future of Professional Computing Societies," will be discussed by George E. Forsythe and John K. Swearingen.

Registration is $9 in advance, $9.50 at the door; registration may be cancelled for any reason prior to April 1, and the amount paid will be refunded. Registrations should be mailed to:

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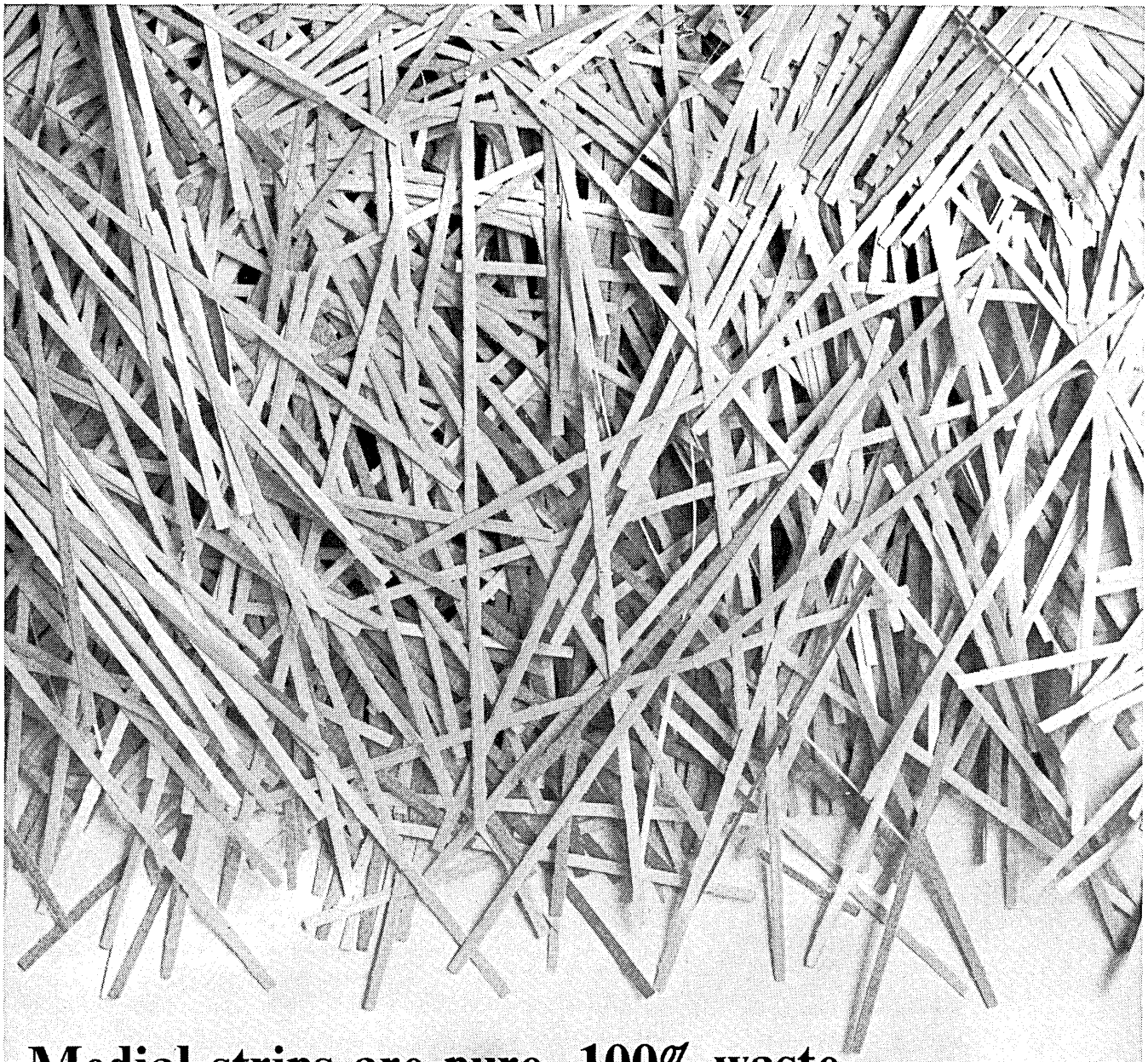
THE DILEMMA: THE CHOICE OF NATIONAL GOALS

William L. Mandel
New York, N.Y.

A number of articles have appeared lately insisting that there are no exceptional social problems associated with automation, nothing much worse than the dislocations following every advance in industrial technique (see "The Real News About Automation," Fortune, Jan., 1965). It must be acknowledged that these accounts serve well as correctives to exaggerated claims for automatic devices as such. They miss the burden of the argument, however, which is not the lack of work needing to be done, but the inadequacy of work in the form of "jobs" (defined as paid employment in a consumer-goods-oriented economy) to provide for an abruptly expanded working-age population that is increasingly concerned with what Professor Galbraith calls "the quality of life," affected as much by public amenities as by personal possessions.

Where industrialization raised productivity to the point of meeting the subsistence needs of large populations, automation extends the process, and can simplify the satisfaction of social needs in the same measure that it now complicates the creation of unsatisfactory jobs, depending on the choice of national goals; and there lies the dilemma.



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COMPUTERS, EDUCATION, AND THE GOVERNMENT

Rod E. Packer, Ph.D.
Dunlap and Associates
Hereford, Arizona

Quickie Quiz:

I. *If:* (a) the computer is the core of automation,
(b) automation is the core of our changing technology,
and (c) technological change is the core of our unemployment problem;
Then: Unemployment's most likely scapegoat is the _____.

II. *If:* (a) education enables us to face new things,
(b) its newness is the computer's main threat,
and (c) this threat by computers spurs our fears of "technological unemployment";
Then: Our best job security, in an automated society, is a solid _____.

III. *If:* (a) the Government increasingly "promotes the general welfare,"
(b) the public's general welfare increasingly is threatened by "technological unemployment,"
and (c) technology's threat can best be dispelled by education;
Then: Public education, particularly involving computer technology, will be increasingly provided by the _____.

Answers:

I. COMPUTER, II. EDUCATION, III. GOVERNMENT

There it is.

As clearly as (a), (b), (c) and as quickly as I, II, III, the Government will surely move into computer education—and, to provide *mass* training, into educational computing.

This move into education, however, like so many governmental endeavors, is hardly clear in over-all direction, nor quick in organized detail. Federal retraining programs against automation's inroads "are scattered all to hell and gone," according to Pennsylvania Democrat Joseph Clark, chairman of Senate hearings on the manpower revolution. "Commerce has this, Education and Welfare has that, Labor has the other. If you have a conference, you get a bunch of guys sitting around who didn't even know the others existed."[1] Educational assistance to poverty's progeny of "functional illiterates" must be "coordinated" through some forty-five programs, or bureaucratic skirmishes in the War on Poverty, directed from all over Washington. In addition, every agency owning a computer now faces alone the orientation of its staff to data processing—in spite of initial attempts, such as the Government Accounting Office's purchase pressures, toward central control of federal computer operations. Every public-supported educational institution still feels its own way in the application of computers to its administrative, research, and instructional activities.

In short, the Government's participation in the educational aspects of computer technology so far lacks the deliberate design that any successful educational "curriculum" must acquire. The following brief run-down on Government applications of technology in public education may help the computer community better to organize its assistance to local, state and national experiments as they take shape.

Departments Involved in Education

Three departments of the administrative branch of the federal government are most directly involved in education. The Department of Health, Education, and Welfare (HEW) is the principal federal participant in our established systems of public schooling at all levels. Naturally, its Office of Education is the main monitor of U.S. aid to state and local educational activities. The Department of Labor, however, is increasingly engaged in a second category of education, industrial training—or adult vocational in-

struction in the modern technological skills needed by automation-displaced workers. The Labor Department's Office of Automation and Manpower is expanding its services, under impetus from the recent Manpower Development and Training Act (MDTA), to all levels of workers, from the unemployed "functionally illiterate" to the semi-professional. Finally, the Department of Defense covers a third educational category, military training. Armed Forces instruction ranges from the academic curriculum of the three Service colleges and U. S. Armed Forces Institute (USAFI) to advanced training in electronic and nuclear systems. In addition to HEW, Labor, and Defense Departments' efforts in liberal, industrial, and military education, every other government agency is involved in public information services about their various activities. In particular, the U. S. Information Agency is charged with educating foreign nations and citizens in American affairs and attitudes. So is the Department of State. The Department of Commerce specializes in business education, and the independent Veterans Administration has its own subject, veteran benefits, with a very large class of interested students.

Expansion of Government Educational Activities

The educational activities of almost every Government bureau is sure to expand. President Johnson has requested for the coming fiscal year unprecedented educational assistance funds of one and one-half billion dollars. And those are only the formal funds. Additional hundreds of millions of dollars will be spent in the War Against Poverty for the literacy and skills instruction that will keep the estimated two million "unemployables" off welfare rolls. (The term "unemployables" is a third category suggested by the Bureau of Labor Statistics for compiling its periodic tables, and also those of the U. S. Employment Service). These unemployables, being largely welfare cases, are the concern of the Dept. of Health, Education and Welfare. Two other catch-words identify the two other specific categories of the public upon whom the Government's educational emphasis will particularly center: the "drop-out" and the "displaced." The high-school drop-out's retention in formal schooling is mainly the concern of the U. S. Office of Education. The retraining of automation-displaced workers is mainly the problem of the U. S. Office of Automation and Manpower.

35,000 Workers Displaced Every Week

It is estimated that 35,000 workers are displaced by automation each week.[1] The raging argument over whether technology simultaneously creates even more jobs than it destroys is irrelevant to the fact that nearly every new job demands more human skills than each old job; the net result is always a need for more job training. Studies have also revealed that 30% of high-school drop-outs permanently join the two million unemployables and the 35,000-per-week displaced workers. Obviously, this enormous and growing pool of people needing education and re-education can only be drained through a massive retraining program implemented with mass-education technology. There is already strong indication that the Government plans to "fight automation with automation." President Johnson, in proposing a doubling of the total national expenditures on education from 1964 to 1965, specifically proposed first-year spending of 45 million dollars to establish "regional educational laboratories . . . to train teachers and to develop new teaching systems."[2] It is in these experimental training centers that the first firm steps toward instructional automation may be taken.

Computer's Assignment in the Job Corps

The computer is already being drafted into the Job Corps. This so-called "Domestic Peace Corps," under Sargent Shriver, is funded under the Economic Opportunity Act, and is known officially as the Office of Economic Opportunity. From here the "War on Poverty" is being waged, although most of its permanent functions may be absorbed in time into the Departments of HEW and Labor. The computer's first assignment in the Job Corps is to collect, process, and analyze data from every conceivable source on the nature and extent of poverty, of vocational training needs, and of patterns of drop-out.

For example, from a preliminary skirmish in the "War on Poverty" in Detroit, data is being collected on the need for public education in job seeking, medical care, legal and family counseling and literacy training. The Office of Economic Opportunity has provided 90% of the 5.2 million dollars to be spent in Detroit to establish Community Action Centers to dispense welfare information on one hand, and collect data about poverty on the other, for a national analysis. Since training to relieve unemployment is a prime ingredient in this total action approach to poverty, the Labor Department has already initiated data analysis contracts, under the funds of Manpower Development and Training Act of 1962, and the more recent Vocational Training Act, with outside agencies. System Development Corporation has been charged with designing a data processing program for monitoring drop-outs and vocational training needs in a five-state area. SDC has also been applying systems analysis and computer simulation techniques to a U. S. Office of Education task of condensing data from 200 high schools, and five typical schools in particular, into a descriptive model of an educational system through which sample students, also simulated by digital data, can be "processed," with the educational product analyzed to suggest new efficiency in school counseling and administration. Riverside-Brookfield High School, in the Chicago area, will shortly be using an IBM 360 system in putting a profile of each of its students, obtained from a battery of tests and past records, through a performance prediction program, as a computer-assisted counseling technique.

Vocational Training

Almost concurrently with the use of computers for educational systems analysis, a second and more direct Job Corps task is being tied to the computer; vocational training for the Age of Automation. With a $49,043 grant from both Welfare and Labor Dept. agencies, Datatrol conducted a pilot computer programming course for 34 unemployed low-skilled high school graduates last year. Their successful placement at Washington area computer installations after only eight months of intensive training has led to an expanded Labor Dept. contract, under MDTA, of $77,850 to the Institute of Computer Technology, a non-profit spin-off from Datatrol in Silver Spring, Maryland. The task calls for cooperation with state employment centers in twelve urban areas in surveying actual needs for different data processing occupations. (Combined with a data-analysis model for monitoring patterns of automation, this study could lead to an adaptive plan for distribution of retraining among the Job Corps training centers to be set up across the country). The whole range of educational up-grading of semi-skilled shows promise as a result of preliminary computer training attempts. Willard Wirtz, Secretary of Labor, notes that "there is a pressing need for skilled subprofessionals who can relieve highly trained engineers and computer specialists from routine duties . . . pilot projects show that high educational attainment is not a prerequisite for this type of course, as long as aptitudes, basic abilities and personal desire match the demands of the course." (A remarkable example of the lack of relationship between a normal education and computer programming skill is the result of a vocational program at the

Pennsylvania State Office for the Blind, in which the blind, who have learned to "program" their every physical move, prove to be exceptionally patient and exacting computer programmers.)

Education About Computers

Secretary Wirtz shows a real sensitivity to the leverage that computer education could exert for the permanent reduction of unemployment in a technological society.[3] And the U. S. Office of Education has also encouraged the development of data processing education. Together with the State of California and Sacramento County, the Office of Education will explore the teaching of use of computers to high school and junior college students. An ADP Center at the Calif. State Board of Education, just announced by state superintendent Max Rafferty, may be followed by ten regional centers scattered about the state, each tied to input/output terminals at local schools through a data transmission network. These centers would be used both for educational administration and analysis, and for training of students in computer technology. The State University of Iowa has also received an Office of Education grant, $248,227, to supplement a $750,000 Ford Foundation grant for a similar center, the Iowa Educational Information Center (IEIC). This center would demonstrate to Iowa public schools the services that automatic data processing can perform in school inventory control, bus routing, student record-keeping, building utilization, and teacher assistance. Des Moines, Iowa, is also the site of a three-year project, named UPDATE, for turning out journeyman computer programmers upon graduation from Des Moines Technical High School.

The uses of computers in state and local educational institutions are already becoming far too numerous to itemize. But some exceptional facts might be noted. Several junior colleges are ready to offer minor degrees in data processing or computer science. Others are making orientation courses in computer technology a regular feature of the curriculum. The University of Texas's College of Business Administration has a mandatory course in the nature and use of computers. Dozens of universities are doing really large-scale research on campus computers, sometimes partially donated by manufacturers, but increasingly paid for out of the tax-payers' money. The University of Massachusetts has ordered a CDC 3600 for academic research and administrative details. Already more than 500 U. of Mass. students are enrolled in computer science courses and another 300 faculty and graduate school students are being trained in computer applications. NYU has actually purchased a CDC 6600, the largest computer in production, for its scientific research. The University of California at San Diego has a 3600 on order, Arizona State uses four computers for administration, research and instruction, and doubtless a hundred other schools around the country have medium-scale processors on campus.

Automated Instruction

Although immediate Government applications of computers will be confined to the two areas discussed so far, educational systems operations, and vocational training, the third—and most glamorous—educational application shows signs of life. Automated instruction is under study by the California school system, by Pennsylvania State University, Florida State, and a smattering of other state and local educational institutions. There has been no major funding of a federal project in educational technology as yet, but it is the transparent theme of this report that the national commitment to mass education against poverty and automation has created an inevitable requirement for government development of automation-oriented instructional systems.

The Vast Demand for Education for Plural Careers

A professional, and one specializing in the "new" technology at that, has difficulty visualizing the vast demand for mass education now being generated by technology. As Dr. Emmanuel G. Mesthene, Director of Harvard's automation studies, puts it, "In the past, we've thought of . . . careers that lasted a lifetime. But more and more people will have two, three, or even more careers in a lifetime because technology shifts the pace of society so fast."

If in the near future, one of us—perhaps you—should find his current career dropping out from under him, we can hope that a system will have been perfected for teaching old dogs new tricks. O. K. Moore, Rutgers sociologist, has already made a start with his "talking typewriter"; and he assures us that "within ten years there will be very complete systems of automated instruction."

Appendices

1. MISCELLANEOUS GOVERNMENT ACTIVITIES IN EDUCATIONAL COMPUTING:

National Academy of Sciences—a study on the use of computers in universities and colleges, to be submitted to the Nat. Science Foundation as a guide to the agency in developing its grants to educational institutions.

Department of Defense—expansion of its program of EDP seminars for top-level officers as well as strategic commanders.

House Subcommittee on Unemployment and Automation—findings that education should have priority in solution of automation problems.

House Education and Labor Committee—emphasis on teaching people to read and write before creating jobs for them.

Office of Economic Opportunity—assistance in learning skills that are in demand.

U. S. Employment Service—re-placement of 4,000,000 workers now in "manual occupations involving little or no training."

Veterans' Administration—programming of its computers in its Dept. of Data Management to figure optional benefits for widows and automatically print-out public information letters to each.

U. S. Information Agency—educational aid to foreign peoples.

President's Commission on Technology, Automation and Economic Progress—a committee of fourteen advisors formed in Jan. '65.

Joint War Games Agency—a DOD group engaging in war gaming, some by computer simulation, to evolve tactical decision training.

Census Bureau—First govt. agency to use a computer, now automatically printing our news releases and public information.

Defense Construction Supply Center—contract to be let this spring on applications of ADP to military libraries.

Committee on Economic Impact of Technology—U. S. Chamber of Commerce group to make recommendations to business and government.

Conference on EDP for State and Local Governments—Univ. of Georgia, Athens, Ga., March 29-31st. (SDC co-sponsor).

Dept. of Commerce—proposing establishment of regional industrial institutes at universities, similar to agricultural stations.

Office of Education—announcement of a new magazine,

"American Education" to report on the Government's role in education.

2. COMPANIES ENGAGED IN GOVERNMENT EDUCATIONAL COMPUTING RESEARCH:

C-E-I-R	IBM
Dunlap and Associates	Institute of Computer Technology
Honeywell	System Development Corporation
Documentation, Inc.	Computer Science Corporation

(this list is merely indicative and does not pretend to be all-inclusive of Govt. AutoEd participants).

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AUTOMATED VENDING

"Come off it, George — that machine is non-programmable!"

The Automation-Unemployment Issue

(Continued from page 8)

displace them. Ordinary high school girl graduates in years past often entered clerical work in the life insurance business for two or three years before they got married—why should they be employed now with computers doing this work? All these people and many more are in an evil predicament.

Fourth, the 5% unemployment rate is really a considerable fiction. The actual rate is much higher. Many persons would eagerly engage in part time work if they could do so conveniently. Also, the counting of unemployment specifically does not include persons who have stopped looking for work. The figures for poverty in the United States show 35 to 45 million people in poverty. We can assume that 40 percent of these people, say, 15 million people, are willing and able to work if they could find a reasonably good solution to the particular problem of employment which they are faced with. (See "War on Poverty" by Vice President Hubert H. Humphrey, published by McGraw Hill Book Co.)

The essence of the answer to the automation-unemployment issue seems to me to be this: society must make sure that every human being either has a decent job or a decent income (or both—preferably both): "jobs or income now." Society has a choice: there is for example an enormous amount of useful work ready and waiting to be done in the public sector of our economy. But if society chooses not to do this useful work, not to provide jobs, then at least it should grant a decent minimum standard of living to the unemployed.

Edmund C. Berkeley

EDITOR

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COMPUTER–MEDIATED INSTRUCTION— A SURVEY OF NEW DEVELOPMENTS

Don D. Bushnell
Resident Staff Member,
Brooks Foundation
(President, Association
for Educational Data Systems)
Santa Barbara, Calif.

Three years ago, a survey of computer applications to instructional programs in secondary schools and institutions of higher learning would have had little to report. Today, the use of the computer as a tool of instruction for teaching computer mathematics, science-related subjects, etc., and as a mediator of self-instructional technology is burgeoning. And while research continues in a number of new applications, for example, in the use of information retrieval techniques for putting automated research and instruction under student control, the surprising fact is that the computer has found its way into actual school settings. In other words, what was once only the tool of researchers has now become a practical instrument for applied programs. It is this demonstrated usefulness of the digital computer that has led the major computer manufacturers to launch new departments for meeting the growing need for computer-assisted instructional systems.

The survey reported herein has been limited primarily to the practical applications of computer-mediated instructional systems. In the two instances where research in a non-school setting is discussed, such developmental programs are considered more applied than basic research programs in the judgment of the author.

As an aid to better learning the computer has been used as an instructional tool in the following ways: (1) as a simulation device for student instruction in decision-making processes; (2) as a mediating and controlling device for self-instructional devices or teaching machines; (3) as an information band for the storing of student learning problems; and (4) as an instructional tool for teaching students about computer operations and mathematics.

A Simulation Vehicle for Student Instruction in Decision-Making Processes

Simulation has been a part of the instructional arsenal at all levels of education for many years. With the advent of the digital computer, classroom simulation for instructional purposes has increased in realism and complexity. Students in social studies classes in Yorktown Heights, New York, play an economic game by means of a remotely controlled typewriter keyboard which is linked to the IBM Advanced Systems Development Division computer in Yorktown. The significance of the game is the relative sophistication with which the controlling computer program has been developed. Time during play is compressed so that a student's game covers a five-year period in fifteen minutes. The consequences of decisions made by the individual student have

direct and immediate effects on the economic well being of the country for which each student is serving as king. Random events, such as plagues, droughts, and fire are brought to bear on the decisions of the student and very definitely affect the outcome of his decision-making. The purpose of this exploratory research program is to study the use of computer media for simulating environments and to provide individualized instruction.

Another example of the use of the simulation device is seen in the work generated by the productive staff of the Board of Cooperative Educational Services in Yorktown Heights, New York; Dr. Richard Wing is Director. Students conduct a simulated experiment in chemical analysis. This means that a chemistry student can sit at his desk and type directions to a machine that will "perform" chemical experiments step by step.

The student has a viewer on his desk that shows him what would happen, for instance, if he orders potassium chromate to be added to a solution of hydrochloric acid. If the solution turns yellow, or the mixing causes an explosion, the student sees this on his viewer.

The machine does not actually mix the chemicals, it merely "simulates" what would occur if this were done in the laboratory. He goes to the laboratory to perform the actual experiment only after he has simulated the same experimental process several times.

Another example of the use of the computer for simulation purposes is seen in the work of Feichtinger at MIT. He uses a PDP-1 system to train medical students in diagnostic decision-making. The student learns the correct procedure in the diagnostic interview and is given additional tips on time-saving routines that enable him to perform his diagnosis efficiently. Through using the computer in a Socratic dialogue, Feichtinger and his staff have trained a number of students at the Harvard Medical Center.

A Mediating and Controlling Device for Self-Instructional Devices or Teaching Machines

The potential of the computer for handling individual student differences in learning rate, background, and aptitude is of primary interest to researchers working with computer-controlled automated teaching machines. Responsiveness to student learning behavior can be achieved by branching the student forward, laterally, or backward through subject materials primarily on the basis of his response to content questions seeded throughout the instructional program.

At the present state of the art, the computer-based teaching machine branches for the following reasons:

a. Characteristics of student response—the promptness and/or definitiveness of his reply.
b. Nature of response—was it right or wrong, what specific errors were committed by the student?
c. History of student learning behavior—his previous response pattern, problem areas, and reading rate.
d. Relevant student personal data: I.Q., sex, personality, aptitudes.
e. Nature of subject matter.
f. Degree of student motivation.
g. Student-generated requests for re-routing.

The only type of control unit which provides the necessary flexibility for branch is the digital computer, because the computer is the only instrument capable of determining the item sequence and knowledge of results to be presented to the student as well as carrying out the bookkeeping activities upon which such determination would be based.

Researchers at the University of Illinois, MIT, IBM, System Development Corp., and other agencies, are pursuing various research interests in this development. Generally, however, all their students work with programmed materials and their response records are stored in the computer on magnetic tape.

Plans at IBM are now under way for the establishment of typewriter stations remote from the central computer system. This would permit students located in a wide geographic area to be linked into one network via leased telephone lines. Also contemplated is a plan for loading standardized paper-and-pencil tests (aptitude, interest, achievement, etc.) into the computer to be administered to each student at an appropriate place in the program. These test profiles could be easily used by the main executive routine in the computer to branch the student through the course in a manner best suited to his interest pattern. Remote stations have, in fact, been installed at a number of locations, including the Chicago Board of Education, Florida State University and the University of Pennsylvania.

An Information Bank Storing Student Learning Data

A facility for the research and development of a complete educational system that would provide optimal learning conditions has been in use at the System Development Corporation for research. This facility, designated CLASS (for Computer-based Laboratory for Automated School Systems) is part of the large, general-purpose Systems Simulation Research Laboratory using a Philco S-2000 computer as the central control mechanism.

CLASS permits simultaneous automated instruction of 20 students, each of whom receives an individualized sequence of instructional materials adapted to his particular needs, or learns in a group mode of instruction mediated by the teacher or computer.

A behavioral engineering approach to improving instructional materials identifying factors that influence the success of programmed instructional methods has been the object of extensive research conducted within CLASS over the past two years at the System Development Corporation. Partially supported by the United States Office of Education, four researchers have been using a technique of individual tutoring to modify and revise instructional materials including standard textbook, programmed instructional sequences, film and filmstrips, flannel board cutouts, and the like. Significantly improved learning of several basic subjects has resulted when students work with these modified instructional packages.

Analysis of Student Learning Behavior

The method of approach, the behavioral engineering technique as it has been named by researchers, is basically simple. It makes use of a systematic method of analysis of student learning behavior for the testing and revision of the commercially available text or instructional package. In each subject area, the material is given to one or two students at a time. If the student has difficulty with the learning task, he is interviewed immediately to ascertain the cause of his difficulty. The experimenter/tutor then attempts to remedy the difficulty through various techniques. For example, he might explain the concept using analogies; he might describe the concept using simpler terms or through a pictorial approach incorporating film modules or filmstrips; he might alter the sequence of instructional items or vary the practice problems. Each of these approaches is visually and verbally recorded and when the student resolves his difficulty, the experimenter-tutor notes the program variation that has been most effective. This procedure is repeated with additional sets of naive students until the modifications take care of most of the typical learning problems that the students can generate. The revisions and new

media that work best are built into the final instructional program. Formal acceptance of the revised version occurs when students taking a standard test can be shown to have achieved superior performance over students working with the original version of the instructional program.

The Philco 2000 has been used extensively in the collection and analysis of student responses to diagnostic test items during the process of tutorial instruction. Areas for curriculum revision are automatically noted by this process of analysis. The research results of this study also seem to point to the existence of half-a-dozen or so basic learning problems which are common to most students involved in a particular unit of study.

In an extension of the work the author was formerly involved in at SDC, the author has initiated a Student Learning Characteristics study at the Brooks Foundation, Santa Barbara, California. In cooperation with the American Textbook Publisher's Institute and the Santa Barbara City Schools, the Foundation will apply behavioral engineering techniques to the improvement of curriculum materials; and a CDC computer will be used as a repository of data for the express purpose of discriminating among learner types. Visual (as distinct from verbal) learners have been shown to respond more favorably to sequences of graphically or pictorially laid out instructional items. These students, who usually rate in the lower percentiles on predominantly verbal I. Q. tests, have been brought to a level of superior performance on achievement tests through the diagnosis of their particular constellation of learning abilities and the tailoring of instructional materials accordingly.

Public School Instruction in Computer-Oriented Mathematics and Data Processing Technology

With increasing frequency, secondary schools and junior colleges throughout the country have justified the purchase or rental of a small or medium sized computer system for the primary purpose of using the computer as an instructional tool in the learning of mathematics, programming, computer system operations and maintenance, and related curricula. Since the advent of problem-oriented computer languages, even the younger student can acquire the programming skills necessary to enable him to use the computer in a variety of subject areas. Teaching students the use of mathematical models and iterative processes has now become possible for schools with access to computing facilities. By using the computer as an instructional device, the students gain a better understanding of problem analysis and logical and sequential thought processes and become grounded in computing skills through first-hand experience with the machines. In a "Report from a Conference on Computer-Oriented Mathematics and the Secondary School," sponsored by the National Council of Teachers of Mathematics, more than fifty schools were mentioned as having computer based courses ranging from traditional applications (e.g., trigonometry, simultaneous equations) to mathematical research and advanced puzzle problems (Gruenberger, 1963).

The demand for trained students in electronic data processing, engineering, business machine operations, and related fields has stimulated colleges and unversities to adopt an updated curriculum and to expand computing facilities. *The 2nd Annual American Data Processing Survey* (1962) reported 397 digital computers and 11 analog computers installed in colleges and universities. By 1963 the number had grown to over 500 *(Data Processing Information).* The 1962 survey summarizes course offerings in this field with data-processing instruction available to students in several disciplines, including sociology, psychology, chemistry, physics, medicine, education, social sciences, and linguistics.

The trend in many institutions has been toward "open shop" computing centers which are available for the use of both faculty and students in any discipline area. With teletypewriting stations linked to the computing center, classrooms and laboratories become substations for program checkout and problem solving further expanding computer availability *(Business Week,* February, 1964). Excellent examples of both the open computing center and the multiplexed typewriter stations are to be found at MIT, Stanford University, and the University of Oklahoma.

Following acceptance in the colleges and universities, data-processing instruction has been introduced into the programs of technical and vocational high school, post-high school, and adult training institutions. Through support from Title VIII of the National Defense Education Act, many states developed educational programs for training individuals to become skilled EDP technicians. Training in key punch operations, the wiring of unit record equipment, computer programming, and system analysis became typical offerings in the field. Good examples of vocational training programs which include extensive courses in data processing are the courses offered in ten centers and schools throughout the state of Washington *(EDP Newsletter,* 1964), the Iowa Technical Education Center in Ottumwa, and the long established program at the Dobbins Technical High School in Philadelphia *(NCTM,* 1963).

To better prepare high school students for technical training or college courses making use of the computer, secondary school administrators and teachers have begun to follow the lead of the technical schools and the universities. Kits of material for ninth grade general science classes which include theory, operations, and uses of electronic computers have become available from the Project on Information Processing of the National Science Teachers Association at Montclair State College in New Jersey. An introduction to Instruction in Computer-Oriented Mathematics for Secondary School Teachers is available from the National Council of Teachers of Mathematics. Course materials and assistance in establishing instructional programs in local schools have long been available from local chapters of the Association for Computing Machinery (ACM) and the Data Processing Management Association who have a special program for "Future Data Processors."

Annual Computer Programming Contest for Secondary School Students

Again this year, as it did last, the Association for Educational Data Systems, a professional association of educators and data-processing directors working in the field of educational data processing, is sponsoring a secondary school Computer Programming Contest. Seven cash awards and thirty awards of a year's subscription to a professional publication, will be given to junior high school and senior high school contestants submitting original computer programs in the areas of (1) applied science, for example, statistical analysis routines, (2) symbolic, i.e., non-numerical, and (3) business applications. The winner of the contest will be awarded a cash prize of $150.00 at the Annual Conference on Educational Data Processing to be held at the Seville Hotel, Miami, Florida, on May 9-12, 1965. Inquiries concerning the contest and programs to be judged should be sent to Dr. Murray Tondor, Pupil Personnel Services, Palo Alto Unified School District, Palo Alto, California.

Portions of this summary were prepared for inclusion in a report to the U. S. Office of Education in partial accomplishment of a grant from that agency. The author was a member of the staff at System Development Corporation at the time this summary was prepared.

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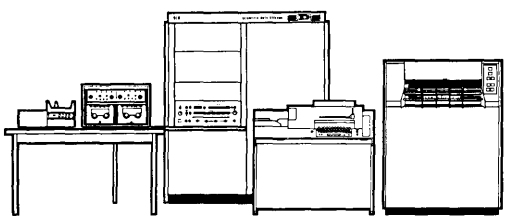

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Artificial Teaching Machines

An artificial teaching machine is an ingenious box programmed to put out information in a sequence of steps that is determined by the student's sequence of responses to previous steps.

The earlier artificial teaching machines, the "little boxes," employ variations of a straightforward tell-and-test routine of the following type:

1. The machine puts out an information statement followed by a question: an "information-and-question frame."
2. The student answers the question.
3. The machine puts out a new information-and-question frame if the student's answer is correct, otherwise, a remedial frame.

Because of the active interplay between machine and student, these little-box machines can generate motivation that some students do not find in conventional self-study methods. The machines can teach—in the restricted sense of accomplishing information transfer, at least for information that can be organized in a simple way. For example, they are well suited to automated drill in certain subject areas.

Computers as Teaching Machines

Since computers are logically much more complex than these little teaching boxes, they should be able to accomplish more complex teaching. Nevertheless, some computer teaching systems have been designed to do essentially no more than little-box teaching. How might they do more? Fortunately, it is not necessary to settle on the characteristics of good human teaching nor to postulate an artificial intelligence, in order to describe certain capabilities and goals that are likely to be important for the evolution of more complex teaching machines. These capabilities and goals, along with some current problems, will be considered under the following categories:

1. Instructional Objectives.
2. Student-Computer Interactions.
3. Natural Language Input.
4. Computer Response-Generation.
5. Teacher-Computer Interactions.

The judgments that are made in the ensuing discussion are not intended to be complete or final; rather they are intended to be suggestive to others interested in these problems.

Instructional Objectives

Speaking broadly, we say that education serves two purposes, to inform the student (information transfer) and to develop his capability for informing himself. Most teaching machines are directed toward information transfer, by helping the student to learn factual material and by training him to acquire important behavioral skills. This kind of instruction is fundamental. It is a necessary precursor to the other kind at any level. This other kind—let us call it inference of complex concepts—is more difficult to teach; indeed it may be unteachable in some aspects.

There are, however, a number of teaching tasks developing the student's capacity to inform himself that may be considered here. These range from straight applications of deductive inference, toward the easy end, to studies involving advanced problem-solving techniques (inductions, heuristics) toward the hard end. In the present research, we have been interested in mechanizing an intermediate capability, that of teaching a student to perform complex

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analytic tasks. A task is analytic if it can be completely specified by a sequence of deductive steps.

We call an analytic task a complex one if it involves many steps in the reasoning, if some of the steps may not be understood or even foreseen until other steps have been taken, if at least one (possibly partially ordered) subset of steps is necessary to arrive at an answer, and if the task does not necessarily terminate in a unique, unambiguous answer. This kind of task is not on the hard end of the spectrum but it is one which has only recently been mechanized. It is representative of certain situations in diagnosing medical ailments, arriving at decisions in business management, developing military strategy, and investigating scientific problems of many kinds.

A teaching system (called in the present research the Socratic System) has been constructed, resulting from an attempt to handle tasks of this kind. This system has been applied to problems in electronics, business finance, and medical diagnosis.[1, 2] Although these demonstrations were simplified and restricted in many ways, they clearly showed that this kind of teaching is possible, and they encouraged the conclusion that other, more difficult, mechanical teaching of complex concepts should be feasible. Excerpts from a Socratic System run are given in the appendix; they illustrate the discussion that follows.

Student-Computer Interactions

A completely general type of interaction facility should make provision for the student to ask questions as well as to answer those put to him by the computer. The student should also be able to volunteer meaningful assertions (possibly stating problem solutions) as well as make assertions in responding to the computer. Moreover, he should be able to ask these questions and make these assertions at any time during the exchange.

The computer should be able to maintain a continuity of context, i.e., carry on an extended dialogue or "conversation" with the student, throughout all possible contingencies. When the student's responses are not appropriate in a current context, this condition should be recognized; the computer should never fail to make a response to any input made by the student.

These capabilities actually exist in a few present-day systems. They are all necessary for the more complex teaching tasks already mentioned. Some of these tasks are further facilitated by the use of non-verbal interaction modes. Various terminal communication devices currently in use permit interactions involving graphical, tabular, and pictorial input and output. These kinds of data must also be processed by the system at some symbolic level, e.g., they must be named. Even when communication involving other sensory modalities is possible, student-computer interactions similar to the ones specified for two-way verbal dialogue will be needed.

Natural Language Input Problems

To accomplish interesting intellectual interactions, it is necessary that the computer pose problems, ask questions, and make assertions, all in more or less unrestricted natural (English) language. Providing essentially unconstrained English output is an easy problem, largely because the key output strings, or string skeletons, can be prestored in memory.

It would be desirable for the machine to "understand" unconstrained English input as well. Until this is possible, and it will take some time[3], compromises are necessary. Fortunately, simple approaches to the input problem are sufficient to satisfy the minimal input requirements for complex teaching. The simplest compromise is that the computer be able to recognize any of a fixed list of English strings, say from a large dictionary. Individual strings are allowed to be arbitrarily long, and semantically related sets of strings may be grouped into classes whose names can also be recognized by the computer. This is the compromise currently implemented in the Socratic System.

A minor consequence of this compromise is that the computer appears unintelligent when confronted with reasonable English inputs which are not part of its vocabulary and with which it thus cannot cope. (Minor, since the object of the system is for the computer to teach effectively within its conventional and logical limitations, rather than to appear to be linguistically intelligent, which, of course, it is not, at the present time.)

A more serious consequence is that, no matter how large the vocabulary of allowable utterances, if it has to be revealed to the student, a multiple choice situation is defined. Admittedly, there is some difference between 10 choices and 100, and clever cat-and-mouse programming can delay the exposure of vocabulary items up to a certain point. Nevertheless certain teaching situations are effectively prohibited—those in which the identification of a course of action or of some choice is prohibited because of the necessity that the student discover it by himself, rather than from seeing it named on a list, thereby suggested to his imagination.

More elaborate compromises, permitting somewhat freer English inputs, can be arranged. One possibility is the use of English sentences formed according to any one of a number of grammar rules. The student would be permitted to compose syntactically allowable phrases or sentences by drawing on items from two lists—a technical dictionary of word-phrases special to the problem area and a small vocabulary of common English words. This technique would alleviate difficulties of the kind just mentioned. It is to be expected that other, more sophisticated, techniques will be evolved on the way to solving the full-scale language input problem. At present this problem is wide open.

Computer Response-Generation

In a computer teaching machine, each time that the student makes an input, a program is executed in order to determine the response of the computer. The logical power of the teaching system resides largely in the capabilities of this program, along with the data structures that it can process. We will call the language which describes this program and data the control language.

In most computer teaching machines the control language is essentially context-free, in the following sense: Given the state of the system, independently of how it was arrived at, the current input of the student is sufficient to determine the response of the computer and the new state of the system. These control language statements can be schematized as

$$S_i\colon I_j \blacklozenge O_k, S_m$$

That is, at state i the j^{th} input triggers the k^{th} output and leaves the system in state m.

Such context-free languages are inadequate for complex teaching applications. These applications require that the content of the computer response be sensitive to wider contexts. Which particular response is made at any time needs to be conditioned on which relevant events took place in the past student-computer interaction. Thus, the interaction history must leave a trace that can be inspected subsequently by the control language processor in order to make its output decisions.

The data structures used in the Socratic System control language are, essentially, conditional expressions.[4] These conditional expressions can be schematized as:

S_i, I_j: ($H_{i,j,1}$, $A_{i,j,1}$;
$H_{i,j,2}$, $A_{i,j,2}$; and so on).

This is read: given state i and the j^{th} input, if the first history description is valid, then do the first set of actions, else if the second history description is valid, then do the second set of actions, and so on. Actions can direct output and can change the state of the system. The language is, obviously, context-dependent.

This control statement language can be used to express highly elaborated teaching strategies as well as highly conditional information outputs. The teaching strategies are, by design, a part of the data provided to the Socratic System. Because of this, and subject only to the input language and control language conventions imposed by the over-all program, it is possible for each teacher to choose his own teaching logic.

The language is general. The cost for obtaining this generality is the relatively large set of conditional data required to derive the interaction. The value is in the increased capabilities for accomplishing complex teaching applications.

It is difficult to predict what new directions for control language development are likely to be fruitful. The next significant advances seem hard to achieve.

Teacher-Computer Interactions

Teaching requires a teacher. Computer teaching will have an insignificant role in educational practice if teachers do not like the task of providing the required data. Their use of computer programmers to mediate the input process will be unsatisfactory in the long run. Compilers (and interpreters) for direct operation by the teachers are what is needed here. On-line interactive systems will be especially useful.

In order to be usable by non-computer people the source languages for these compilers must be well designed. As a bare necessity they must permit the teacher to use natural language as much as possible—Fortran is no substitute for English. Several efforts have been undertaken in this area.[5] All of these are limited to the context-free machines described above.

We are currently implementing a context-dependent compiler for use with the Socratic System. This is especially necessary for us because of the extensive logic (expressed as conditional data) that must be provided for complex teaching applications. We expect this compiler system will impose few constraints on natural language input. Those conventions that have been imposed have been chosen so as to appear natural, whenever possible.

New developments in programming language techniques should have direct applications to these systems. The ultimate in people-oriented (as opposed to programmer-oriented) compilers is yet to come.

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Appendix

A Socratic System Protocol

The following is a series of excerpts taken from a transcript of inputs and outputs obtained on a Socratic System interaction in a medical diagnosis run. The sets of dots . . . . . indicate omissions. The student inputs are expressed in capital letters and indented. The computer outputs are expressed both in capitals and lower case, and are not indented.

PHYSICAL EXAM?

Fine. What in particular would you like to know?

CHEST EXAM?

It is common practice in the medical profession to begin an examination by checking the patient's general appearance.

GENERAL APPEARANCE?

Acutely prostrated, lying in bed on his right side. Looks acutely ill, sweaty, apprehensive, but alert. Paroxysmal cough, bringing up a little rusty streaked sputum. Breathing with difficulty.

EENT EXAM?

Check all the vital signs first!

PULLS?

Do you mean pulse?

YES.

100 a minute. Occasional extra systole.

. . . . .

LABORATORY REPORTS?

Fine. Which lab tests would you like to have done?

RBC?

A red count will be done.
Results will be sent to you as soon as possible.

. . . . .

Some of the first series of lab reports have just come in.
Urine exam: insufficient fluid for analysis.
RBC: 5 million.
WBC: 15500.

Differential: Shift to left.

When the other reports are in you'll be notified.
Before proceeding with the reexamination it might be instructive to pause and consider the diagnostic implications of the information at hand. Perhaps you think it too early to arrive at any definitive conclusion. On the other hand, you may be prepared to make the diagnosis now. Are you?

NO.

Fine. Nevertheless, we've got a fair amount of information—at least enough to raise some, perhaps several, diagnostic possibilities. Have you any in mind?

YES.

Name one.

PULMONARY INFARCTION.

Fine. Pleural pain, dyspnea, fever and the physical exam signs and symptoms are certainly consistent with pulmonary infarction. Do you think shaking chills and the presence of rusty sputum further support this diagnosis?

NO.

Right. Though the white count is consistent, isn't it?

NO.

Wrong. The white count *is* consistent. This should further support your diagnosis.
We've considered one possibility. Do you have another diagnosis in mind?

NO.

In that case I'd like to talk about viral pneumonia. The tachycardia, high WBC, elevated respiratory rate, shaking

chills, bloody sputum and severe pleural pain all lend weight to that diagnosis—right?

. . . . .

APPENDICITIS.

Sounds good! But what about the history of cough and the chest signs? What evidence would help you establish this diagnosis?

EVIDENCE FROM ABDOMINAL EXAM.

Right! Go to it!

ABDOMINAL EXAM?

The heart exam should be done before this.

HEART EXAM?

Unchanged, except systolic murmur more prominent.

ABDOMINAL EXAM?

Pain localizing in lower right quadrant with continuing diffuse abdominal tenderness.

APPENDICITIS.

Appendicitis? Nonsense.. By this time you should have your attention focussed on a different part of the patient's anatomy.

. . . . .

PNEUMOCCAL PNEUMONIA.

Are you absolutely sure?

YES.

You can't be until you have irrefutable evidence. What would help you nail down the diagnosis?

EVIDENCE FROM SPUTUM SMEAR AND CULTURE.

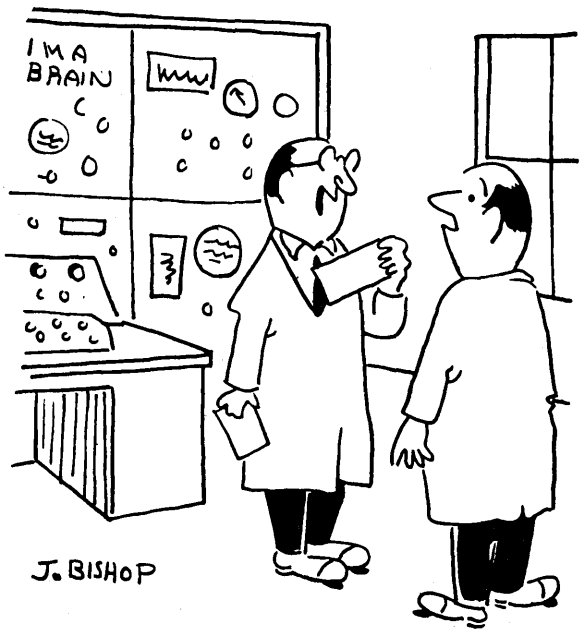
Good. Anything else?

NO.

I think you might also want evidence from x-ray findings. Go ahead and we'll see what happens.

. . . .

COMPUTER TIT-FOR-TAT



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PROGRAMMED INSTRUCTION MATERIALS FOR COMPUTER PROGRAMMING—A SURVEY

Gloria M. Silvern
Senior Technical Specialist
Computing and Simulation Center
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Downey, California

Introduction

This is a sequel to the article by the writer which appeared in the March 1963 issue of **Computers and Automation** and in which six of the earliest "programmed" courses in computer programming were reviewed (Reference 1). In the intervening period, a number of new programmed materials have been produced for this field—as well as some which claim to be "programmed" but are not. About a dozen different computer languages and a large assortment of machines are represented. Twenty-five courses are included in this survey of currently available programmed materials on computing and data processing. These are not critical, comprehensive reviews; no attempt has been made to analyze the contents of each course for appropriateness and completeness. Rather, this survey is designed to acquaint the reader with available materials by identifying and describing them, with added comments where appropriate.

To accommodate readers not completely familiar with programmed instruction, Part I will provide background and "state-of-the-art" information. Others have the option of branching now to Part II, covering programmed materials currently available for computer programming.

Part I
WHAT IS PROGRAMMED INSTRUCTION?

Description of Programmed Instruction

Programmed Instruction, also known as Programmed Learning, and Teaching Machine Technology are techniques of instructing without the presence of a human instructor.

Programmed Instruction is a learner-centered method of instruction which presents subject matter to the trainee in small steps or increments, requiring frequent responses from him and immediately informing him of the correctness of his response. The interaction of program and learner may be depicted as shown in figure 1.

The correct answer acts as reinforcement to motivate the trainee for further learning. Thus, he is guided step-by-step to the successful completion of the assigned task, without a human instructor present.

The trainee responses may be written, oral or manipulative. A response may be constructed, as in the completion type, or it may be selected from among several alternatives, as in the multiple-choice type.

The instruction should be designed to provide for individual differences. Also, each trainee should be able to proceed at his own pace.

Programmed Instruction generally consists of the following steps:

1. The program instructs the learner (visually, aurally, or both) and provides a question or problem.
2. The learner uses the instruction to conceptualize the answer or solve the problem (mental, manipulative, or both).
3. The learner decides upon the answer or solution.
4. The learner informs the program by multiple-choice, written-completion or oral-completion. (Oral-completion is used in foreign language instruction.)
5. The program verifies, or has the learner verify, the response and feeds this back to him. The learner may repeat, branch or go on to the next incremental instruction, depending upon the curriculum design.

The term "self-instructional" is often used interchangeably with "programmed instruction." However, they are *not* synonymous. Correspondence courses have always been "self-instructional," but no one would consider calling them "programmed instruction." A well written textbook should be understandable without the assistance of an instructor. When certain texts are identified with the label "self-instructional," exactly what does this mean? Is it implied that the others are useless unless accompanied by a human instructor? Or, should any textbook with questions, problems and exercises at the end of each chapter be identified as "self-instructional," especially if correct answers are included in an appendix? Should these "self-instructional" texts be considered bona fide programmed instruction? Not necessarily! Beware of the term "self-instructional" and the implication that it is synonymous with "programmed instruction."

Then, what *are* the criteria for determining if a text *should* or should *not* be classified as programmed instruction? One set of criteria or guidelines includes the following:

1. Instruction is provided without the presence of a human instructor.
2. The trainee learns at his own rate. Conventional

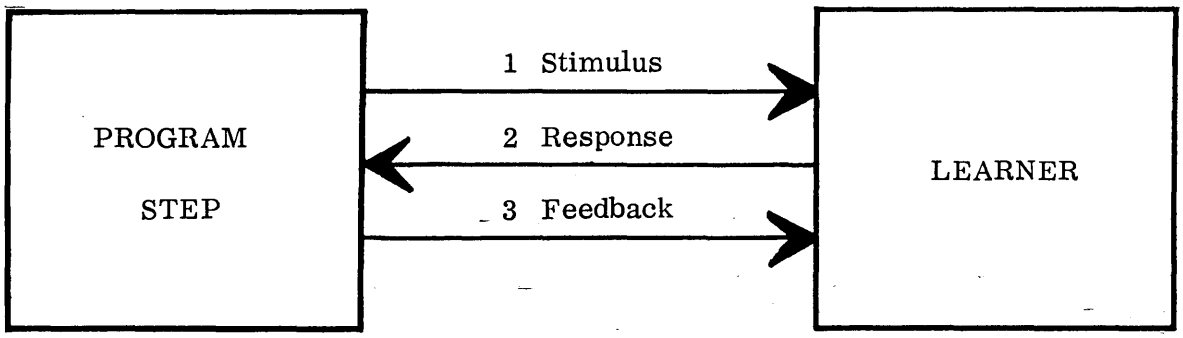


FIGURE 1

group instruction, films, television and other devices and methods which do not allow the learner to control the rate at which instruction is provided do not satisfy this criterion.

3. Instruction is presented in small incremental steps requiring frequent responses by the learner. Research evidence still does not reveal how "small" the ideal step should be nor how often responses should be required. The step size should be a function of the subject matter and the intended learner population.
4. There is a particip ing, overt interaction, or two-way communication, between the learner and the program.
5. The learner receives immediate knowledge of his progress through feedback.
6. Reinforcement is used to strengthen learning.
7. The sequence of the lessons is carefully controlled and consistent.
8. The program shapes and controls human behavior.

For a more complete, comprehensive definition of programmed instruction, the reader is referred to any one of a number of articles (Reference 2).

Comparison of Programmed Text and Teaching Machine Program

The program, which is the essence of programmed instruction, may be developed as a programmed text or contained in a teaching machine. In either case, the program is most like the "lesson plan" used by an instructor for conventional instruction, since it is an organized, sequential pattern of learning behavior.

A programmed text is the program in a printed document form; this is quite different from a "textbook." The learner reads a small amount of information from the programmed text; then he is required to answer a question or complete a statement. In a "scrambled" text, he is presented with a multiple choice; his response determines what information will be presented to him next—new, explanatory, review or remedial—or which "branch" he will take. In non-branching or linear programmed texts, the correct answer is provided immediately so that he may compare his response with it and recognize any incorrect responses before continuing on to the next step.

A "teaching machine" is a physical device which contains a program. It may be a simple mechanical page turner or a sophisticated electronic audio-visual device. The teaching machine program may physically exist in the form of slides, filmstrip, pre-recorded audio tape, sheets of paper, other storage materials or combinations of these. A step is often called a "frame" in these programs; one of the derivations of this term is based upon the stimulus being presented in a frame of a filmstrip. Some machines, instead of requiring a written response, require that buttons, switches, or keys be pushed or other mechanical responses be made. Some machines can determine the correctness of the response, some can record this information, and some can use it to determine what should be presented next to the learner. Like the programmed text, the teaching machine program may be linear, it may provide for branching, or it may be a composite of both.

A teaching machine is *not* any machine which instructs, for if it were defined that way, then an ordinary television set would be a teaching machine. To be a teaching machine, it is necessary that its programs meet all the criteria for programmed instruction previously outlined.

Some consider the programmed text to be a kind of paper teaching machine since the text, like the hardware machine, is a vehicle for the program. Regardless of form, the sequence of steps in the program must be sound, both logically and psychologically. In fact, programmed instruction is based upon psychological principles of learning theory developed by psychologists who specialize in research in the analysis of human behavior, such as Prof. B. F. Skinner of Harvard University and S. D. Pressey of Ohio State University (Emeritus), both of whom are noted for their pioneering contributions in this field.

In administering programmed instruction, practical differences come into sharp focus between the use of a program in machine form in contrast with text form. Generally, machines provide better initial motivation, and they remove the trainee from the age-old textbook relationship with its uncontrolled methodologies. They can prevent unauthorized re-reading of previous frames and provide greater control of behavior during the learning experience. Since the learner cannot see how much paper or film is in the machine, there is less traumatism when starting a very long program. However, machines are subject to mechanical difficulties, they are not as easily transported and stored, and the more versatile ones are rather expensive to procure and maintain.

Advantages and Disadvantages of Programmed Instruction

Advantages of using programmed instruction include:

1. More flexible scheduling. Since there is no group instruction, absences do not create gaps in the learner's knowledge or understanding, and lessons do not need to be "made up." Interruptions or distractions, while never desirable, are not disastrous. A trainee can start a course at almost any time and finish it without regard for the progress of other trainees.
2. More trainee participation. *All* of the work is performed by the learner either overtly or covertly.
3. Provides for differing rates of learning. The fast learner is not held back; the slow learner is not left behind.
4. More uniform levels of achievement. The slow learner can achieve at a higher level. The difference is in time expended rather than in the amount learned.
5. Increase in achievement.
6. Saving of time for most learners. Better use is made of time.
7. More uniform quality of course. Conventional courses encompassing identical subject-matter tend to vary considerably when presented by different instructors and to different classes.
8. Better instruction than in the case where an instructor is not sufficiently knowledgeable in a particular subject-matter.
9. Instructor is freed for other and more creative tasks. However, someone, usually the instructor, must administer the programmed instruction and perhaps prepare it.

However, programmed instruction also has its drawbacks. The preparation of programmed materials is generally more expensive than conventional training materials. Besides the higher cost of the physical materials themselves, preparation time is longer and special training is required for the personnel who analyze and develop programmed courses. Due to time, cost, and limitations on personnel who are able to create programmed materials, it is usually not feasible to prepare custom-designed courses unless commercial "off-the-shelf" programs are not available which meet the specific requirements and satisfy the course objectives. Thus, one often selects, from "off-the-shelf" programs, those which are most suitable. However, even when these available programs are purchased, the price is invariably higher than for ordinary textbooks, and, in addition, the materials often may not be reusable by other trainees.

Another factor which must be taken into consideration, especially in the computing field since it is subject to frequent changes, is the effect of rapid obsolescence. By the time a good programmed text is written, tried out, and revised, and the cycle repeated until it is finally acceptable, the subject-matter content may be obsolete or it may require further revision due to technical changes. Programmed instruction is therefore best suited to those areas which are least likely to change.

Thus, a great deal of trade-off judgment should be exercised when deciding to develop a programmed course and when choosing and evaluating commercially available programmed instructional materials.

Assessing Programmed Instruction Materials

How should programmed materials be assessed? What criteria should be used to evaluate these materials? For answers to these questions, the reader is referred to Part III, "Quality Control for Programmed Learning Materials," of the earlier article in **Computers and Automation** (Reference 1) and to the references given there. Reference 4 is more suitable for assessing educational programs, while Reference 5 is intended for the quality control of training programs in business, industry and government.

Part II

PROGRAMMED MATERIALS CURRENTLY AVAILABLE FOR COMPUTER PROGRAMMING

The list which follows of programmed materials and of "so-called" programmed materials in computer programming is not exhaustive: company and school materials not generally available outside the organization have not been included, nor have those still in the development stage. Those which are currently available and which the writer and the reader could actually obtain or examine are described here. They are categorized by computer language, starting with FORTRAN, then COBOL, followed by an assortment of other actual languages. Finally there are fictional languages and general data processing which may be considered to be language-independent.

FORTRAN

1. Title: "FORTRAN AUTOTESTER"
   Author: Control Data Corp. Staff
   Publisher: Control Data Corporation
   Date Published: 1961
   Price: See John Wiley and Sons Edition
   Physical Form: Text, loose-leaf, 3½" x 6", 176 pages +, 176 steps
   Type or Mode: Combination of multiple-choice with branching, constructed responses which are linear, and no response steps. The multiple-choice responses tend to provide only two branches. Constructed responses include program writing. The majority of steps do not require *any* response to be made by the learner.
   Expendability: Responses made separately; may be reused indefinitely.
   Criterion Test: There are occasional quizzes and a final set of problems to be solved.
   Criteria Rating: Satisfies the criteria for programmed instruction with the following reservation: Individual steps or sequences of steps often provide too many teaching points before response is required and feedback is given.
   Content/Behavioral Objectives: The preface states that "This short course is an attempt to give to the scientist and engineer, *sufficient* skill, in a *minimum* of time, to enable him to *efficiently* program his own problems."
   Evidence Rating: No evidence that program was debugged prior to publication. Conditions of validation not published.
   Remarks: For further comments, see previous review (Reference 1).

2. Title: "FORTRAN AUTOTESTER"
   Author: Robert E. Smith and Dora E. Johnson
   Publisher: John Wiley and Sons
   Date Published: 1962
   Price: $2.95
   Physical Form: Text, Paperbound, 3½" x 6", 176 pages +, 176 steps
   Remarks: This text differs from "FORTRAN AUTOTESTER" published by Control Data Corporation only in cover, title page and binding.

3. Title: "COMPUTER LANGUAGE—An Autoinstructional Introduction to FORTRAN"
   Author: Harry L. Colman and Clarence Smallwood
   Publisher: McGraw-Hill Book Company, Inc.
   Date Published: 1962
   Price: $4.50 soft cover; $5.95 cloth
   Physical Form: Text, plastic-bound, 6" x 9", 196 + xiv pages + coding forms
   Type or Mode: "No-response" mode and exercises requiring written-completion.
   Expendability: Only the coding forms in the rear constitute expendable materials; the other few written responses called for may be written externally to the text.
   Criterion Test: Each of the eight parts has a set of exer-

cises which are very much like problems at the end of a chapter of a standard college text. There is no post-test.

Criteria Rating: The "no-response" mode used throughout the text does not satisfy the criteria of (a) participating, overt interaction between the learner and the program, and (b) immediate knowledge of progress using feedback.

Content/Behavioral Objectives: The Preface states that this text is helpful "to those who wish merely to acquaint themselves with the rudiments in Fortran programming. It should be useful to managers and administrators who need a basic acquaintance with the concepts and terminology of computer programming and to high school and college students in mathematics, statistics, engineering and business administration."

Evidence Rating: The authors state that "Early drafts underwent informal trials, which resulted in extensive revisions and retrials." Conditions of validation not published.

Remarks: For further comments, see previous review (Reference 1).

4. Title: "FORTRAN: Programmed Instruction Course"

Author: IBM Staff

Publisher: International Business Machines Corporation

Date Published: 1963

Physical Form: Text, soft-covered, saddle-stitched, 8½" x 11", series of booklets: Chapter 1 (38 pages +, 184 steps), Chapter 2 (41 pages, 185 steps), Chapter 3 (53 pages, 233 steps), Chapter 4 (50 pages, 214 steps), Illustrations (plastic-bound, 33 pages), Problem Book (46 pages), Advisor Guide

Type or Mode: Written-completion using constructed responses, mainly single-word and problem solution, with some multiple-choice and simple branching.

Expendability: Written responses are made into the four Chapter booklets and the Problem Book; all are expendable.

Criterion Test: Problem Book contains periodic exercises and end-of-chapter examinations. Trainee is directed to contact Advisor for post-test.

Criteria Rating: Satisfies criteria as a written-completion program.

Content/Behavioral Objectives: The preface states that "the objective of the course is to provide the knowledge and some of the skills required to *write* computer programs using the FORTRAN system; . . . " According to the Foreword, "no previous experience with any kind of programming system is assumed."

Evidence Rating: There is evidence that the course has been tried out extensively and revised. See McGraw-Hill Book Company edition.

Remarks: This version is nearly identical with the 3rd edition, 1962, entitled "Self-Teaching FORTRAN," by S. C. Plumb. It contains only a few minor changes and corrections, and differs mainly in physical form of text, step format and location of exercises and examinations. For further comments on the 3rd edition, see previous review (Reference 1).

5. Title: "INTRODUCTION TO FORTRAN: A Program for Self-Instruction"

Author: Stephen C. Plumb

Publisher: McGraw-Hill Book Company

Date Published: 1964

Price: $5.50

Physical Form: Text, hard-covered, stitch-bound, 6" x 9", 203 + ix pages, 775 steps

Type or Mode: Written-completion using constructed responses, mainly single-word and problem solution, with some multiple-choice and simple branching.

Expendability: The student is directed to make his written responses either in the book or on separate sheets of paper.

Criterion Test: The text contains periodic exercises, end-of-part examinations and a post-test.

Criteria Rating: Satisfies criteria as a written-completion program.

Content/Behavioral Objectives: The preface states that "the objective of the course is to provide the knowledge and some of the skills required to *write* computer programs using the FORTRAN system; . . . Fortran is introduced here at a very elementary level; no prior experience in computer programming is necessary . . . reader is (presumed) familiar at least with high school algebra. . . . "

Evidence Rating: The publisher states that "INTRODUCTION TO FORTRAN has been thoroughly and extensively tested and revised at IBM. The test group averaged sixteen hours for the completion of the program and exercises, and achieved an average score of 90% on the accompanying examinations." Complete conditions of validation not published.

Remarks: This version is nearly identical with the 1962 3rd edition, "Self-Teaching FORTRAN" and the 1963 edition, "FORTRAN: Programmed Instruction Course." It contains only some minor changes and corrections, and it differs mainly in physical form of text, step format and location of exercises and examinations. For further comments on the 3rd edition, see previous review (Reference 1).

6. Title: "AUTO-PRIMER IN COMPUTER PROGRAMMING for the IBM 1620 in FORTRAN"

Author: Doris R. Entwisle

Publisher: Blaisdell Publishing Company

Date Published: 1963

Price: $6.50

Physical Form: Text, soft-covered, plastic-bound, 8½" x 11", 345 + x pages

Type or Mode: Text-workbook in which textual information is presented and followed by a set of exercises. The exercise sets are essentially "self-tests" rather than responses to programmed steps. Feedback is provided after the complete set is answered. The text portion may consist of a single paragraph or several pages, after which responses are required in an exercise set; there are no programmed steps.

Expendability: Written responses are made directly into the text; it is expendable.

Criterion Test: During tryout, the author utilized a post-test in the form of a problem to be programmed and run on a computer. A post-test is *not* included in the text-workbook.

Criteria Rating: Does not satisfy the criteria for programmed instruction, particularly the criterion that instruction be presented in small incremental steps requiring frequent responses by the learner. It is, however, a good example of a *validated* text-workbook.

Content/Behavioral Objectives: The author states that "this text is designed to teach you how to write programs for the IBM 1620 computer . . . in a language called FORTRAN. . . . Many of the skills . . . can be . . . transferred to other . . . computers with FORTRAN compilers . . . especially to the IBM 7090, 7094, and 1401. . . . It is assumed that you have had no experience whatsoever with computers." As a result of the author's effort to simplify, the learner receives some misconceptions about programming and the computer.

Evidence Rating: A preliminary version was tried out with 85 undergraduate electrical engineering students and with 22 graduate industrial engineering students. Revisions and additions were made as a result of the tryout analyses. Additional material was added to cover changes in the FORTRAN compiler; these constitute less than ten percent. The final edition has not been empirically tested.

COBOL

7. Title: "REQUIRED COBOL—1961: A Self-Instructional Program"

Author: Auerbach Corporation Staff

Publisher: Basic Systems, Inc.

Date Published: 1963

Price: $90.00 per copy for 1 to 10 copies

Physical Form: Text, four volumes, soft-covered, plastic-bound, 8½" x 11", 990 pages, 3,900 frames; plus a Student Manual (250 pages) and a vinyl binder-portfolio with a sliding mask to conceal and reveal feedback and reinforcement frames.

Type or Mode: Written- and oral-completion using constructed responses, with some multiple-choice. There is some branching, permitting the student with prior knowledge to skip over material believed to be already mastered. However, the program is essentially linear.

Expendability: Written responses are made directly into all four volumes and student manual; all are expendable.

Criterion Test: Frequent "Sneaky Pete," "Swiss Cheese" and "Review Practice/Quiz" frames constitute criterion tests for each set. Each group of sets, or volume, has an interim exam which is a self-test. A post-test consists of a large-scale problem plus procedural questions.

Criteria Rating: Satisfies criteria for a written-completion program.

Content/Behavioral Objectives: To prepare computer source programs in Required COBOL—1961; to learn, practice and review every feature of Required COBOL —1961. It is intended both for trainees having no knowledge of data-processing and for programmers and systems analysts relatively sophisticated in this area.

Evidence Rating: Two separate validations were conducted in which 24 trainees completed the try-out materials. Half of these trainees obtained grades of 90% or better on the post-test, while the other twelve obtained grades ranging from 89 to below 50. The average grade was 84%, and the average completion time was 62 hours.

8. Title: "COBOL: A Self-Instructional Manual"

Author: James A. Saxon
Publisher: Prentice-Hall, Inc.
Date Published: 1963
Price: $6.50
Physical Form: Text, soft-covered, bound, 8½" x 11", 190 + xi pages

Type or Mode: Text-workbook in which a series of short, complete lessons is presented. Each lesson contains about two pages of text material and examples, followed by a set of problems. The problem sets are essentially "self-tests," *not* responses to programmed steps. The correct answers, together with remarks, are provided after each complete problem set. There are 34 lessons, grouped into 13 units.

Expendability: Written responses are made directly into the text; it is expendable.

Criterion Test: Quizzes which are also self-tests constitute criterion tests for each unit. A final quiz and a final problem to be programmed together constitute the post-test.

Criteria Rating: Does not satisfy the criteria for programmed instruction, particularly the criterion that instruction be presented in small incremental steps requiring frequent responses by the learner. It is, however, a very good example of a text-workbook.

Content/Behavioral Objectives: The author states that this text was "developed to teach the beginner the fundamentals of COBOL programming. ... this book will not develop *expert* COBOL programmers. . . . It will teach the basic rules of COBOL. . . . Previous knowledge of computers, data processing or programming is not required. . . ." This text is machine-independent, and refers the learner to manuals for each computer when machine characteristics are involved.

Evidence Rating: No evidence is given in the introductory section nor in an appendix to describe how it was tried out and debugged and the conditions of validation.

9. Title: "A PROGRAMMED TRAINING COURSE IN COBOL"

Author: American Institute for Research, Inc., Staff
Publisher: Burroughs Corporation
Date Published: 1963
Price: $25.00
Physical Form: Text, three volumes, soft-covered, bound, 8½" x 11", 4635 frames, (approximately 1600 pages); plus three EXHIBITS & ANSWERS booklets. Volume 1 contains "Unit One—Basic Level," 1059 frames; accompanied by "Unit One—Exhibits & Answers" booklet. Volume 2 contains "Unit Two—Intermediate Level," 1945 frames; accompanied by "Unit Two—Exhibits & Answers" booklet. Volume 3 contains "Unit Three—Detailed Level," 1631 frames; accompanied by "Unit Three—Exhibits & Answers" booklet.

Type of Mode: Written-completion using single- and multiple-word responses and problem solutions. Linear.

Expendability: Written responses are made directly into all three volumes and three answer booklets; all are expendable.

Criterion Test: At the end of each unit, the learner is stepped through the solution to one or more problems. However, these are not identified to the learner as tests, nor are they criterion or post-tests.

Criteria Rating: Satisfies criteria for a written-completion program.

Content/Behavioral Objectives: The introductory section states that "these materials can teach you to program in COBOL effectively, and to discuss COBOL authoritatively."

Evidence Rating: The introductory section states that "all elements of the text and of the method used in it (were pretested). Repeated trial and revision of the materials with individuals similar to the eventual trainees helped determine . . ." the final material. Program performance data, while not included with the materials, are available on request according to the publisher. The course outline includes Approximate Average Completion Time for each lesson; the average completion time for the complete course is given as 70 hours, 31 minutes. Unit one, which can be used alone as a basic orientation for supervisory and management personnel, requires an average completion time of 13 hours, 30 minutes.

10. Title: "PROGRAMMED INSTRUCTION TEXT for BURROUGHS B 200 COMPACT COBOL"

Author: Programmed Instruction Group, Sales Education, Equipment and Systems Marketing Division, Burroughs Corporation
Publisher: Burroughs Corporation
Date Published: 1964
Physical Form: Text, soft-covered, bound, 8½" x 11", about 766 + viii pages, 1742 frames

Type or Mode: Written-completion using constructed single- and multiple-word responses, with some program writing. There is some branching, consisting of skipping over review material if the quizzes are answered correctly. Since there is no remedial branching, the text is essentially linear. It is a departure from the traditional sequence of frames in that each of the 66 lessons begins with a "study page"—about a page of information to be studied which does not call for any responses. This is followed by two or three sets of about ten frames covering the study material. The trainee responds to a page of frames, then receives feedback and checks his answers. This pattern has most of the characteristics of a text-workbook combined with some characteristics of programmed instruction.

Expendability: Written responses are made directly into the text; it is expendable.

Criterion Test: The text contains two quizzes which are self-tests spaced at appropriate intervals in the course and a final problem at the end. The final problem is structured to provide a good deal of assistance, including flow charts. The trainee is taken through the problem step-by-step, receiving feedback, and is instructed to check his entries before going on. This final problem is not a post-test.

Criteria Rating: Satisfies most of the criteria for a written-completion program. However, (1) the stimulus (instructional material) in a step contains a very large number of teaching points before any overt or covert responses are called for, and (2) the feedback is not given immediately after each frame: the trainee must respond to between one and eleven frames before receiving any feedback whatsoever.

Content/Behavioral Objectives: The introductory section states that "you will learn all the elements of the COMPACT language, and be able to apply this language to the writing of efficient and effective programs. . . . When this text has been completed, you will have written portions of programs and one complete program . . . After completing this course you will have a good knowledge of the skills needed to create and write fairly complex COMPACT programs for the BURROUGHS B 200 Series Systems. However, the text is intended to provide only a foundation for writing programs, and you will gain more knowledge and understanding of the programming techniques commensurate with the language as you write and run your own COMPACT programs."

The introductory section states that "this text has been designed and written for the individual who has a knowledge of the BURROUGHS B 200 Series Systems, with machine language and automatic language programming experience . . . however, anyone with a basic orientation in computers (should have) little or no difficulty. . . ."

Evidence Rating: No evidence was given in the introductory section nor in an appendix to describe how it was tried out and debugged and the conditions of validation. However, the Table of Contents includes Average Time in Minutes for each lesson and indicates that the average completion time for the entire text, including the final problem is 44 hours, 10 minutes.

OTHER ACTUAL LANGUAGES

11. Title: "PROGRAMMING THE IBM 1401: A Self-Instructional Programmed Manual"

Author: James A. Saxon and William S. Plette
Publisher: Prentice-Hall, Inc.

Date Published: 1962
Price: $9.25
Physical Form: Text, hard-covered, stitch-bound, 6" x 9", 208 + xv pages
Type or Mode: Text-workbook in which a series of short, complete lessons is presented. Each lesson contains about two pages of text material and examples, followed by a set of problems. The problem sets are essentially "self-tests," *not* responses to programmed steps. Correct answers and reinforcing explanatory information are provided after each complete problem set. There are 42 lessons, grouped into ten units.
Expendability: Written responses are made directly into the text; it is expendable.
Criterion Test: Quizzes which are also self-tests constitute criterion tests for each unit. The final lesson consists of a final problem which, together with the final quiz, represent the post-test.
Criteria Rating: Does not satisfy the criteria for programmed instruction, particularly the criterion that instruction be presented in small incremental steps requiring frequent responses by the learner. It is, however, a very good example of a text-workbook.
Content/Behavioral Objectives: The introduction states that this "workbook has been developed to teach the beginner to *program* for the IBM 1401 computer. . . . this workbook will not qualify the student as an *expert* programmer. It will teach him the fundamentals of programming for the IBM 1401."
Evidence Rating: No evidence is given in the introductory section nor in an appendix to describe how it was tried out and debugged and the conditions of validation.
Remarks: For further comments, see previous review (Reference 1).

12. Title: "BASIC 1401 PROGRAMMING: Programmed Instruction Course"
Author: IBM Staff
Publisher: International Business Machines Corporation, Data Processing Division.
Date Published: 1963
Physical Form: Text, loose-leaf form, 8½" x 11". Trainee materials: Volume 1 (311 frames), Volume 2 (592 frames), Volume 3 (377 frames), + Student Materials (Notes, Reference Manuals and Supplies such as template, worksheets and coding sheets). Administration materials: Advisor Guide, Instructor Guide, Case Studies, Intermediate Examinations, Final Examination.
Type or Mode: Combination of mental- and written-completion using single- and multiple-word responses and problem solution including flow charting. Incorrect quiz answers direct the trainee to branch back to specified frames. Some permissive skipping ahead to the next quiz is allowed for areas with which the trainee is already completely familiar. Essentially linear with some branching.
Expendability: Student materials constitute the only expendable portion. Since, where written responses are required, the trainee is directed by the text to use student materials or scratch paper, all other materials are reusable.
Criterion Test: Quizzes, which are self-tests, are spaced throughout the course. Four intermediate examinations are administered and scored by the trainee's Advisor.
Criteria Rating: Satisfies the criteria for programmed instruction except that much of the interaction is covert rather than overt.
Content/Behavioral Objectives: The Course Description states that the student will be able to:

"1. Read and understand flowcharts for typical 1401 Programs developed by programmers.
2. Develop his own flowcharts from specifications contained in the problem statements no more complex than the Case Studies.
3. Write symbolic program instructions on SPS coding sheets for steps and routines shown in flowcharts.
4. Describe the functions performed by 1401 Components required in the Case Study problems.
5. Define technical terms and apply concepts that deal with basic fundamentals of 1401 programming beyond those covered by the Case Studies."

The trainee prerequisites are: "High School graduate . . . and a score of C or better on the Programmer's Aptitude Test."
Evidence Rating: No evidence is given in any of the materials to describe how it was tried out and debugged and the conditions of validation. However, the following average time requirements are furnished: Volume 1, 3 hours; Volume 2, 9 hours; Volume 3, 15 hours.
Remarks: There is a trainee-Advisor relationship throughout the course. The trainee receives the Student Materials and one volume from his Advisor and must complete it satisfactorily before receiving the next volume. The Advisor provides supplemental assistance, personal follow-up, supervision and evaluation. The programmed instruction is followed by three days on Case Study problems in a classroom environment with a human instructor, at the end of which a post-test is administered.

13. Title: "1401 DPS BASIC PROGRAMMING—AUTOCODER: Programmed Instruction Course" (N 0050)
Author: IBM Staff
Publisher: International Business Machines Corporation, Data Processing Division
Date Published: 1964
Physical Form: Text, loose-leaf form, 8½" x 11". Trainee materials: Volume 1 (202 pages, 320 frames), Volume 2 (341 pages, 627 frames), Volume 3 (247 pages, 398 frames), Volume 4 (121 pages, 252 frames), + Student Materials (Notes, Reference Manual, Problem Statements, and Supplies such as template, worksheets, and coding sheets). Administration materials: Advisor Guide (39 pages), Instructor Guide (127 pages), Case Study and Practice Problems (27 pages), Intermediate Examinations (24 pages), Final Examination (12 pages).
Type or Mode: Combination of mental- and written-completion using single- and multiple-word responses and problem solution, including flow charting. Incorrect quiz answers direct the trainee to branch back to specified frames. Some permissive skipping ahead to the next quiz is allowed for areas with which the trainee is already completely familiar. Essentially linear with some branching.
Expendability: Student Materials constitute the only expendable portion. Since, where written responses are required, the trainee is directed by the text to use student materials or scratch paper, all other materials are reusable.
Criterion Test: 29 quizzes, which are self-tests, are spaced throughout the course. Four intermediate examinations are administered and scored by the trainee's Advisor; poor scores result in an oral examination by the Advisor. The post-test, consisting of a Case Study problem, is administered in a classroom environment.
Criteria Rating: Satisfies the criteria for programmed instruction except that much of the interaction is covert rather than overt.
Content/Behavioral Objectives: The Course Description states that the student will be able to:

"1. Read and understand flowcharts for typical 1401 Programs developed by programmers.
2. Develop his own flowcharts from specifications contained in problem statements that are no more difficult than the Case Study.
3. Write symbolic program instructions on Autocoder coding sheets for steps and routines shown in flowcharts.
4. Describe the functions performed by 1401 Components required in the Case Study problem.
5. Define technical terms and apply concepts that deal with basic fundamentals of 1401 programming beyond those covered by the Case Study."

The trainee prerequisites are: "High School graduate . . . and a score of C or better on the Programmer's Aptitude Test."
Evidence Rating: No evidence is given in any of the materials to describe how it was tried out and debugged and the conditions of validation. However, the following average time requirements are furnished: Volume 1, 5 hours; Volume 2, 8 hours; Volume 3, 11 hours; and Volume 4, 12 hours; for a total of 36 hours.
Remarks: There is a trainee-Advisor relationship throughout the course. The trainee receives the Student Materials and one volume from his Advisor and must complete it satisfactorily before receiving the next volume. The Advisor provides supplemental assistance, personal follow-up, supervision and evaluation. The programmed instruction is followed by four hours of work on a Case Study in a classroom environment with an

Instructor. The Case Study problem is then normally followed by Course N 0055, a 6½ day continuation of this course given by a human instructor in non-programmed form in a classroom environment. Lesson plans for this portion are included in the Instructor Guide. The Final Examination is administered on the last day of the human instruction portion of the course.

14. Title: "PROGRAMMING THE IBM 7090: A Self-Instructional Programmed Manual"
Author: James A. Saxon
Publisher: Prentice-Hall, Inc.
Date Published: 1963
Price: $9.25
Physical Form: Text, hard-covered, stitch-bound, 6" x 9", 210 + xiv pages
Type or Mode: Text-workbook in which a series of fifteen lessons is presented. Each lesson contains from ½ to 12 pages of continuous textual material with examples, followed by a set of one or more problems. The problem sets are essentially "self-tests," *not* responses to programmed steps. Correct answers and reinforcing explanatory information are provided after each page of problems. Most lessons contain several such sequences of text material, examples, problems and answers.
Expendability: Written responses are made directly into the text; it is expendable.
Criterion Test: There is a self-test midway in the course and a post-test at the end.
Criteria Rating: Does not satisfy the criteria for programmed instruction, particularly the criterion that instruction be presented in small incremental steps requiring frequent responses by the learner.
Content/Behavioral Objectives: The author states that this text is designed to teach the reader with no previous training in data processing or computer programming "to *program* for the IBM 7090 computer."
Evidence Rating: No evidence is given in the introductory section nor in an appendix to describe how it was tried out and debugged and the conditions of validation.

15. Title: "INTRODUCTION TO THE HONEYWELL 200: A Programmed Text"
Author: Kenneth L. Inman and John E. Harrah
Publisher: Honeywell, Inc., Electronic Data Processing Division
Date Published: 1964
Price: $4.50
Physical Form: Text, soft-covered, bound, 8½" x 11", 282 + vi pages, about 540 frames
Type or Mode: Written-completion using constructed single- and multiple-word and graphic flow chart responses. Linear. The text is divided into seven lessons; most begin with a page of non-programmed narrative and graphic information before the teaching frames.
Expendability: Written responses are made directly into the text; it is expendable.
Criterion Test: Each of the seven lessons is followed by a quiz which is a self-test. There is no post-test at the end of the course.
Criteria Rating: Satisfies criteria for a written-completion program.
Content/Behavioral Objectives: The authors state that this "is a basic introduction to the Honeywell 200 System intended for the reader with little or no previous experience in electronic data processing. The preliminary focus is on general concepts and data processing principles.
Evidence Rating: No evidence was given in the introductory section nor in an appendix to describe how it was tried out and debugged and the conditions of validation.

16. Title: "TRANSITION TO EASYCODER: A Programmed Text"
Author: John E. Harrah and Harris J. Hulburt
Publisher: Honeywell, Inc., Electronic Data Processing Division
Date Published: 1964
Price: $4.50
Physical Form: Text, soft-covered, bound, 8½" x 11", 304 + vi pages
Type or Mode: The text is divided into eight lessons. Most employ the written-completion mode using constructed single- and multiple-word responses and problem solution. Occasionally there are from one to three pages of text material and figures between the programmed portions. Lesson II, however, is in the form of a text-workbook. It contains ten pages of high density text material containing complex charts and diagrams crowded with information. Interspersed are three pages of statements requiring written-completion for which the reader is instructed to refer to the charts and diagrams to obtain the information called for. There is no feedback to inform the trainee of the correctness of his response. The text is essentially linear; some branching is permitted to skip over options not included in the programmer's installation.
Expendability: Written responses are made directly into the text; it is expendable.
Criterion Test: There is no post-test nor any self-tests.
Criteria Rating: In general, satisfies the criteria for a written-completion program, but a number of aberrations exist. Lesson II does not satisfy the criteria for programmed instruction. Also, in the other lessons most steps contain too many teaching points. Diagrams often are unnecessarily complex. In many instances, instruction is given in the feedback area which should be presented in the stimulus area of the next step.
Content/Behavioral Objectives: In the Foreword, the authors state: "the intent of this manual is to introduce Easycoder language, provide familiarization with Honeywell 200 computer capabilities, describe programming procedures, and define Honeywell terminology." 1401 system programming is a prerequisite.
Evidence Rating: No evidence was given in the introductory section nor in an appendix to describe how it was tried out and debugged and the conditions of validation.

17. Title: "PROGRAMMING AND WIRING THE UNIVAC 1004 CARD PROCESSOR: A Self-Instructional Programmed Manual"
Author: James A. Saxon and Richard W. Senseman
Publisher: Prentice-Hall, Inc.
Date Published: 1964
Price: $7.00
Physical Form: Text, soft-covered, bound, 8½" x 11", 255 + xvi pages
Type or Mode: Text-workbook in which a series of short lessons is presented. Most lessons contain less than a page of text material and examples, followed by a set of problems. Some lessons contain slightly more information or longer examples. The problem sets are essentially "self-tests," *not* responses to programmed steps. The correct answers, together with reinforcing explanatory information, are provided after each complete problem set. There are 75 lessons, grouped into 17 units.
Expendability: Written responses are made directly into the text; it is expendable.
Criterion Test: Each unit ends with a short quiz which is a unit self-test. In addition, there is a course self-test at the midpoint. A final problem to be programmed constitutes the post-test.
Criteria Rating: Does not satisfy the criteria for programmed instruction, particularly the criterion that instruction be presented in small incremental steps requiring frequent responses by the learner. It is, however, an excellent example of a text-workbook.
Content/Behavioral Objectives: The authors state that this text is designed to teach "the basics of programming and wiring the UNIVAC 1004 Card Processor. No computer, data processing or mathematical background is necessary."
Evidence Rating: No evidence is given in the introductory section nor in an appendix to describe how it was tried out and debugged and the conditions of validation.

18. Title: "1004 CARD PROCESSOR, 80-Column: Programmed Instruction"
Author: Basic Systems Incorporated, Programming Staff
Publisher: UNIVAC Education Department, UNIVAC Division of Sperry Rand Corporation
Date Published: 1963
Price: $18.00
Physical Form: Text, five volumes, soft-covered, bound, 8½" x 11", 1621 frames; plus two Panel Books and a vinyl binder-portfolio with a sliding mask to conceal and reveal feedback and reinforcement frames.
Type or Mode: Written-completion using single- and multiple-word constructed responses and problem solution. There is some branching to permit skipping over optional material. However, the program is essentially linear.
Expendability: Written responses are made on scratch paper and separate forms such as instruction charts, storage charts and connection panel diagrams. The

five volumes and two panel books are reusable.
Criterion Test: There is no post-test included nor any self-tests.
Criteria Rating: Satisfies criteria for written-completion program.
Content/Behavioral Objectives: The introduction states that this is a text "on how to program the UNIVAC 1004 Card Processor."
Evidence Rating: No evidence is given in the five volumes or two panel books to describe how it was tried out and debugged and the conditions of validation.

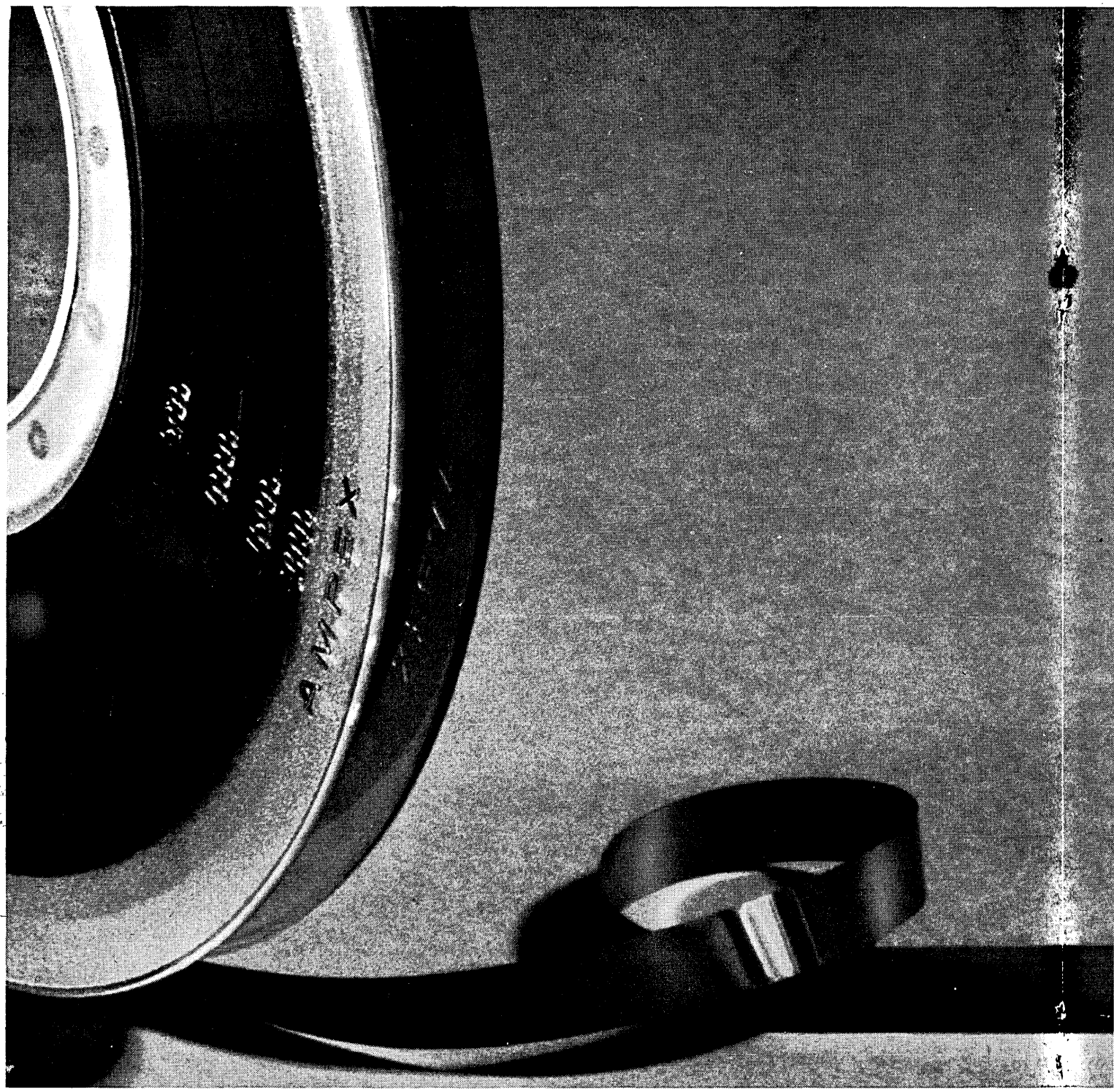
GENERAL PROGRAMMING

19. Title: "COMPUTERS: A Four-Part Course in Programming" (TutorFilm)
Author: Theodore G. Scott
Producer: U. S. Industries, Inc., Educational Science Division
Date Produced: 1962, Rev. 1963
Price: Program (4 reels) $375.00; may be rented. Machine (AutoTutor Mark II) $1250.00; may be rented.
Physical Form: 35 mm single frame filmstrip, black and white, for use in AutoTutor Mark II teaching machine. 4 reels:
Reel 1: Part I — A First Course in Programming
Reel 2: Part II — Techniques in Programming
Reel 3: Part III — Advanced Techniques in Programming
Reel 4: Part IV — Business and Scientific Applications
Administrative Materials: Instructor's Guide (4 pages), Table of Contents and Course Outline (24 pages)
Type or Mode: Multiple-choice branching, using push button to select one of several alternatives, causing corresponding next step to be projected on optical screen. Each of the four parts is divided into five lessons.
Expendability: Since scratch paper is used for taking notes and working problems, and the trainee's response consists of pushing buttons, the program is reusable.
Criterion Test: Each lesson concludes with a self-test, and incorrect responses result in branching to repeat or remedial instruction. Each part has a final examination which is a post-test. Part IV has two post-tests, one for business applications and one for scientific applications.
Criteria Rating: A multiple-choice branching program, satisfying the criteria for programmed instruction.
Content/Behavioral Objectives: An introductory frame states that by "programming an imaginary machine that is a simplified version of a typical digital computer . . . You will learn how to write instructions, how to get numbers and instructions into the memory, and how to get answers out. You will also learn several important programming techniques." The Instructor's Guide states that the course "assumes no prior knowledge of computers by the student. All he needs is basic arithmetic."
Evidence Rating: The Instructor's Guide states that "The preliminary version of this TutoFilm program was tested with business school student . . . Corporation employees . . . College sophomores and . . . high school seniors." Tryout data and conditions of validation not given. Study times of 5 to 12 hours each for Parts I and II, and 6 to 14 hours each for Parts III and IV, are reported.
Remarks: For further comments, see previous review (Reference 1).

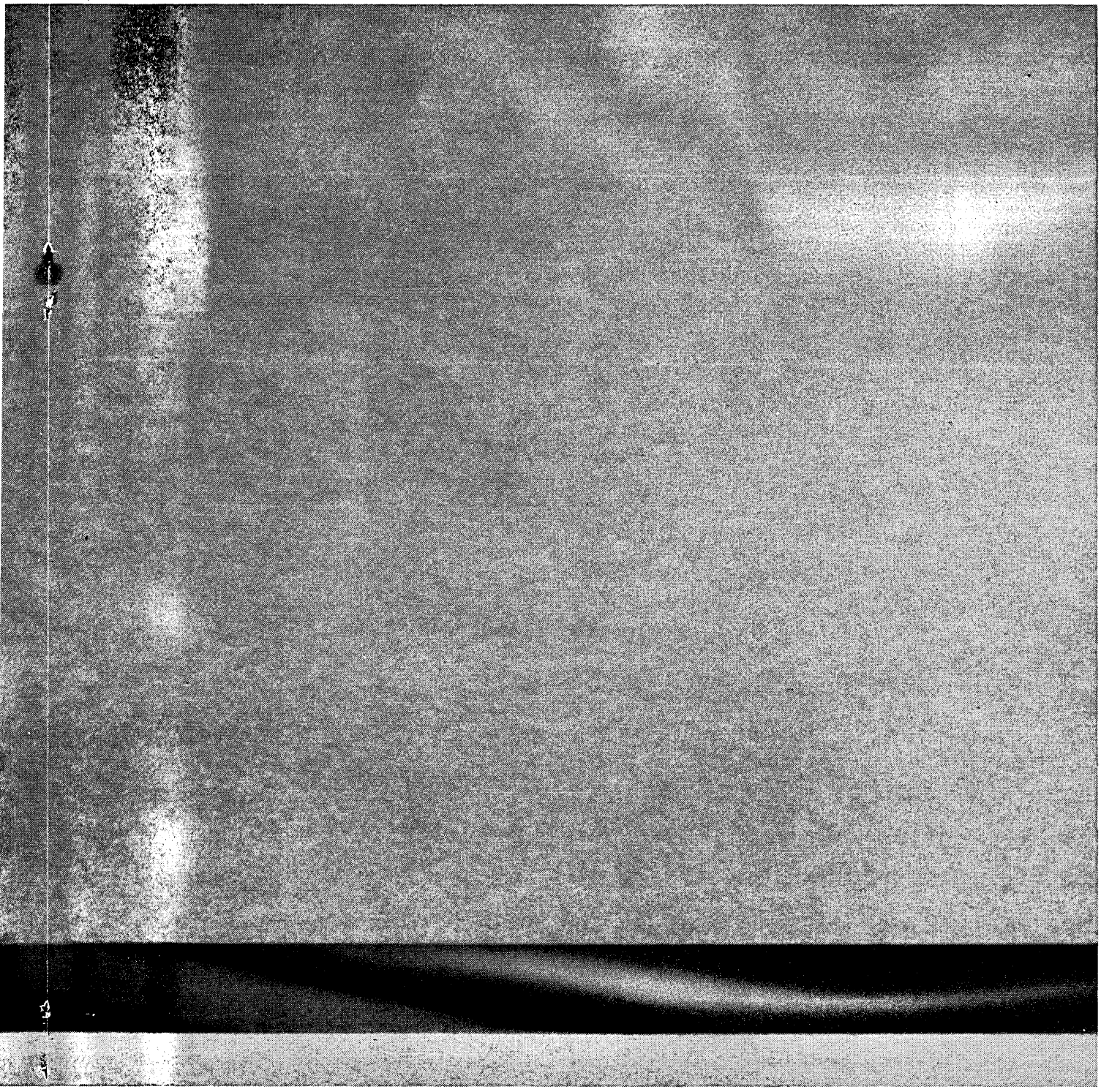
20. Title: "BASIC COMPUTER PROGRAMMING" (TutorText)
Author: Theodore G. Scott
Publisher: Doubleday & Company, Inc.
Date Published: 1962
Price: $5.95
Physical Form: Text, hard-covered, stitch-bound, 492 + x pages. A ribbon book-mark is attached to the binding of this TutorText.
Type or Mode: Multiple-choice branching, using the scrambled text technique. Each step begins with a restatement of the trainee's answer to the previous step and whether it is correct or incorrect. If incorrect, remedial instruction is given and then the trainee is directed to return to the previous step and try again. If correct, reinforcing explanatory information is given, followed by new material and then by a set multiple-choice alternatives. The multiple-choice steps contain two, three or four alternatives, with most containing three.
Expendability: Since scratch paper is used for taking notes and working problems, and the trainee's response consists of turning to the page indicated next to his selection, the text is reusable.
Criterion Test: Ten chapters each conclude with a self-test. These are the only criterion tests; there is no post-test.
Criteria Rating: A multiple-choice branching program, satisfying the criteria for programmed instruction.
Content/Behavioral Objectives: The introduction states that "This book is devoted to the programming of a hypothetical machine . . . You will learn how to write instructions, how to get numbers and instructions into the memory, and how to get answers out. You will also learn techniques . . . useful . . . with computers."
Evidence Rating: No evidence is given in the introductory section nor in an appendix to describe how it was tried out and debugged and the conditions of validation.
Remarks: The titles of Chapters I through X of this text are the same as the titles of Lessons I through X of the first two reels of the TutorFilm "COMPUTERS: A Four-Part Course in Programming."

21. Title: "COMPUTER PROGRAMMING TECHNIQUES" (TutorText)
Author: Theodore G. Scott
Publisher: Doubleday & Company, Inc.
Date Published: 1964
Price: $7.95
Physical Form: Text, hard-covered, stitch-bound, 664 + viii pages. A ribbon book-mark is attached to the binding of this TutorText.
Type or Mode: Chapter I is a review of "BASIC COMPUTER PROGRAMMING" and is in non-programmed text form. Chapters II through XIII are programmed, in multiple-choice branching mode, using the scrambled text technique, same as that previously described for "BASIC COMPUTER PROGRAMMING."
Expendability: Since the trainee's response consists of turning to the page indicated next to his selection, the text is reusable.
Criterion Test: Chapter II through XIII each conclude with a self-test. These are the only criterion tests; there is no post-test.
Criteria Rating: Except for Chapter I, it is a multiple-choice branching program, satisfying the criteria for programmed instruction.
Content/Behavioral Objectives: The introduction states that "This book tells you how these programs are prepared and how they are used by computers to perform calculations. This book describes many important programming techniques and some devices . . . will learn how problems are approached for programming and what types of problems are most suitable for computer solution."
Evidence Rating: No evidence is given in the introductory section nor in an appendix to describe how it was tried out and debugged and the conditions of validation.
Remarks: The introduction states that "BASIC COMPUTER PROGRAMMING, which preceded this volume . . . is, in a sense, a companion book."

22. Title: "FUNDAMENTALS OF ELECTRONIC DATA PROCESSING: A Programmed Text"
Author: Kenneth L. Inman
Publisher: Minneapolis-Honeywell Regulator Company, Electronic Data Processing Division
Date Published: 1963
Price: $4.50
Physical Form: Text; soft-covered, bound, 8½" x 11", 282 + vi pages, about 575 frames
Type or Mode: Written-completion using constructed single- and multiple-word and graphic flow chart responses. Linear.
Expendability: Written responses are made directly into the text; it is expendable.
Criterion Test: Only the first two of the seven lessons are followed by quizzes which are self-tests. There are no other tests and no post-test.
Criteria Rating: Satisfies criteria for a written-completion program.
Content/Behavioral Objectives: The Foreword states that "this manual is a basic introduction to electronic data processing intended for the reader with little or no previous training in the field. The focus throughout is on general concepts . . . the purpose is to illustrate general principles. . . ."
Evidence Rating: No evidence is given in the introductory section nor in an appendix to describe how it was tried out and debugged and the conditions of validation.



Two entirely new, long-wear, heavy-duty Ampex computer tapes are now available. The two (Ampex 838 for 800 bpi applications and 832 for 556 bpi applications) are the result of an intensive 2 year development program. Using an advanced oxide formulation, these new tapes feature a mirror-smooth surface that consistently gives the cleanest, most reliable performance ever possible. The proof of the new formulation is in the using: no other tape on the market does as much to reduce 'temporary errors' and static build-up. Even the reel is new: IBM compatible configurations are available on solid



Announcing: the most important advance in computer tape in four years.

flanged plastic reels with new aluminum hubs. Who benefits from this remarkable new tape? Anyone who uses IBM (including full width tested), IBM compatible, RCA 301, and most Univac computer systems. Try it. Test it. Use it. We think that you'll agree that the time spent in developing this remarkable new tape was time well spent. For a demonstration, call your Ampex representative, or write the only company providing recorders, tape and core memory devices for every application: Ampex Corp., 401 Broadway, Redwood City, California.

AMPEX

23. Title: "FUNDAMENTALS OF ELECTRONIC DATA PROCESSING: A Programmed Text"
Author: Kenneth L. Inman
Publisher: Prentice-Hall, Inc.
Date Published: 1964
Price: $6.50
Physical Form: Text, soft-covered, bound, 8½" x 11", 282 + vi pages, about 570 frames
Type or Mode: Written-completion using constructed single- and multiple-word and graphic flow chart responses. Linear.
Expendability: Written responses are made directly into the text, it is expendable.
Criterion Test: Only the first two of the seven lessons are followed by quizzes which are self-tests. There are no other tests and no post-test.
Criteria Rating: Satisfies criteria for a written-completion program.
Content/Behavioral Objectives: The Foreword states that "this book is a basic introduction to electronic data processing intended for the reader with little or no previous training in the field . . . the purpose is to explain general principles. . . ."
Evidence Rating: No evidence is given in the introductory section nor in an appendix to describe how it was tried out and debugged and the conditions of validation.
Remarks: Except for Chapter V, this text is essentially the same as "FUNDAMENTALS OF ELECTRONIC DATA PROCESSING" published by Honeywell, with some specific Honeywell references deleted. Lesson V, Flow Charts, has been revised considerably using the new proposed ASA standards. Chapter VII, however, has not been revised to reflect the newer flow chart conventions.

24. Title: "ELECTRONIC DATA PROCESSING SYSTEMS: A Self-Instructional Programmed Manual"
Author: Leeland R. O'Neal
Publisher: Prentice-Hall, Inc.
Date Published: 1964
Price: $10.00
Physical Form: Text, hard-covered, stitch-bound, 6½" x 9", 409 + xi pages.
Type or Mode: Mostly written-completion using constructed single- and multiple-word and graphic flow chart responses and program writing. Near the end of each section, immediately before the self-test, there is a series of diagnostic-type multiple-choice branching steps.
Expendability: Written responses are made directly into the text; it is expendable.
Criterion Test: Each of the six sections concludes with a section self-test. Each section is further subdivided into a series of lessons. Having completed the first lesson in the first section, the trainee begins the second lesson by taking a short lesson pre-test. This lesson pre-self-test is identical with the lesson post-self-test. If the pre-self-test is answered correctly, the trainee is allowed to branch forward to the next lesson pre-self-test. Otherwise, he takes the instruction in the lesson. This skip ahead technique is used for the first four sections, each of which contains two of these lessons. A comprehensive examination at the rear of the text constitutes the post-test.
Criteria Rating: Satisfies criteria for programmed instruction.
Content/Behavioral Objectives: The 31 specific objectives are stated on the introductory pages of each section. These deal with drawing system diagrams, drawing and analyzing flow charts, defining specified terms, analyzing and writing programs, I/O and others.
Evidence Rating: In the Preface, the author states that "the average score on a similar examination (to the post-test) was 92 percent with a range of 77 percent to 100 percent and a standard deviation of 5.6 percent. These statistics were secured from a group of 49 students with high school and technical school backgrounds." He also states that "Some students have completed this course in six hours by taking advantage of the skip feature. Other students have taken thirty hours to complete this course. The average completion time has been approximately 19 hours—not counting the time required for the comprehensive examination." (approximately two hours)

25. Title: "BASIC COMPUTER SYSTEMS PRINCIPLES: Programmed Instruction Course"
Author: IBM Staff
Publisher: International Business Machines Corporation, Data Processing Division
Date Published: 1964
Physical Form: Text, loose-leaf form, 8½" x 11". Trainee materials: Volume 1 (195 pages, 792 frames), Volume 2 (305 pages, 1,057 frames), Volume 3 (272 pages, 1,039 frames), Illustrations (208 pages), and Notebook (71 pages + supplies including template, worksheets and coding sheets). Administration materials: Advisor Guide (32 pages) and Examinations (29 pages).
Type or Mode: Combination of mental- and written-completion using single- and multiple-word and graphic flow charting responses and problem solution. Some permissive skipping ahead is allowed depending on the trainee's previous knowledge.
Expendability: Notebook is the only expendable material and becomes the property of the trainee at the end of the course. Since, where written responses are required, the trainee is directed by the text to use the Notebook or scratch paper, all other materials are reusable.
Criterion Test: Each volume is divided into two sections, and after each section the trainee is directed to contact his Advisor for the section examination which is the section post-test. These tests are scored by the Advisor. There is no course post-test at the end.
Criteria Rating: Satisfies the criteria for programmed instruction except that much of the interaction is covert rather than overt.
Content/Behavioral Objectives: The Course Description states that the student will be able to:

"1. Employ standard problem solving techniques and tools:
   a. Problem statement
   b. Decision table
   c. System and program flowcharts
   d. Standard documentation techniques
2. Demonstrate a knowledge of electronic computers as problem-solving tools:
   a. Computer input-output media and their coding
   b. Computer input-output devices
   c. Storage characteristics (fixed- and variable-word length) and internal coding systems
   d. CPU operations (adders, registers, serial and parallel transmission)
   e. Programming techniques and devices (loops, switches, initialization, instruction modification, indexing, table lookup)
   f. Programming systems (symbolic languages, processors, RPG, IOCS, utility programs)
   g. Operating systems"

The trainee prerequisites are: "None for installation managers, operators and programmers with card computer experience. All others should attain a grade of C on the Programmer's Aptitude Test."

Evidence Rating: No evidence is given in any of the materials to describe how it was tried out and debugged and the conditions of validation. However, the following average time requirements are furnished: 5 hours for Section A, 4½ hours for Section B, 5½ hours for Section C, 7½ hours for Section D, 8½ hours for Section E and 4 hours for Section F, for a total of 35 hours.
Remarks: There is a trainee-Advisor relationship throughout the course. The trainee receives Volume 1, Illustrations and Notebook from his Advisor and must complete the volume and the section post-tests before receiving the next volume. The Advisor provides supplemental assistance, personal follow-up, supervision and evaluation. This BCS course is pre-requisite to certain other courses.

The reader is invited to submit to the author the names and sources of any programmed materials which are currently available and not included in this survey.

The author wishes to express her gratitude to Dr. Leonard C. Silvern, Principal Scientist of Education and Training Consultants, for reading the manuscript and offering helpful suggestions.

REFERENCES

1. G. M. Silvern, "Programmed Instruction for Computer Programming, **Computers and Automation,** Vol. XII, No. 3; March, 1963.

2. L. C. Silvern, "Fundamentals of Teaching Machine and Programmed Learning Systems," a programmed course; Education and Training Consultants, Los Angeles, California, 1961.

Powerful new computer. Only $695 a month. Only from IBM.

Our new 1130 Computing System has approximately 20 times more power than our best previous desk-size digital computer.

But it rents for less than half. And is backed by IBM programming and services.

We tailored the 1130 to the needs of the small-budget engineering or scientific worker. It also helps printers and newspapers cut the cost of computer-directed typesetting... and serves the accounting needs of many smaller businesses.

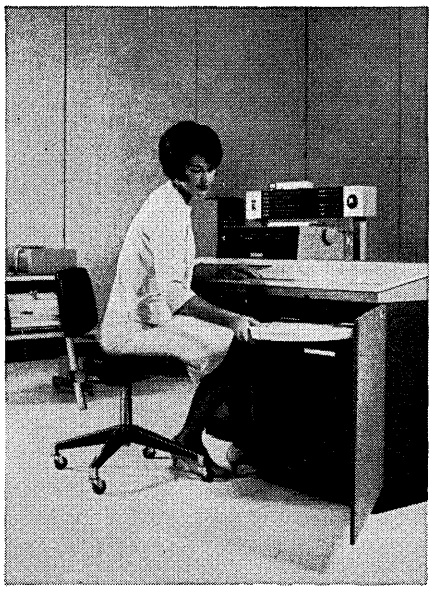
The 1130 is fast. It comes with a big, new direct-access file. It utilizes the improved micro-circuitry developed for IBM SYSTEM/360. And it rents for as little as $695.

Look what that buys you: Paper tape in and out. A high-speed CPU with 4K 16-bit words of core storage. FORTRAN and a new 1130 Symbolic Assembler Language to speed programming.

For an extra $200 a month, you can double core storage to 8K.

For $880 a month, you get a basic card system that gives you 300 cards/min. in and 80 columns/sec. punched out (400 and 160 for $995/month). A new printer (80 lines/min. alphanumeric; 110 lines, numeric) goes for $275/month.

The new direct-access disk storage lets you put over half a million



words of data on a single interchangeable disk cartridge. A basic disk model rents for $895/month. You can transfer up to 35,000 words per minute on or off the file. Since the disks are interchangeable, a disk system is the ideal solution for an open-shop operation.

With the disk feature, you can use a monitor programming system that takes over much of the routine housework involved in operating a computer. The monitor lets you stack jobs—in any sequence—and lets the computer process them automatically.

It lets you run a shop more efficiently by reducing turnaround time from the origin of a problem to its solution. You put the monitor on the disk—it occupies less than 20% of the disk's capacity, leaves over 400,000 words or 800,000 characters for your programs.

Over 40 separate programs for the new 1130 come in seven tested application packages. Included among these are mathematical and statistical programs, COGO, petroleum engineering exploration, geophysical programs and automatic typesetting programs.

Other features: a console printer (15.5 cps) and keyboard... utilities and subroutines programs... double precision and floating point arithmetic.

You can get a 1627 Plotter for generating graphs, maps, flow charts, engineering drawings direct from digital information in the system.

And check these standard features—yours at no extra cost—with every model of the 1130: Parallel data transfer... Parallel arithmetic ... Automatic program interrupt... Three index registers... Overlapped processing... Indirect addressing... Multiply and divide... Parity checking... Double-precision instructions... Boolean logic.

But it won't make coffee. Sorry.

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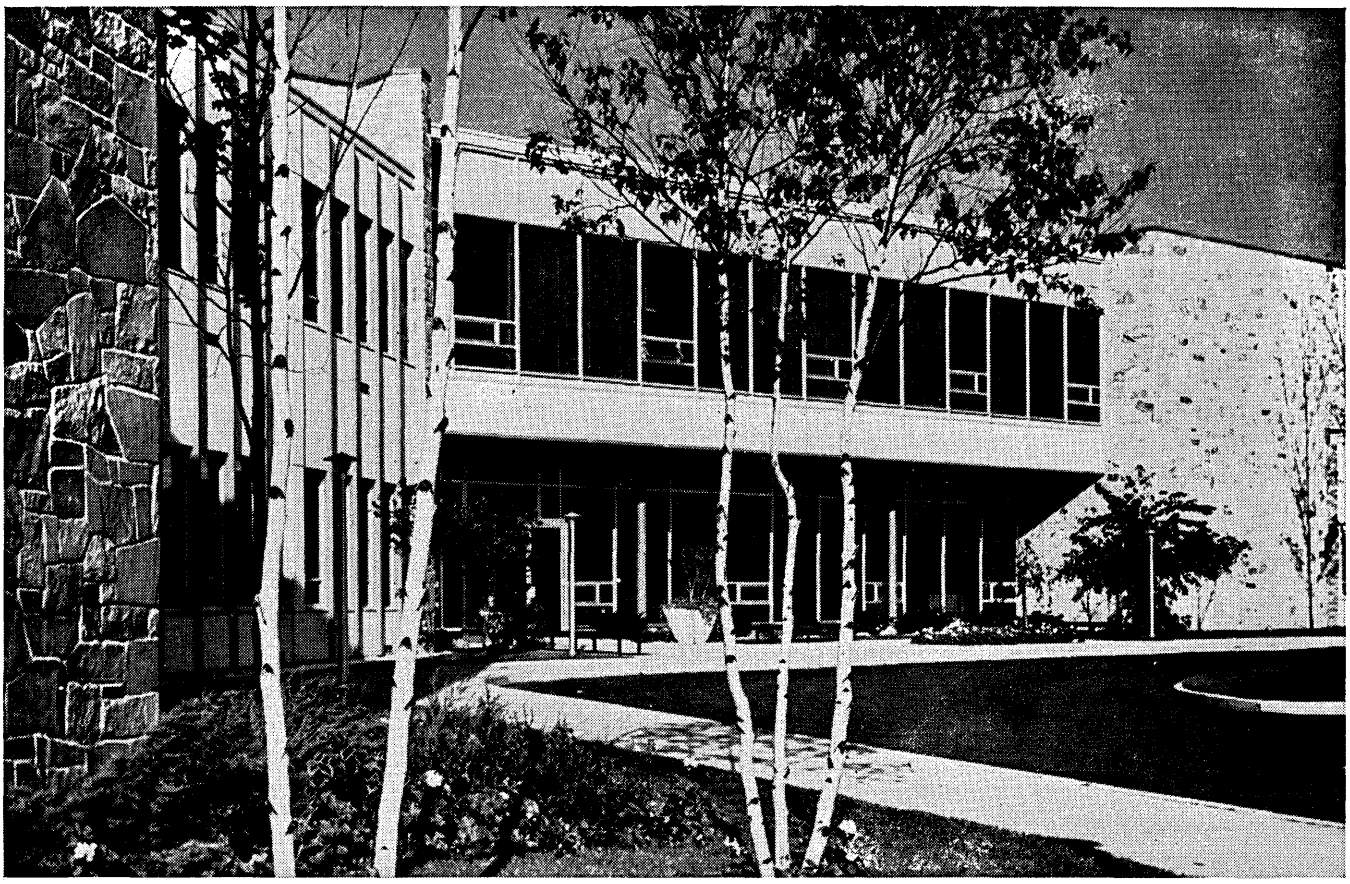

we're moving. move with us.

The opening of our new Engineering and Research Center in suburban Boston has accelerated Honeywell's pace-setting expansion program, creating a record number of professional opportunities for experienced computer engineers.

Located near Route 128, the Massachusetts Turnpike and other main roads, this award winning facility is adjacent to Lexington, Concord and other picturesque communities, and yet within easy commuting distance from Boston, Cambridge and more than thirty major universities and colleges.

Immediate opportunities for experienced graduate engineers span the entire spectrum of advanced computer technology, with emphasis in the following areas:

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ELECTRONIC DATA PROCESSING

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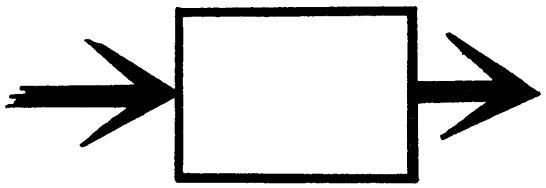
Opportunities exist at other Honeywell Divisions. Send resume to F. E. Laing, Honeywell, Minneapolis 8, Minnesota. An equal opportunity employer.



The Battle Lines Are Drawn. . . .

Never have so many been offered so much by so few.

There can be no question that the 1965 offerings of the "big eight" computer manufacturers represent the most impressive line-up of competitive equipment yet. There is also no question that this will be the most competitive year for IBM so far—with a possible reduction in market share from a current high of 79% of all installations.

In 1964 a total of 45 new computer systems were announced, only eight of which were IBM systems. Evaluation of the line-up facing the potential user certainly indicates the tremendous competition in the industry, with complete lines being offered by almost all suppliers.

Ranking the lines offered by the eight major manufacturers is difficult, and requires a definition of the parameters. A cost/performance ranking would not be the same in each class of system; it would also not correlate to the market share ranking. Even the market share would have to be defined either as installations made during 1965 or as new orders received, or both.

Considering market share only as "value of new orders received during the year 1965" regardless of replacements, a possible projection could result in the following table:

1. IBM—System 360/20; 360/30; 360/40 360/50; 360/60; 360/62 360/70; 360/92	72%
2. RCA—Spectra 70/15; 70/25 70/45; 70/55 (to be announced 70/35; 70/65 ?)	7%
3. General Electric—Series 400 Series 600 (to be announced—new "gamma" line ?)	6%
4. Univac—1004; 1050; 1040 490 Series; 418; 1108	4%
5. Control Data Corp.—3000 Series 6000 Series	3%
6. Honeywell—H200, H2200, H300 (to be announced H2300; H3300 ?)	3%
7. NCR—315 Series 500 Series	2%
8. Burroughs—B100; B200; B300 Series B5000 Series	1.5%

with the remaining 1.5% randomly distributed.

To look at cost/performance, a more complex series of calculations is necessary. Thus, if one held cost constant, classes of systems would evolve. In each class, performance would have to be measured based *strictly* on the *application* or *problem* mix.

$2000 per month rental: Class A—"Teeny" Systems
IBM 360/20
RCA 70/15
Univac 1004
NCR 500

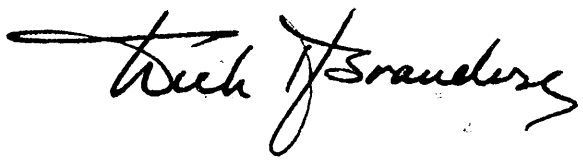
$6000 per month rental: Class B—Small Systems
IBM 360/30; GE 415, 425; CDC 3100; RCA 70/25; Honeywell H200, 300; Univac 1050, 1040; Burroughs B100, B200, B300; NCR 315

$15,000 per month rental: Class C—Medium Systems
IBM 360/40, 360/50; GE 435, 455; CDC 3200, 3300, 3400; RCA 70/45, 70/55; Univac 418; Honeywell H2200

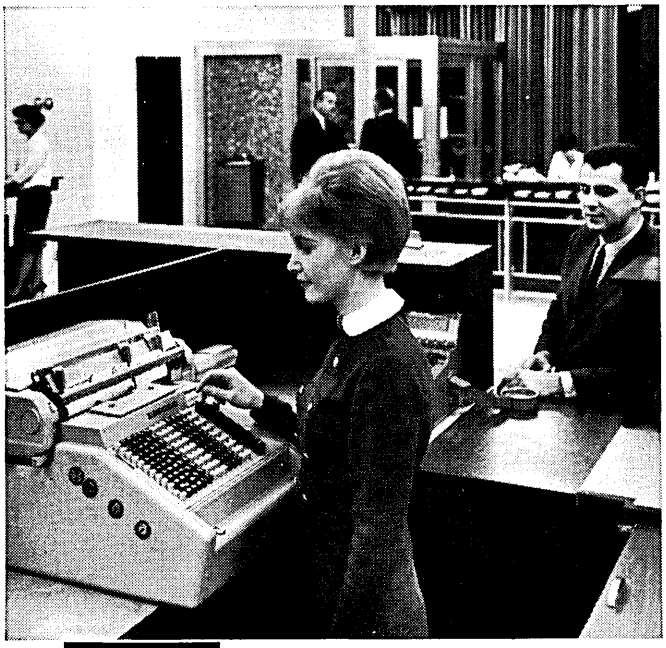
$30,000 per month rental: Class D—Large Systems
IBM 360/60, 360/62, 360/70; Univac 490, 1108; CDC 3600, 3800; RCA 70/55; GE 625; Burroughs B5000, 5500

$75,000 per month rental: Class E—Family or Economy Size Systems
IBM 360/92; CDC 6400/6600/6800; GE 635

It is evident that the user can find competition in each class, a system to fit every pocketbook. Each manufacturer has consolidated his position during 1964, ready for the competition of 1965 and 1966. IBM, RCA and NCR with new lines; CDC, GE and Honeywell by filling out their existing lines; and Univac and Burroughs with announcements still to come. With this, it is truly a buyers' market—for the ultimate benefit of the 5000 organizations who will place their first computer order in 1965.



CONTRIBUTING EDITOR



Burroughs Teller Console

Hot Line!

Burroughs On-Line!

BETTER SERVICE

Yes, you're looking at the on-line system with the hot line—instantaneous access to electronic account records for each teller through the teller console.

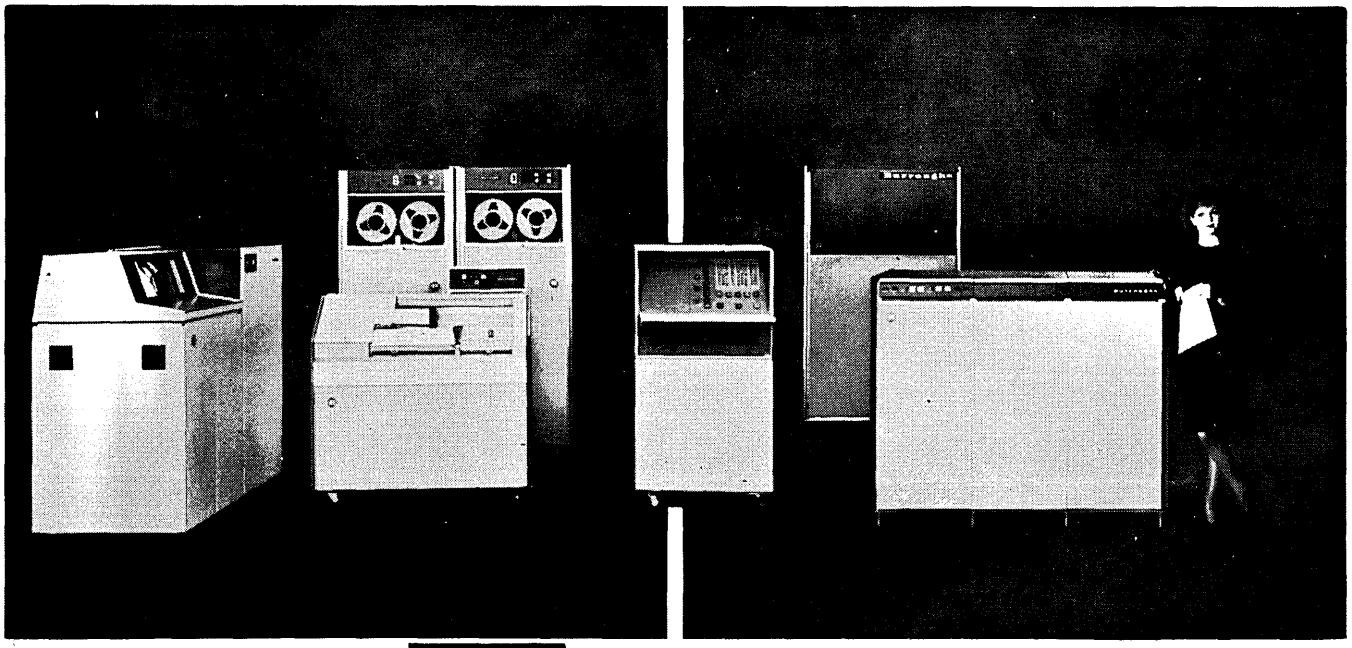
Customers are happier because service is much faster, more accurate, and they can transact any and all business at *any* window in *any* office.

Tellers like the Burroughs On-Line System because it protects them from posting to the wrong line of the passbook, simplifies cash-balancing, and posts dividends and no-book transactions to the passbook automatically (even identifies them with the original entry date).

BETTER CONTROL

You'll like the Burroughs On-Line System because your records and your customers' records are right up to the second; because the system automatically controls teller cash, unposted items, uncollected funds, holds and dormant accounts; because it keeps work load peaks and operating costs down; because it permits you to grow faster and more economically; and because of the maximum accuracy which improves customer relations.

Because the Burroughs On-Line System controls work load peaks and operating costs, keeping them low, you can handle increased customer traffic, improve customer service and add more offices at minimum cost.



Burroughs B 300 Data Processing System with Disk File

Burroughs Corporation

Burroughs—TM

EFFECTIVE HARDWARE AND SOFTWARE

(1) Burroughs On-Line Teller Consoles—proved teller-oriented design, easier to operate and audit, provide complete computer-to-teller communication. (2) Burroughs B 300 Data Processing System—most productive in its price class, capable of processing other jobs while simultaneously on-line. (3) Burroughs Random Access Disk File—five times faster than any other with expandable storage capacity. (4) The most economical communications network, combining telephone lines and Burroughs communication control units. (5) An operating program providing maximum efficiency and fast transaction response times.

CUSTOMER ACCEPTANCE

The Provident Institution for Savings in the Town of Boston, and
Bankers Data Processing, Inc., Boston
Chase Federal Savings & Loan Assn. (Miami Beach)
Public Bank (Detroit)
Bank of St. Louis
Lincoln First Federal Savings & Loan Assn. (Spokane) and
Pacific First Federal Savings & Loan Assn. (Tacoma)

Commercial banks, savings banks, savings and loan associations, cooperatives and service centers from coast to coast are turning to Burroughs On-Line Systems. Join them. Contact us at Detroit, Michigan 48232.

Circle No. 17 on Readers Service Card

CALENDAR OF COMING EVENTS

Mar. 22-25, 1965: IEEE International Convention, Coliseum and New York Hilton Hotel, New York, N. Y.; contact IEEE Headquarters, E. K. Gannett, 345 E. 47th St., New York, N. Y.

Mar. 24-26, 1965: Spring Meeting of the H-800 Users Association, Mayflower Hotel, Washington, D. C.; contact K. H. Pearce, Northern Ill. Gas Co., P. O. Box 190, Aurora, Ill. 60507

Apr. 6-8, 1965: 3rd Annual Symposium on Biomathematics and Computer Science in the Life Sciences, Warwick Hotel, Houston, Tex.; contact Office of the Dean, Div. of Continuing Education, Univ. of Tex. Graduate School of Biomedical Sciences at Houston, 102 Jesse Jones Library Bldg., Tex. Medical Center, Houston, Tex. 77025

Apr. 13-15, 1965: National Telemetering Conference, 15th Annual Meeting, Shamrock-Hilton Hotel, Houston, Tex.; contact Lewis Winner, 152 W. 42 St., New York, N. Y. 10036

Apr. 15-16, 1965: First International Conference on Programming and Control, U. S. Air Force Academy, Colorado Springs, Colo.; contact Prof. G. B. Dantzig, Operations Research Center, Univ. of Calif., Berkeley, Calif.

Apr. 21-23, 1965: 16th Semi-Annual Meeting of Philco 2000 Users Group (TUG), El Tropicana Motor Hotel, San Antonio, Tex.; contact Omar Phipps, Philco Western Development Laboratories, Palo Alto, Calif.

Apr. 21-23, 1965: 2nd Annual Meeting and Technical Conference of the Numerical Control Society, La Salle Hotel, Chicago, Ill.; contact Jerry Singleton, Numerical Control Society, 122 E. 49 St., New York, N. Y. 10017

May 3-8, 1965: Symposium on the Numerical Solution of Partial Differential Equations, Inst. for Fluid Dynamics and Applied Mathematics and the Computer Science Center, Univ. of Md., College Park, Md.; contact Inst. for Fluid Dynamics and Applied Mathematics, Univ. of Md., College Park, Md. 20742

May 5-7, 1965: 1965 Electronic Components Conference, Marriott Twin Bridges Motor Hotel, Washington 1, D. C.; contact John E. Hickey, Jr., Chilton Co., Chestnut & 56th Sts., Philadelphia, Pa. 19134

May 10-12, 1965: National Aerospace Electronics Conference (NAECON), Dayton, Ohio; contact IEEE Dayton Office, 1414 E. 3rd St., Dayton 2, Ohio.

May 13-14, 1965: Symposium on Signal Transmission and Processing, Columbia Univ., New York, N. Y.; contact Dr. L. E. Franks, Bell Tel. Labs., No. Andover, Mass.

May 18-21, 1965: GUIDE International User Organization Meeting (Users of Large Scale IBM EDP Machines,) Statler-Hilton Hotel, Detroit, Mich.; contact Lois E. Mecham, Secretary, GUIDE International, c/o United Services Automobile Association, 4119 Broadway, San Antonio, Tex. 78215

May 18, 1965: SWAP Conference, Marriott Motor Hotel, Twin Bridges, Washington, D. C.; contact Gordon V. Wise, Control Data Corp., 8100 34th Ave. So., Minneapolis, Minn. 55420.

May 19-21, 1965: 15th CO-OP Conference, Marriott Motor Hotel, Twin Bridges, Washington, D. C.; contact Gordon V. Wise, Control Data Corp., 8100 34th Ave. So., Minneapolis, Minn. 55420.

May 19-21, 1965: Power Industry Computer App. Conference (PICA), Jack Tar Hotel, Clearwater, Fla.; contact G. W. Stagg, American Elec. Power Serv. Corp., 2 Broadway, New York, N. Y. 10008.

May 20-21, 1965: Spring Technical Meeting of the Digital Equipment Computer Users Society (DECUS), William James Hall, Harvard University, Cambridge, Mass.; contact DECUS, Maynard, Mass. 01754

May 24-29, 1965: IFIP Congress '65, New York Hilton Hotel, New York, N. Y.; contact Evan Herbert, Conover Mast Publ., 205 E. 42 St., New York 17, N. Y.

June, 1965: Automatic Control in the Peaceful Uses of Space, Oslo, Norway; contact Dr. John A. Aseltine, Aerospace Corp., P. O. Box 95085, Los Angeles 45, Calif.

June 1-3, 1965: Reprogramming Conference, a Special Interest Symposium of the Association for Computing Machinery, Nassau Inn, Princeton, N. J.; contact Mrs. L. R. Becker, Applied Data Research, Inc., Route 206 Center, Princeton, N. J. 08540

June 10-12, 1965: Annual Southeastern Regional Conference of Association of Computing Machinery, Palm Beach Towers, Palm Beach, Fla.; contact Donald J. Beuttenmuller, Gen. Chairman, 243 Russlyn Dr., W. Palm Beach, Fla.

June 17-18, 1965: 3rd Annual Conference of The Computer Personnel Research Group, Washington University, St. Louis, Mo.; contact Prof. Malcolm H. Gotterer, Program Chairman, 120 Boucke Bldg., Pennsylvania State University, University Park, Pa. 16802

June 21-25, 1965: Information Sciences Institute, Seminar I: Image Processing, Univ. of Maryland, Computer Science Center and University College, College Park, Md.; contact Div. of Institutes, Center of Adult Education, Univ. of Md., College Park, Md. 20742

June 21-25, 1965: San Diego Symp. for Biomedical Engineering, San Diego, Calif.; contact Dean L. Franklin, Scripps Clinic & Res Found., La Jolla, Calif.

June 22-25, 1965: 2nd Annual SHARE Design Automation Committee Workshop, Chalfonte Haddon Hall, Atlantic City, N. J.; contact J. Behar, IBM Corp., Mathematics and Applications Dept., 590 Madison Ave., New York, N. Y. 10022

June 22-25, 1965: Sixth Joint Automatic Control Conference (JACC), Rensselaer Polytechnic Institute, Troy N. Y.; contact Prof. James W. Moore, Dept. of Mechanical Engineering, Univ. of Va., Charlotteville, Va.

June 28-July 1, 1965: Information Sciences Institute, Seminar II: Pattern Recognition, Univ. of Maryland, Computer Science Center and University College, College Park, Md.; contact Div. of Institutes, Center of Adult Education, Univ. of Md., College Park, Md. 20742

June 29-July 2, 1965: Data Processing Management Association 1965 International Data Processing Conference and Business Exposition, Benjamin Franklin Hotel and Convention Hall, Philadelphia, Pa.; contact Data Processing Management Association, 524 Busse Highway, Park Ridge, Ill.

Aug. 14-Sept. 6, 1965: National Science Foundation Conference on Digital Computers for College Teachers of Science, Mathematics and Engineering, Univ. of Southwestern Louisiana, Lafayette, La.; contact Dr. James R. Oliver, Director, USL Computing Center, Box 133, USL Station, Lafayette, La. 70506

"ACROSS THE EDITOR'S DESK"

Computing and Data Processing Newsletter

TABLE OF CONTENTS

APPLICATIONS

ECG'S ANALYZED BY COMPUTER

A "hybrid" computer has been programmed to read and interpret electrocardiagrams (ECG's), one of a doctor's most valuable tools in the diagnosis of heart disease. The computer analysis frees the doctor of much of the time-consuming visual examination and reduces the cost to the patient. Using this system at a central laboratory, will allow the family doctor to analyze electrocardiagrams as routinely and inexpensively as blood samples.

The computer developed for this purpose is a Beckman 2220/SDS 920 integrated system comprising analog and digital sections. The analog section processes and analyzes the input data; the digital section diagnoses the results. The "real-time" language for the computer was designed by Computer Usage Company. Other CUC programs facilitate manual control of the computer and the integration of the analog and digital sections. (For more information, designate #41 on the Readers Service Card.)

COMPUTER PROGRAMMING USED TO SPEED REGISTRATION AT UNH

The University of New Hampshire turned to the use of computer programming to speed up the complex task of registering its students. Registrar Owen B. Durgin said that registration of the University's 4,966 students, was performed this semester, for the first time, through use of an IBM 1620 computer. (A trial run of the automated system was made this past fall when 1400 freshmen were assigned to classes through computer programming.)

The extent of the institution's class-scheduling problem is underscored by the fact that there are approximately 540 courses, offered in 1500 sections, from which students establish their study programs. Required courses for freshmen and sophmores, in particular, necessitate a great many sections so that all students may be accommodated. Freshman English, for instance, has 49 sections meeting at various times throughout the University's five-day class week. The problem is to place each student in a course section that does not meet at the same time as another course in which he wishes to enroll.

Under the University's former system, students stood in long lines on "Registration Day" and individually enrolled in courses according to whether space was still available, and the class did not meet at the same hour as any of their other courses. Under this "first-come, first-serve" system, courses taught by "popular" professors were quickly over-subscribed, while others were only partially filled. Often, students specializing in a particular study field found that a course required for graduation was filled before they were able to get to the head of the registration line.

Last January students filled out IBM cards indicating mandatory and elective courses they wished to take, along with alternate courses to be substituted for electives that would not fit into a particular schedule. The IBM machine made a number of attempts to fashion a workable schedule for each student, based on his designated choices and alternates. The few which could not be satisfactorily resolved by the machine were then reviewed in consultation with the students.

Because of the heavy demands for use of the computer throughout the University, the Registrar's Office processed the student schedules from 8 p.m. to 7 a.m. three nights beginning January 22 — the only "free time" available on the machine.

"BATCHED PERIPHERALS" CONCEPT USED BY MARTIN COMPANY

A "batched peripherals" concept for greater efficiency and flexibility has produced impressive savings in the Martin Company (Denver, Colo.) inventory control program. First-year savings under the new system have been estimated at $38,000. Annual savings thereafter are expected to average about $40,000.

With the new system, Martin Co. has used microfilm to replace paper as its basic control and audit record. It also has placed its routine decision-making re-

quirements for common usage, low value, standard items within the computer and has produced numerous internal operating efficiencies in the area of material control.

As Integrating Contractor on the TITAN II inter-continental ballistic missile, Martin is responsible for coordinating the activities of half a dozen major contractors and several thousand smaller contractors. Some 500,000 parts are used in each TITAN missile and the inventory needed for Martin's plants alone averages 10,000 commodity type items, and 9000 requirements type items.

Previously, Martin's peripherals operated on-line with two IBM 7094 computers. This slowed up the entire configuration. It also allowed more opportunity for error, created problems whenever it became necessary to back up, and made it necessary to stop the main frame every time paper had to be changed in the printers or microfilm had to be changed in the General Dynamics S-C 4020 computer recorder.

The "batched peripherals" concept is designed to get maximum use of each piece of data processing equipment. This involves the use of the two 7094's, a GE-225 computer, the 4020 computer recorder, three printers and a card punch. The 225 is equipped with a GE Disc Storage Unit (DSU) and a Datanet-60 controller, and serves as the "nerve center" of the system.

All inventory control data is processed on the two 7094's. Magnetic tape output is fed into the 225 and the data is then stored in the Disc Storage Unit. The DSU schedules and operates the 4020, the three printers and the card punch. All peripherals operate simultaneously, rather than sequentially.

In the inventory control application, the 225 specifies the desired output medium (hard copy, cards or microfilm). When microfilm is desired, the data passes from the DSU through the Datanet-60 controller to the 4020, where 16 mm microfilm records are produced — in the desired format — at a rate of 7000 lines per minute.

Meanwhile, other peripheral equipment, under the control of the 225, is free to process additional work. This includes an average daily output of 41,000 updated nomenclature records, 21,000 updated master balance records and 2000 cards.

Martin's new inventory control system not only has reduced processing costs, provided faster updating of records, improved forecasting techniques, and provided faster access to vital inventory data, but it also has permitted the application of additional management controls to the inventory handling process. The concept of "batched peripherals" actually halps Martin's computers to do more computing, its printers to do more printing and its entire data processing system to do more work faster than ever before.

COMPUTER CONTROLLED PAPER MAKING

A computer controlled paper making process has resulted in increased production, more efficient use of manpower and improved quality control for Harding-Jones Paper Co., Middletown, Ohio. According to C. M. Jones, President, the process control system is the first to be applied by a rag paper mill.

An IBM 1710 process control system was installed a year ago on the company's paper machine. The paper machine under computer control has a maximum speed of 600 feet per minute and trims to a width of 72 inches. Daily output averages 19 tons.

Harding-Jones' process control system regulates the operation of the mill by collecting and analyzing data from 38 sensing devices along the length of the paper machine. These highly sensitive instruments measure variables such as raw stock consistency, flow rates, temperatures and machine speeds.

The most effective combination of historical operating standards for each grade of paper is stored in the computer and is automatically applied during subsequent runs. Any deviations from these levels that occur during the manufacturing process are automatically detected by the sensing instruments and fed into the computer. Instruments controlling the machine are then adjusted to bring quality back to its highest level, automatically, or on a closed-loop basis.

The paper machine operator can increase the production rate merely by dialing a new speed into the computer.

NEW CONTRACTS

AUTOVON SWITCHING CENTERS BEING MANUFACTURED BY GT&E SUBSIDIARY

High-speed electronic switching centers for the U. S. government's world-wide Automatic Voice Network (AUTOVON) will complete many global telephone calls in less than 10 seconds when the overseas portion of the network becomes operational in 1967, according to General Telephone & Electronics Corporation. The overseas AUTOVON switching centers are being manufactured by Automatic Electric Company of Northlake, Ill., a subsidiary of GT&E, under a $21 million contract from the U. S. Air Force's Electronic Systems Division at L. G. Hanscom Field, Bedford, Mass. The Air Force is administering the program for the Defense Communications Agency (DCA).

DCA is responsible for the nation's Defense Communications System — an integrated system which will meet the voice and digital data requirements of the armed services during any type of global conditions. The system is comprised of AUTOVON and an Automatic Digital Network (AUTODIN).

AUTOVON, considered the most versatile telephone system yet designed, provides for multi-continent conference calls involving up to 30 telephones, automatic pre-emption of inter-office telephone lines for high-priority calls, and "hot lines" which ring a pre-determined telephone as soon as the caller picks up his own telephone instrument. Twenty-two AUTOVON switching centers are planned in 14 countries throughout the world — 14 centers in the European-Mediterranean network area, seven in the Pacific, and one in the Caribbean. In addition to the switching centers, the overall AUTOVON system will include transmission media and terminal facilities for voice and graphic communications.

STATE OF CALIFORNIA SIGNS CONTRACT WITH LOCKHEED

Governor Edmond G. Brown of California has announced that the state has signed a contract with the Lockheed Missiles & Space Co. of Sunnyvale to make a study for the state information system using the advanced technology of the space age. The contract for $100,000 is one of a series of four studies to be made by the aerospace industry on governmental problems (an approach proposed by Governor Brown last November 14). It is to be completed within a six month period.

Lockheed's executive vice president, Herschel J. Brown, said that Lockheed proposes to develop the information study along three lines: (1) perform a system analysis of 18 functional areas, including all state agencies, special state units, local governments, and various private enterprises; (2) develop the conceptual design of the state-wide information handling system based upon information gathered in the system analysis phase; and (3) develop an implementation plan, determining system design, financing and operation and including a proposal for joint participation by federal and local governments and private industry.

The principal part of the study will be done in Lockheed's Research and Development Division.

RADIATION INC. TO DEVELOP WORLD-WIDE WEATHER MEASURING SYSTEM

Radiation Incorporated, Melbourne, Fla., will develop a new weather data collection system which will given an around-the-world weather report every 90 minutes. The satellite-borne instrument package will be tested aboard the Nimbus B meteorological satellite. The contract from Goddard Space Flight Center of the National Aeronautics and Space Administration, is expected to amount to about $1.7 million when negotiations are completed.

The new equipment, called the Interrogation Recording and Location System (IRLS), will tie together readings made on the ground and in space. Radiation Incorporated will develop receiving and data storing equipment for the satellite as well as the necessary electronic devices for unmanned low-maintenance ground stations.

Under the contract negotiation terms, Radiation will develop three IRLS flight units to be flown in the satellite and six platforms for the ground stations. Project officials have not yet determined the locations for these stations.

In addition, the Florida-based firm will provide engineering and prototype models — for both the satellite and ground stations — for laboratory testing of the entire system before IRLS is flown on Nimbus for the first time, approximately 18 months after the contract has been awarded. The contract also will call for field services of the ground stations for three years.

JOB CORPS CONTRACT AWARDED SDC

System Development Corporation (SDC), Santa Monica, Calif., has been awarded an $85,000 contract by the Job Corps' Office of Program Development and Analysis, Washington, D.C., for the development of a computer-based information processing and retrieval system.

SDC scientists and information processing technicians will adapt existing computer programs — originally designed for and currently in use by military organizations — to allow Job Corps personnel to accumulate, organize, retrieve and analyze information relative to the Job Corps program.

GT&E BEGINS PRODUCTION ON $7.4 MILLION AIR FORCE CONTRACT

General Telephone & Electronics Corporation has begun production on a $7.4 million contract for advanced airborne computers which will be incorporated into larger electronic systems by the Air Force. The special purpose, compact computers include plug-in circuit modules which can be removed easily for maintenance. Each computer, comprised of a power supply, logic circuitry and memory unit, is approximately two feet square and six inches deep and weighs less than 250 pounds.

Work is being performed by Sylvania Electric Products Inc., a GT&E subsidiary, under a contract from the Aeronautical Systems Division, Air Force Systems Command. The equipment is being produced at Needham, Mass. and at Santa Cruz, Calif. Delivery is scheduled to begin in December and extend into the spring of 1966.

GE RECEIVES CONTRACT FOR $2.9 MILLION FROM NASA

The National Aeronautics and Space Administration's Wallops Station, Wallops Island, Va., will place a Real-Time Impact Prediction and Data Processing System, supplied by the General Electric Company, into operation this year.

Under a $2.9 million NASA contract, GE's Radio Guidance Operation will provide a system that will improve significantly the test range capabilities of Wallops Station. The primary mission of the system will be to predict the instantaneous impact points for current and future NASA launch vehicles.

GE's Radio Guidance Operation (Syracuse, N.Y.) will provide problem analysis, system design, hardware implementation, programming, installation, and maintenance.

NEW INSTALLATIONS

FAWCETT PUBLICATIONS INSTALLS COMPUTER

Fawcett Publications, Inc., Greenwich, Conn., has installed an IBM 1460 computer which will cut the time required to process book orders by some 75 percent — response time on reorders will be reduced from four days to one.

The computer also will be used to produce a sales history of each book by title and type for each wholesaler. These statistics will then be used to determine the initial "order" of new book titles to wholesalers, resulting in a more efficient distribution and higher sales percentage for books shipped.

Fawcett publishes Crest, Premier and Gold Medal books and distributes to some 800 wholesalers throughout the world.

Newsletter

HONEYWELL COMPUTER TO DIRECT 60-LOOP UNIT FOR DUTCH SHELL

A new lubricating oils distillation plant under construction at the Shell Nederland refinery in Pernis, Holland will operate under direct control of a digital computer. The computer, a Honeywell 620 system, will control 60 valves by direct 4-20 ma signals, monitor 150 variables and 30 alarm points, and log operating data.

The installation is part of experimental work being carried out by Shell and will be one of the first of its kind.

Honeywell electronic instrumentation will be installed to provide standby control. Through external circuitry, it will be possible, by means of a single switch, to simultaneously transfer control of all valves from the computer to panel-mounted instruments. Similar transfer also can be effected for selected loops individually in both directions.

The computer control system is being supplied through Honeywell's Dutch subsidiary, which will assume installation responsibility.

INTERNAL REVENUE SERVICE ORDERS IBM SYSTEM/360 FOR NATIONAL COMPUTER CENTER

The Internal Revenue Service will install an IBM System/360 Model 62 at the Internal Revenue National Computer Center at Martinsburg, W. Va. The center will continue to use its two IBM 7074 computer systems. The new equipment will be able to exchange data with the 7074 systems.

The new system's central processor will have directly accessible memory of 262,000 characters, and will be able to retrieve information at an effective rate of 125 nanoseconds per character. IBM 7340 Model 3 Hypertape units make the system one of the most powerful ever ordered from IBM for a non-scientific application. This unit permits double-density storage of data, packing several times as much information on each tape as is possible with a conventional unit. An IBM 2311 disk storage device also will be used in the system.

The center now processes income tax information from businesses, banks and brokers throughout the nation. Individual returns are being gradually phased into the automatic data processing system this year. The new equipment (scheduled for installation by October) will handle anticipated growth in the volume of work at the center at least through 1970.

HOSPITAL WILL USE PDP-7 FOR LAB, CLINICAL STUDIES

The Psychiatry Department of Massachusetts General Hospital (Boston) has ordered a PDP-7 computer from Digital Equipment Corporation, Maynard, Mass., for clinical and laboratory analyses in applications ranging from brain surgery to protein crystal studies.

It will function primarily in on-line experiments, recording and analyzing data, performing preliminary evaluations of data to determine its validity for further processing, and, in some cases, controlling experimental procedures.

The hospital had earlier used Digital's PDP-4 computer. Since the PDP-7 is program-compatible with the PDP-4, the specialized programs developed by the hospital, as well as the general purpose software, can be used on the new machine.

U. S. NAVY TO USE IBM SYSTEM/360s IN MANPOWER MANAGEMENT SYSTEM

A highly-advanced manpower information system, usihg five IBM System/360s, will provide virtually instant access to an inventory of the skills and talents of each of the more than one million men and women in the United States Navy. The five data processing systems will be installed for the Navy's Bureau of Naval Personnel.

The new system is designed to permit the Navy to: (1) obtain on demand, personnel management information which will heighten its effectiveness in emergency situations; and (2) forecast personnel requirements of both existing and future weapons systems using operations research techniques, mathematical models and simulations.

Two IBM System/360s — a Model 40 and a Model 30 — will be located at BuPers Headquarters in Washington, D.C. Three other System/360 Model 30s will be located at Personnel Accounting Machine Installations (PAMIs) at remote locations — Norfolk, Va., San Diego, Calif., and Bainbridge, Md. The Norfolk PAMI processes Atlantic Fleet data, San Diego processes information for the Pacific Fleet, and Bainbridge handles manpower information for the continental United States.

A central "data bank" — containing active master files holding the Navy's complete roster of officers, enlisted men, Naval activities and requirements — will be maintained at BuPers. Stored information will be instantly available to the BuPers computer as well as the remote PAMI computers.

IEEE INSTALLS GE-225

The Institute of Electrical and Electronic Engineers, Inc. has installed a General Electric 225 computer to take care of its expanding accounting and administrative needs. The system includes a disc storage unit and four magnetic tape handlers.

The IEEE, with 150,000 members and a predicted growth to more than 200,000 members within the next decade, will use the GE-225 system for: (1) Accounting and billing, in connection with membership records; (2) Printing of various mailing lists, including those for billing, administrative communications and distribution of 37 publications; (3) Maintenance of a membership history for each person in the world-wide society; and (4) Payroll and other administrative work within the headquarters organization located in New York.

The new GE-225 system will replace a ledger processing system, a mechanical addressing system and a number of separate manual operations now carried on at the headquarters.

MANNED SPACECRAFT CENTER TO INSTALL UNIVAC 1108

The Computation and Analysis Division of the Manned Spacecraft Center, Houston, Texas, will install a UNIVAC 1108 Computer to complement its computation capability required to support the manned spaceflight effort. The UNIVAC 1108 will be used by NASA to handle the many intricate computational

tasks involved in the Gemini and Apollo projects. These include heat transfer, structural problems, stress analysis, nose cone shapes, trajectory and re-entry problems, as well as preflight simulation, and other advanced engineering studies. The system will cost $2.6 million.

The UNIVAC 1108 configuration includes a 65,000, 36-bit word core memory with an effective cycle time of 375 nanoseconds. The flying head FH-432 magnetic drum, with an average access time of 4.25 milliseconds and a 1.4 million character per second transfer rate, stores the system's operating software and source language processors, including FORTRAN IV, the language in which 80% of the system's total work load will be written. The system will be manufactured in UNIVAC's St. Paul, Minn., facility.

CHASE MANHATTAN BANK ORDERS FIVE RCA SPECTRA 70's

The Chase Manhattan Bank, New York, N.Y., will install five of RCA's new Spectra 70 computer systems to handle the paperwork associated with the bank's vast corporate trust operations. The new order will bring to 25 the number of RCA computer systems employed by Chase Manhattan.

The Bank has ordered three Spectra 70/15 and two Spectra 70/25 computers for its agency trust function, and will maintain stockholder records in two complete masterfiles containing complete stockholder and stock certificate data.

The five Spectra 70 computers will join 27 other computers in the Chase Manhattan Data Processing Centers. Among their many tasks the computer centers in Chase's New York headquarters process a record 1.8 million checks valued at close to $1.5 billion per day.

RETAIL SHOE CHAIN TO INSTALL H-200

William Hahn Co., a leading retail show chain in the Washington/Baltimore area, has ordered a Honeywell 200 business computer to handle its inventory control, sales auditing, accounts payable, payroll and other future applications. Hahn, with 16 stores in the Washington/Baltimore area, one in Harrisburg, Pa., and three in Houston, Texas, will begin using the computer this summer.

Inventory control, the major application, will require the computer to keep an up-to-date count of the 600,000 pairs of shoes stocked by Hahn's. It will do so according to style by numbers of pairs on-hand and on-order as well as sales by store, style and price.

In its secondary applications, the Honeywell 200 will audit all sales checks, verify cash register and sales information and accumulate payroll information. The system also will compute the payroll for more than 700 employees.

VA ORDERS SYSTEM/360

The Veterans Administration has placed an order with IBM Corporation for a System/360 Model 30 digital computer. The computer, scheduled for installtion at the VA Hospital, Washington, D.C., during the fall of 1965, will be used for experimentation with a patient care oriented hospital information system.

The equipment, which includes on-line storage of approximately 30 million characters, will be used as a real-time processor with remote terminals located in the patient care areas of the hospital. The VA hopes such a system will improve the utilization of the hospital's medical care facilities and also free physicians and nurses of many record-keeping chores.

ORGANIZATION NEWS

BRANDON APPLIED SYSTEMS OPENS OFFICE IN ISRAEL

Brandon Applied Systems, Inc., New York, N.Y., a technical consulting firm specializing in data processing, has established a permanent office in Tel Aviv, Israel. Thus, the company becomes the first American data processing consulting firm to have an office in this country.

Although the firm has affiliates in England, Holland and Scandinavia for many of its services, this represents the first major expansion move for this firm in the international market.

According to Dick H. Brandon, President of Brandon Applied Systems, Inc., a careful study was made of various countries with expanding requirements for technical capability. Israel was selected on the basis of its explosive growth, its high level of technical personnel, and its history of favorable relationships with American technology.

CSC ACQUIRES TWO ITT SUBSIDIARIES

Computer Sciences Corporation, Los Angeles, Calif., has acquired two subsidiaries of International Telephone and Telegraph Corporation — ITT Communication Systems, Inc., and ITT Intelcom, Inc.

ITT Communication Systems, Inc. will be known as Communication Systems Incorporated (CSI). CSI is headquartered in Paramus, N.J., and employs more than 300 scientists, management specialists and systems engineers in the design and development of a global communications network for the U. S. Air Force

ITT Intelcom, Inc. will become System Sciences Corporation (SSC). SSC is located at Falls Church, Va., and has more than 150 staff members engaged in engineering and systems management services in the field of communication satellites.

CSC President Fletcher Jones said that the acquisitions were concluded by the payment of an undisclosed amount of cash for all the outstanding stock of the two ITT companies. Both companies will be operated as wholly-owned subsidiaries of CSC with no changes in personnel or operations.

HONEYWELL AND SAAB SIGN AGREEMENT

The electronic data processing (EDP) divisions of Honeywell and Svenska Aeroplan Aktiebolaget (SAAB) have announced the signing of a two-way marketing agreement covering distribution and sale of business and scientific computing systems.

The agreement covers the general-purpose business and scientific computer systems produced by both firms. SAAB will represent Honeywell in Sweden, Norway, Denmark and Finland; and Honeywell will reciprocate for SAAB in the United States.

Newsletter

FORMS, INC., ACQUIRED BY AMERICAN BANK STATIONERY

George W. Shay, President of Forms, Inc., Willow Grove, Pa., has announced the signing of an agreement in principle for the acquisition of the assets of this company by American Bank Stationery Company, Baltimore, Md.

Forms, Inc., is a continuous forms manufacturing firm. American Bank Stationery is the world's second largest independent producer of bank checks and stationery.

Thomas M. Sheridan, President of American Bank Stationery Company, said, "...Jointly we will be able to better serve automated banks, other types of financial firms and commercial businesses in general". Mr. Sheridan emphasized that Forms, Inc., will be operated as a subsidiary and that all officers and employees will continue to serve in their present capacities.

SCHAEVITZ ENGINEERING ACQUIRES CONTROL LOGIC, INC.

Herman Schaevitz, president of Schaevitz Engineering, Pennsauken, N.J., has announced the acquisition of Control Logic, Inc., Natick, Mass., in an exchange of shares.

Schaevitz Engineering is a leading specialist in sensing devices to measure and control acceleration, weight, displacement, pressure and other physical qualities. Control Logic has developed and produces welded digital circuit modules and special-purpose systems for automatic control, high-speed computation information storage and retrieval, data handling and related applications, with emphasis on miniaturization.

Mr Schaevitz said, "The digital and analogue data-logging capabilities of Control Logic complement those of our other companies to give us total system capabilities in aerospace and industrial automation".

COMPUTER APPLICATIONS ACQUIRES EMAC DATA PROCESSING

The respective boards of Computer Applications Inc., New York, N.Y., and EMAC Data Processing Corp., Woodside, N.Y., have approved in principle the acquisition by Computer Applications, through its wholly-owned subsidiary Electronic Business Services (EBS) of all of the assets of EMAC. Such agreement is subject to approval of a final agreement by the boards of directors, as well as approval of the stockholders of EMAC.

The acquisition involves payment of 10,000 shares of Computer Applications common stock to EMAC stockholders.

EMAC Data Processing Corporation provides data processing services similar to those supplied by EBS. Alan A. Fink, president of EMAC, said the joining of EMAC with EBS will make available to EMAC customers a greater range of service capabilities. He added that participation in Computer Applications broad operations promise also to benefit EMAC stockholders. Key personnel of EMAC will continue with Electronic Business Services Corporation.

COMPUTING CENTERS

NCR TO OFFER "ON-LINE" COMPUTER SERVICE FOR BANKS

The National Cash Register Company, Dayton, Ohio, is planning a major program to provide "on-line" data processing services in several metropolitan areas for savings and loan associations and for savings banks.

The companys' first "on-line" computer center is scheduled to open in New York City this spring. NCR said it has contracted with eight savings banks and one savings and loan association in the New York area for the service, representing over a million accounts. A similar Pittsburgh center, which is scheduled to open in mid-year, has entered into service contracts with 18 savings and loan associations.

In financial institutions using the service, customers will be able to go to any teller's window at any branch of the savings and loan association or savings bank for service. Each teller's machine will be linked by telephone lines to the central computer which can communicate with the teller through his input machine. Special safeguards are provided to insure that each institution's records are accessible only to its own personnel. The computer at the data center will automatically verify the account number and other transaction details, insuring that the teller makes no mistakes. Each transaction will be handled in a matter of seconds.

The data center computer will post the accounts on CRAM (Card Random Access Memory) units, process the transaction, and control the updating of the customer's passbook at the teller's window. Any one account out of a million can be selected in a fraction of a second, NCR said. It has been estimated that the maximum delay which could occur — if every teller sent in a transaction at the same instant — would be only 20 seconds.

The "on-line" equipment to be used at the centers is identical to that already installed by NCR in several savings banks, except for code identification numbers (machine, bank, branch) and the special programming required to serve a number of institutions at one time confidentially. The systems all use NCR "Class 42" teller's machines specially wired for data transmission.

The 315 systems used for the service will have as many as eight CRAM units for a capacity of up to 1½ million accounts. Each center will have another 315 system available for back-up.

NCR's schedule for the next 18 months calls for similar centers to be established in Chicago, Los Angeles, San Francisco and Boston. The company said it would offer a comparable service wherever sufficient demand develops. Each center is capable of providing effective service to subscribers as far away as 300 miles. The New York City center, for instance, will cover New Jersey, Connecticut, and Long Island, and the Boston center will serve the remainder of New England.
(For more information, designate #42 on the Readers Service Card.)

IBM'S TIME-SHARING SERVICE EXTENDED TO LA DATACENTER

A remote computing extension of IBM's Datacenter service will be available from Los Angeles beginning in the third quarter of 1965. Time-sharing service was

first announced last December for IBM's midtown New York Datacenter in the Time-Life Building.

The extension will enable scientists and engineers in the western United States — working in their own offices — to time-share the capabilities of an IBM 7040 computer at a distant IBM Datacenter. The number of users that can participate in this type of remote computing network will be doubled. The computers in Los Angeles and New York City each can accommodate up to 40 subscribers simultaneously.

Each user will work at a typewriter-like terminal in his own office to "converse" with the 7040, thus time-sharing the capabilities of the computer at a fraction of the cost of using it alone. The subscriber needs at his location only an IBM 1050 data communications system and a communications device linking his 1050 terminal to the Datacenter.

The new service will be available in a four-hour session each IBM working day of the month. (For more information, designate #43 on the Readers Service Card.)

'DO-IT-YOURSELF' COMPUTER CENTER

A 'do-it-yourself' computer service was inaugurated recently in Chicago, Ill. The unusual service, which is called Data-Mat, permits a customer to bring unprocessed data to a mid-town center, obtain free parking and the use of a private office to sort and prepare information, and perform all necessary computations on any of four computer systems.

The center is open around-the-clock, seven days a week. Attendants are available at all times to assist customers. Cost of the service is based upon the number of hours the computer equipment is used. Scheduled time is sold on a guaranteed basis, and customers may contract for as little as three hours a month.

Data-Mat was originated by Statistical Tabulating Corp., one of the world's largest independent service bureau organizations. Michael R. Notaro, chairman and president of Statistical Tabulating Corp., said the service is "intended to fill a void that now exists within the computer-using community". He estimated that more than 2000 local firms — mostly small retail, finance, banking, service and manufacturing businesses — are potential users of the Data-Mat service.

Another potential market for Data-Mat is among present users of computers, who can purchase Data-Mat time to handle overflow work from installed systems on an as-needed basis, Dean Gardner, vice president and general manager of the Data-Mat center, added. Mr. Gardner noted that several of Chicago's largest computer users — including Illinois Bell Telephone, Morton Salt Company, and Standard Brands, Inc. — have already contracted for the service.

A typical user of Data-Mat might prepare company payroll information, for example, on punched cards at his own office. The cards, representing the amount of time employees worked during the pay period, are then brought to Data-Mat, together with reels of magnetic tape containing payroll deduction data, and blank checks to be printed by the computer.

Upon arrival, the customer prepares his materials for computer processing in one of a row of private Data-Mat offices. When his scheduled turn on the computer comes up — at a guaranteed time — he takes his cards, blank checks and magnetic tapes to the center.

There he loads the magnetic tape reels onto a tape drive, reads the punched cards through a reader unit onto magnetic tape, and loads the blank check forms into a high-speed printer. He is then ready to process the data, and activates the central processing unit. (The computer systems include a Honeywell 200 system and three IBM 1401 systems.)

In convnetional service bureaus, bureau personnel do most of the data preparation and processing, but with Data-Mat, the customer performs these functions. "Such a service provides on-the-job training, knowledge and experience for a customer's staff with virtually no risk and no capital equipment outlays," Mr. Notaro said.

EDUCATION NEWS

AEDS TO ESTABLISH A NATIONAL CENTER

The Association for Educational Data Systems (AEDS) has been awarded a two-year grant totalling $50,000 to aid the development and management of a national center rendering certain educational data processing services to the nation's schools. The AEDS Association, a professional association of data processing and information management specialists working in the field of education, are undertaking the establishment of the national center within the Washington D.C. area. Terms of the grant from the Fund for the Advancement of Education, stipulate that the funds are to assist the newly established national center in rendering free services to all non-profit educational institutions. These services include:

1. A central library of documented computer programs available to school districts or institutions of higher learning who want to apply automatic data processing procedures to administrative functions and instructional programs. A nationwide search will be undertaken for the best and most generalizeable computer programs for incorporation in the central depository.

2. Establishment and maintenance of a professional placement service for persons already in, or interested in entering, the field of education.

3. A "Visiting Consultants" program for the purpose of identifying and listing qualified persons available (on the basis of competence and proximity) to a school district or institution of higher learning for advising in the planning of a new or expanded information processing system.

4. Maintenance of a clearing house or information exchange for answering requests for information, listing special or noteworthy applications by district and/or equipment configurations, and generally encouraging exchanges of information among persons in the educational community with similar interests and needs.

5. Stimulation and conduct of seminars and workshops on

critical problems in educational data processing. Three seminars will be called this fiscal year.

6. The publication and dissemination of special educational materials. In addition to the AEDS Bulletin, Educational Data Processing Newsletter, and EDP Journal, which the Association is now distributing to its members, the new center will undertake the printing and mailing of course outlines, materials, syllabi, and bibliographies for the teaching of subjects identified with the computer sciences on the elementary and secondary levels throughout the country. A handbook on computer installation and personnel is also to be prepared at the national center.

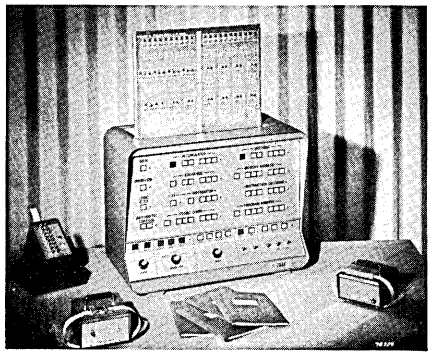
Mr. Simeon Taylor, Chief of Statistics Division, National Education Association, 1201 Sixteenth Street N.W., Washington, D.C., is membership chairman of the Association and he or the AEDS President may be contacted for information regarding the center and its services.

NEW PRODUCTS

Digital

DIGITAL COMPUTER TRAINING SYSTEM

Fabri-Tek Inc., Minneapolis, Minn., has entered the technical educational field with the development of a new Digital Computer Training System. The BI-TRAN SIX Digital Trainer is the heart of this system.



The system has the general capabilities of an internally-stored programmed computer but has been design-limited for educational purposes. The BI-TRAN SIX has a coincident-current (15 microsecond cycle time) ferrite core memory with a capacity of 128 words of 6 bits each. A set of instructions are included which permit a wide latitude of problem solution at the basic level of programming.

Special training features include over-size, extendable circuit cards with group component layouts and silk-screened circuit designators. The cards can be extended while the trainer is in operation for circuit and logic instruction without a requirement for use of extender cards. This permits flexibility in demonstrating or analyzing waveforms through the use of an oscilloscope. Logic prints have been matched in exact correspondence to the circuit cards for easy comprehension of circuit and logic concepts. All computer registers and controls of the trainer are brought out on an easy-read panel for student "hands-on" computer operation.

The Fabri-Tek System is designed to cover a wide variety of technical subjects from the software topics to the hardware topics. The training concept of the system affords student self-motivation through "hands-on" use of the equipment.

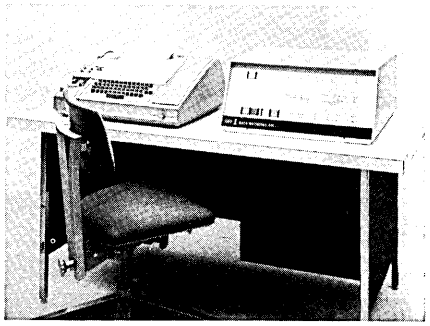
Appropriate course material, such as a Teacher's Guide, a Student Workbook and a Technical Operations Manual, is being prepared by McGraw-Hill. Low-cost peripheral equipment, especially designed for training purposes, include an off-line paper tape punch, a paper tape reader, a paper tape strip printer and an octal-to-binary manual input keyboard.

By selecting appropriate course material, the BI-TRAN SIX can be used not only at the university and vocational school levels but also in the elementary grades.
(For more information, designate #45 on the Readers Service Card.)

DMI 610 SERIES

Data Machines, Inc., Newport Beach, Calif., has developed a new low-cost line of digital computers called the DMI 610 series. Three machines in the series are now available — the DMI 610, 611 and 612.

Word size is 12 bits including sign. Memory is magneto-strictive delay line, packaged in modules of 256 words per module. Up to 16 memory modules (4096 words) may be used. The DMI 610, 611 and 612 computers have 28, 38 and 50 commands respectively plus special micro-instruction features. Input/output includes teletypewriter, paper tape reader and punch.



The DMI Series are well-suited for educational and training programs, problem solving, system control functions and a wide range of scientific applications.
(For more information, designate #48 on the Readers Service Card.)

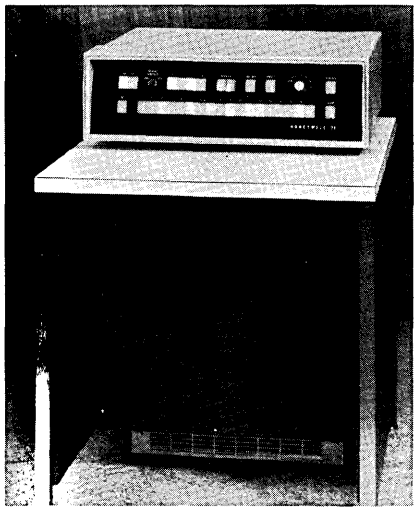
THE HONEYWELL 20 DIGITAL CONTROL SYSTEM

Honeywell Inc. has developed a low-cost general-purpose digital computer control system for industrial application. The new system, the Honeywell 20, incorporates microcircuit and advanced logic techniques. It uses a new and simplified control language said to cut programming costs appreciably.

The Honeywell 20 system uses either of two central processors which are functionally identical except for operating speeds. One, the Honeywell 21, has a 6-microsecond memory cycle and an average execution rate of 80,000 instructions per second. The other, Honeywell 22, has a 1.75 microsecond memory cycle and an average execution rate of 220,000 instructions per second.

The system's central processor (which can operate in a temperature range from 32° to 120° F. without air conditioning) has an 18-bit word length plus parity and memory guard bits. Its random access magnetic core memory is expandable from 2048 to 16,384 words, of which 8192 words are directly addressable. Programming features include indexing, indirect addressing, multi-level priority interrupts, and direct memory access channels.

The new control language, called CONTRAN, for Control Translator, is specifically designed for on-line computer control. It consists of English and mathematical statements and eliminates the need, Honeywell said, for assembly language that requires an intimate knowledge of machine characteristics. CONTRAN allows the process engineer, after only minimum training, to write compiler-level control programs.



— H21 central processor, console-mounted.

The Honeywell 20 system software package, Controlware, includes, in addition to CONTRAN, an augmented FORTRAN II compiler with process control statements, a Control Assembly Program (CAP), Executive Control Program, and an extensive library of process control, mathematical, diagnostic and utility routines, and control algorithms. (For more information, designate #46 on the Readers Service Card.)

LOCI-2

Wang Laboratories, Inc. of Tewksbury, Mass., has announced the introduction of a Companion Instrument to the LOCI-1, LOgarithmic Computing Instrument.

The LOCI-2 is an advanced model in the LOCI family of desktop computers. In addition to having all of the features of the LOCI-1 (see Computers and Automation, January 1965, p. 45), it has a card-reader for programmed operation and extra storage registers. The LOCI-2, operated as an extended calculator in the manual mode, is capable of performing addition, subtraction, multiplication, division and exponentiation, as well as taking logarithms and extracting roots. All these basic functions are computed in approximately 40 milliseconds, faster than many general purpose computers.

For programmed operation in the automatic mode, the LOCI-2 has a flexible repertoire of commands with which iterative procedures are easily and compactly coded. In particular, there are commands for making decisions and for constructing loops in a program.

Many problems are too tedious to attempt on a desk-calculator, but too small to justify the expense and effort of a general purpose computer. By switching back and forth between the manual and automatic modes, the LOCI-2 combines the versatility of the calculator with the powers of the computer.
(For more information, designate #50 on the Readers Service Card.)

UNIVAC 1824 MICROELECTRONIC AEROSPACE COMPUTER

A production model of the UNIVAC 1824 microelectronic aerospace computer is shown below.

It measures just 15 1/2 x 9 3/8 inches x 8 3/8 inches high, weighs under 46 pounds and consumes only 140 watts of power maximum. The 1824 has been successful in meeting the stringent high reliability, weight, power consumption, acceleration, vibration and temperature requirements imposed on present day aerospace computers. The completely thin-film memory consists of 4096 48-bit words of non-destructive readout (NDRO) and 512 24-bit words of destructive readout (DRO).

The 1824 now is a deliverable production line item of the Sperry Rand Corporation's UNIVAC Defense Systems Division, St. Paul, Minn. UNIVAC says it is the only aerospace computer in production anywhere in the U.S. The 1824 represents the first successful association of thin-film memory with 100 per cent integrated circuitry in an operational aerospace computer.
(For more information, designate #49 on the Readers Service Card.)

30% INCREASE IN THE OVERALL PROCESSING SPEED OF SYSTEM/360 MODEL 30

IBM Corporation, White Plains, N.Y., has announced developments which provide increases of up to 30 per cent in the overall processing speed of System/360 Model 30. Improved processing capability is the result of two factors. Model 30's memory cycle time, formerly 2.0 microseconds, has been reduced to 1.5 microseconds. This increase in memory speed is coupled with a 33 per cent increase in System/360 magnetic tape speeds. Both speed increases will be available at no additional cost.

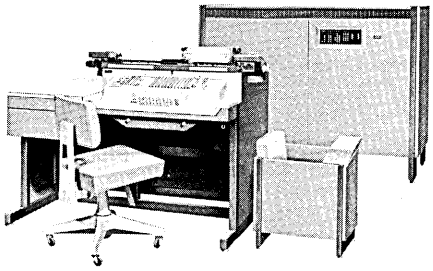
Other System/360 developments announced are: compatibility features which enable programs written for the IBM 1620 to be executed by System/360; and ability to select any printer characters for special graphic effects and arrange them in any sequence for maximum printing speed.
(For more information, designate #47 on the Readers Service Card.)

NCR SERIES 500

A low-cost series of highly flexible, modular computers has been developed by the National Cash Register Company, Dayton, Ohio. The new systems, called the NCR Series 500, are designed especially to bring electronic data processing to small and medium-size businesses which have been restricted in use of EDP because equipment on the market was not suited to their needs or pocketbooks.

The new Series 500 lies between the 395 electronic accounting system and the medium-scale

315 computer series. Its modularity permits growth from a modest first system to a sophisticated complex of equipment as the user's needs grow or change. Control center of any Series 500 system is an internally-stored magnetic-core alphanumeric processor. Basic memory size starts at 2400 and goes up to 4800 characters. Several different models of control consoles are available, providing a variety of capabilities.



— The magnetic-ledger-card system, shown above, is the smallest NCR Series 500 System. It includes a processor, control console with both alpha and numeric keyboards, and a multiform carriage printer. Input is available through magnetic ledger cards and keyboard entry. Output is through magnetic ledger cards and carriage printer.

NCR offers more than 20 different types of peripheral equipment specifically for the Series 500, including a buffered line printer with a speed of 125 lines a minute and a buffered card punch. Input and output equipment is available in both low-speed and medium-speed configurations. Input media for the Series 500 can be any one or a combination of punched paper tape, punched cards, optical type font, magnetic ledger cards or console entries. Processed data can be turned out in the form of magnetic ledgers, punched cards, punched tape or hard-copy records and reports.

O. B. Gardner, NCR's data processing vice president, reports that over 100 orders already have been taken for the new computer systems. First deliveries of the Series 500 systems are scheduled for this coming fall.
(For more information, designate #44 on the Readers Service Card.)

Software

ADVANCED VERSION OF ATOLL BEING DEVELOPED BY MESA

Mesa Scientific Corporation, Inglewood, Calif., has started work on a contract to develop and implement a formal language for the multi-computer, real-time checkout system of the Saturn V Apollo. An advanced version of the Acceptance, Test, Or Launch Language (ATOLL) will be formulated for the Saturn V launch complex at the Kennedy Space Center, Fla.

The advanced ATOLL will enable launch system engineers to write vehicle system and subsystem test procedures in the form of readable test-oriented language statements. The language will be oriented toward real-time operations and parallel processing as required by the Saturn V launch system.

When the language has been defined and accepted, it will be implemented for execution within the three-computer launch checkout system. Modes of executing the language statements will be determined in detail, in coordination with other system design efforts now underway at Huntsville. Mesa also is participating in the system design. Additionally, Mesa will define the support procedures required to maintain and operate the advanced ATOLL system.

The Saturn V vehicle, now being developed by the NASA Marshall Space Flight Center, Huntsville, Ala., and associated contractors, will be 360 feet tall and weigh 6,000,000 pounds at take-off.

RENO

A new program, called RENO, for renumbering the more popular computer languages into a new source with statement numbers arranged in ascending numerical order, has been developed by Computer Lanugage Research, Dallas, Texas. The principal uses of RENO are to reorganize an existing program into a logical order or to break the chain in linked programs. Number overlapping where chained programs are used or where a new program is constructed using parts from many existing programs is circumvented by RENO.

The new RENO program, utilizing sources written in such languages as FORTRAN, ALGOL, GECOM, COBOL, or WINNTRAN, punches a complete new source, providing a side-by-side listing of the new and old programs and a list of new and old statement numbers or labels. Provisions are made wereby the RENO control cards may be inserted to start or stop renumbering, change the increment between numbers, and start or by-pass punching sequence number.

RENO is the first of several computer software programs under development by Computer Language Research to become commercially available.
(For more information, designate #53 on the Readers Service Card.)

IBM DEMONSTRATES COMPATIBILITY BETWEEN COMPUTERS

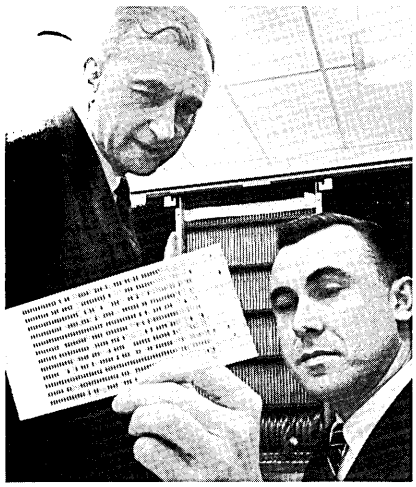
Without being altered in any way, programs written for the IBM 1401 were run on a new IBM System/360 Model 30 at increased speeds — and in a few cases as much as three times faster than on the 1401. Typical programs from more than 80 United States, Canadian and Swedish computer installations were processed at a recent demonstration at IBM's Endicott development laboratory.

More than 100 programs written for 1401 computers were run on a System/360 at the laboratory. They included a mutual fund capital gains analysis from the First National Bank of Jersey City; a payroll from the City of Los Angeles; and a tax debiting routine from the Swedish census bureau.

System/360 uses microprogramming techniques to execute programs written for the 1401 and other computers. Microprogramming enables a computer to interpret or amplify instructions in a variety of ways, triggering the computer's logic circuits to perform the proper operations.

As embodied in System/360's read-only storage, microprogramming provides two levels of computer compatibility. On one level it makes possible a single set of instructions for various models of System/360. On the second level it can provide compatiblity between

System/360 and fifteen currently installed IBM computers.



— One element of an IBM System/360 read-only storage is examined by Eugene R. Lee, senior data processing analyst for the City of Los Angeles (left), and C. B. Rogers, director of product programs for IBM's Data Processing Division. Dozens of perforated cards such as the one shown are combined in a read-only storage unit to interpret 1401 instructions so they can by understood by System/360.

This second level of compatibility, demonstrated at Endicott, is called emulation. Each instruction in the 1401 programs was interpreted by System/360's read-only storage, enabling the System/360 to carry out the desired operations. The System/360 Model 30 used an emulator called the 1401 compatibility feature. This enables the Model 30 to execute programs written for the IBM 1401, 1440 and 1460 computers.
(For more information, designate #54 on the Readers Service Card.)

'NETWORK EQUIVALENT ANALYSIS'

C-E-I-R, Inc., Arlington, Va., has developed a new proprietary computer program for the electric utility industry which permits representation of large electrical networks by smaller "equivalent" networks for more effective analysis and study.

The "network equivalent analysis" program may be used independently or in conjunction with three earlier analytical programs — "load flow", "short circuit", and "transient stability" — developed for electric utilities by C-E-I-R. Users of these programs will be able to employ the network equivalent analysis program with little additional input preparation.
(For more information, designate #55 on the Readers Service Card.)

Data Transmitters and A/D Converters

CARD TO TAPE CONVERTER

A hopper fed card to tape converter, designated the TPU-64, has been developed by Digital Electronics, Inc., Kansas City, Mo. Operating speed of the TPU-64 is 800 characters per minute. Tab cards and edge punched cards, either machine or hand punched, can be read with the same high degree of reliability.

The completely self-contained device is small in size and light weight for portability. It is designed for use in factory, numerically controlled machine tools, or office, standard card to tape conversion use. Optional features include: external keyboard, non-standard tape coding, alpha numeric printer (which prints all card data), and automatic control of data processing equipment — typewriters, printers, calculators, etc.
(For more information, designate #51 on the Readers Service Card.)

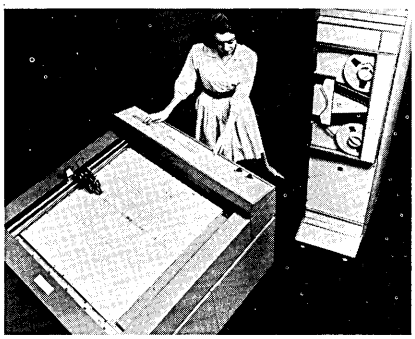
ADAGE OFFERS TWO NEW CONVERTERS

Adage, Inc., Cambridge, Mass., has added two new converters to its VOLDICON line of analog-to-digital converters — the VT13-AB and the VT7-AB. Based on a design combining techniques of successive approximation and parallel threshold decoding, the VT13-AB accomplishes a 14-bit analog-to-digital conversion in less than 4 microseconds. The 8-bit VT7-AB performs a complete conversion in under 800 nanoseconds. Maximum conversion rate is 200 kilocycles for the VT13-AB and 1 megacycle for the VT7-AB. Input ranges for both converters are ±5, ±10, ±20, or ±100 volts full scale with other values available on special order.
(For more information, designate #52 on the Readers Service Card.)

Input-Output

EAI INTRODUCES NEW DATAPLOTTER

A new compact, solid-state X-Y plotter has been introduced by Electronic Associates, Inc., West Long Beach, N.J. This instrument, called the 3500 DATAPLOTTER®, provides graphic display of computer generated information on a 30" x 20" or 45" x 60" plotting surface. In the off-line plotting mode, information can be fed to the plotter from magnetic tape, punched paper tape or cards, as well as entered manually from a keyboard. In the on-line mode, information can be fed directly from a computer.



— 3500 DATAPLOTTER®

Speed and accuracy at low cost are the key features of this device. The 3500 DATAPLOTTER can draw lines to within 0.015 of an inch between two points and can position points to within an accuracy of ±0.05 per cent. Lines can be drawn by the plotter at speeds in excess of 2000 per minute — plotting points at the rate of 350 per minute — and labeling and annotating are made at the rate of 180 per minute using an alpha-numeric symbol printer.

A wide range of application includes data reduction, engineering plans and surveys, business graphs, and meteorological and aerospace data.
(For more information, designate #61 on the Readers Service Card.)

IBM 1260 ELECTRONIC INSCRIBER

IBM Corporation, White Plains, N.Y., has developed a new electronic inscriber which enables banks to increase the speed and efficiency of proof and transit operations. The device, called

the IBM 1260 electronic inscriber, can be used to prove a deposit and simultaneously record information in magnetic ink on the check or deposit slip. Documents inscribed by the 1260 can be processed by any computer system with MICR capability, including IBM System/360. Solid Logic Technology circuits with an operating speed of 700 nanoseconds have been applied to the inscribing function.

The 1260's speed and versatility results from its ability to perform several functions simultaneously, thus reducing multiple handling of documents. In a single operation, it can automatically: magnetically inscribe a document with dollar amount, deposit analysis data and control information; list the document on an adding-machine tape for future verification; prove, endorse and serially number the document; and distribute it into one of up to eight pockets.

Three different programs, or methods of handling documents, can be set up at one time in the 1260 through the use of pluggable Solid Logic Technology circuit cards. The program required for a particular application, such as assigning distribution entries or crediting totals, is selected by turning a dial.

The device will be manufactured at IBM facilities in Rochester, Minn., with deliveries scheduled to begin in the first quarter of 1966.
(For more information, designate #58 on the Readers Service Card.)

DIGITAL STRIP PRINTER

A high-speed digital strip printer that prints data at the rate of 23 lines per second has been developed by the DATA/LOG division of Litton Industries, San Francisco, Calif.

The drum-type printer, called the Monroe DATA/LOG MC 13-80, accepts any four-line code using solid state electronics. Models are available with 4, 8, 12 or 16 printing positions. Each position prints characters 0 through 9.

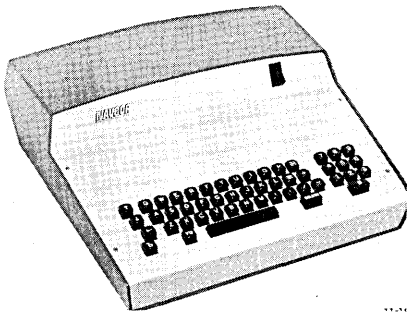
The MC 13-80 (meaning 1380 lines per minute) is of modular construction with self-contained power supply, timing circuitry and conversion matrix. It is shock-mounted and silenced. Registers for 250 microsecond transfer time and high-order zero suppression are available.

The MC 13-80 was designed for data logging applications.
(For more information, designate #59 on the Readers Service Card.)

NAVCOR SERIES 1050 KEYBOARDS

Navigation Computer Corp. (NAVCOR), Norristown, Pa., have announced its Series 1050 all-purpose Keyboards as part of a new line of tape punches and readers.

Series 1050 Keyboards are available in both numeric and alphanumeric forms. Codes are selected simply by plugging in a printed circuit card. Timing and control functions are entirely electronic. Each key magnetically operates a sealed glass reed switch, insuring high reliability even under severe environmental conditions. The keys themselves are interlocked to prevent double-strike errors. They are offered in several different configurations.

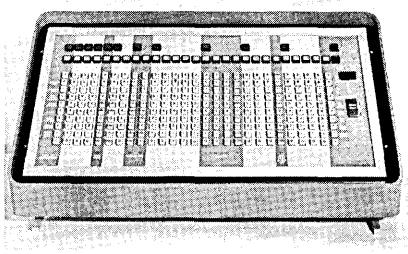


Options include a choice of direct electrical outputs from the reed switches through a diode matrix, or buffered parallel or serial outputs at any specified logic levels. Timing pulses are also available as outputs.
(For more information, designate #56 on the Readers Service Card.)

TPU-28, KEYBOARD TAPE-CARD PUNCH

The TPU-28 is a 28 bank keyboard to tape or card punch device developed by the Digital Electronics, Inc., Kansas City, Mo. It can be used for data preparation whenever further processing of that data is required.

In the standard device, one or two entry columns can be used to set up supervision circuits so that programmed fields must be filled with data before punching will occur. Lights are lit over



the columns where data must be entered and go out when data is entered. Automatic characters can be preprogrammed and punched at the beginning and end of each block of tape.
(For more information, designate #57 on the Readers Service Card.)

Components

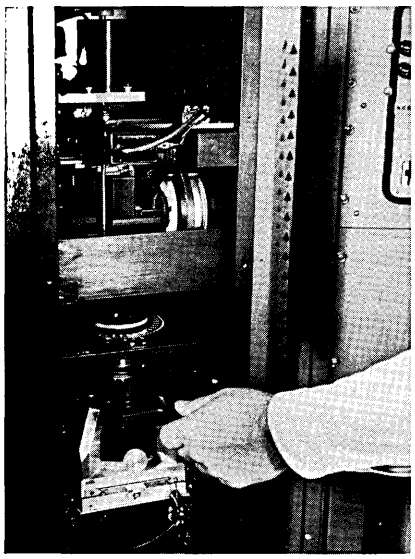
AUTOMATIC DRAWING MACHINE MAPS MICROSCOPIC ELECTRONIC CIRCUITS

An automatic line-drawing machine that simplifies the production of tiny electronic circuits has been developed by the National Cash Register Company for the Air Force Avionics Laboratory. NCR's Advanced Development Division has delivered the experimental device under a contract to provide a new approach in making "masks" for microcircuitry.

Conventional maskmaking is done with a complicated graphic and photo-reduction process to produce a photo master the exact size of the finished circuit. The masters are then contact printed on silicon wafers to form electrical paths for the ultra-miniature circuits.

With the new device, NCR researchers said, the entire photo-reduction maskmaking process can be side-stepped. A lens system in the machine focuses a tiny dot of light directly on the final master photoplate, which is placed on a movable stage. The stage is then moved in extremely small increments through coded instructions from punched paper tape. The result is that the dot of light on the moving plate traces the desired image, or "map" of the circuit.

The machine is progammed by the punched paper tape to "draw" the circuit lines in the exact size required, eliminating complicated and exacting reductions.



Quality of the finished product is said to be excellent, offering a selection of line widths from five one-thousandths of an inch to one ten-thousandth of an inch. The finished image is accurate to less than one fifty-thousandth-inch line.

In addition to eliminating many processing steps in the conventional method by drawing circuits in final size, the method permits any mask to be remade at a later date with assurance that it will register with other masks of the set. Thus, design modifications are easily made in the circuits by localized changes in the mask programs.

An NCR spokesman said circuit development cost and time could be considerably reduced with the machine. He said the concept represents a major new development in the production of integrated circuits.

DENSIMAG® MAGNETIC TAPE

A new magnetic tape, called DENSIMAG®, can withstand temperatures up to 600°F for prolonged periods of time and has improved magnetic and handling characteristics. It has been developed by the Whittaker Corporation, Los Angeles, Calif.

The new Whittaker tape has a metallic magnetic coating over a non-magnetic stainless steel substrate. In addition to its high temperature capability, its physical properties overcome the problems of brittleness or fragility, common among homogeneous metal tapes currently available. Because of its packing density capability, twice as much information can be stored in a given area as on current tapes.

Residual magnetic induction or magnetic intensity is approximately 7500 Gauss which is a factor of 10 higher than oxide tapes. The equivalent recording signal level of oxide tapes can be obtained by DENSIMAG with only one-tenth the thickness of the coating. Whittaker engineers say that the smooth and homogeneous coating will wear indefinitely. The coating will have nominal wearing effect on recording heads and will resist particle attachment and scoring.

Obvious uses for the new tape are those with temperature, sterilization or elasticity problems. It is presently being produced by a continuous process in widths varying from 1/4 to 2 inches. Limited amounts are available now with volume production of DENSIMAG planned to begin during the first half of this year.
(For more information, designate #63 on the Readers Service Card.)

NEW LITERATURE

"INPUT-OUTPUT" BOOKLET AVAILABLE FROM C-E-I-R

A new 24-page booklet, describing how business and government agencies can make practical use of new economic "input-output" tables published by the U. S. Department of Commerce, is now available. Copies of the publication, entitled "What if?", may be obtained free of charge from C-E-I-R, Inc.

The recent release by the Commerce Department of "input-output" tables showing the complex inter-relationships between 86 industrial groups — the first such release in 17 years — "puts at our disposal a powerful tool to remove much of the guesswork from vital areas of forecasting, planning, expansion and investment", the booklet points out. Use of the tables not only will make business and government predictions more accurate, but also will enable a businessman to determine how changes in consumer demand, taxes, defense expenditures and the like affect his own enterprise.
(For more information, designate #65 on the Readers Service Card.)

DPMA PUBLISHES BOOKLET ON BASICS OF AUTOMATIC DATA PROCESSING

The ABC's of ADP, a twenty-five page booklet describing the basic principles of automatic data processing is available from Data Processing Management Association.

The booklet, authored by James A. Campise of Computer Sciences Corporation and Max L. Wagoner of the Bendix Corporation, was written to introduce ADP to high school and college students, as well as managers who must familiarize themselves with fundamental data processing concepts. It treats such subjects as unit record and computer principles, business and scientific data processing, hardware and software, data processing personnel requirements, and the problems facing ADP management.

Single copies of ABC's of ADP are available on request. Additional copies are fifteen cents each, postpaid, with minimum orders of ten copies.
(For more information, designate #66 on the Readers Service Card.)

GUIDE TO INFORMATION SOURCES FOR SCIENTISTS AND ENGINEERS

The National Referral Center for Science and Technology at the Library of Congress recently has published a new directory to help meet the information needs of scientists and engineers. The 356-page book is entitled A Directory of Information Resources in the United States: Physical Sciences, Biological Sciences, Engineering.

The volume contains narrative descriptions of the subject specialization, information services, and publications of some 1100 organizations and institutions throughout the United States. Professional societies, academic research groups, industrial firms, Government offices, and technical libraries are included.

Copies may be purchased at $2.25 each from the Superintendent

of Documents, Government Printing Office, Washington, D.C. 20402.

COMPUTER EQUIPMENT BULLETIN

Free copies are available of Information Processing Systems' latest Equipment Bulletin describing used electronic data processing equipment for sale. Used equipment wanted by buyers is also listed.
(For more information, designate #64 on the Readers Service Card.)

DIGITAL LOGIC HANDBOOK AVAILABLE

Computer Logic Corporation has announced the availability of its new 80-page Digital Logic Handbook. The handbook contains design and circuit application information relative to the CLC compatible family of digital logic plug-in circuits.

Subjects covered include an explanation of CLC Digital Logic, Boolean Algebra, waveform techniques, level-shifting at no cost, zero-cost gating, logic counters, thin film memories, analog-digital conversion, least-cost high-speed memories, and various system techniques.

The Handbook may be obtained for $1.00, plus 25¢ to cover shipping.
(For more information, designate #67 on the Readers Service Card.)

MEETING NEWS

THIRD NATIONAL AUTOMATION CONFERENCE OF THE A.B.A.

"Man-Machine Relationships" will be the theme of the Third National Automation Conference of the American Bankers Association to be held in San Francisco (Calif.) March 8-10. The general sessions will be held in the Masonic Auditorium.

An advance program featuring "subjects that concern management-level officers in banks of all sizes" has been announced by Conference Chairman A. R. Zipf, senior vice president, Bank of America N.T. & S.A., San Francisco. The keynote speaker on Monday morning (March 8) will be Thomas J. Watson Jr., chairman of the board, IBM Corporation, New York. Other major addresses will be delivered by: Reno Odlin, A.B.A. president and chairman, The Puget Sound National Bank, Tacoma, Wash.; Dr. Louis Rader, vice president and general manager of industrial electronics division, General Electric Co., New York; Fletcher Jones, president, Computer Sciences Corp., El Segundo, Calif.; and Chairman Zipf.

Concurrent sessions are being held in several hotels starting Monday afternoon, with special tutorial sessions scheduled Tuesday morning. This is being done in order to cover vital subjects in the allotted time and to permit in-depth treatment of specialized areas.

Among topics at Monday afternoon sessions will be "management Orientation for Automation", "Automation's Impact on Personnel and the Organization", "Computer Accounting Techniques", "Marketing's Newest Tool: the Computer", and "A Realistic Look at Programming Techniques and Software".

Tuesday's agenda includes a "Status Report on Banking Automation" and concurrent workshops on "Approaches to Small Bank Automation", "Trust Automation", "Savings Automation", "New Customer Services", and "Aids to Management Decision Making". Case history studies of small bank automation and automation tips on several matters of interest to larger banks will be offered at Wednesday morning's sessions. The Conference will close Wednesday afternoon with six more concurrent sessions.

IEEE CONFERENCE BATCH FABRICATION AND FUTURE COMPUTERS

Computer industry representatives from throughout the nation will meet, in Los Angeles (Calif.) April 6-8, to explore the effects of fast-developing batch fabrication techniques on future computers. The conference, according to General Chairman L. C. Hobbs, will discuss expected transitions in the computer industry.

The conference pace will be set by Dr. Simon Ramo, president of Bunker-Ramo Corp., with the keynote address, "The Needed Economic Breakthrough in Electronics". If electronic advances are to be of wide benefit to society, they must be financially feasible, according to Dr. Ramo, who will discuss the prospects.

Batch fabrication is a term used to define identical components which have been created simultaneously in quantity through a highly standardized production process. Units which can be batch fabricated include microelectronic components, memories, displays, interconnections, input-output and bulk storage devices. Aspects of batch fabrication technologies and their effect on logic and memory, machine organization, system design, programming, professional education and broad social implications will be discussed at seven technical sessions.

Technical papers, written by men working in the field, have been distributed to advance registrants for study. Papers will not be formally presented, and open discussions will permit attendees to inject new materials and opposing views. Informal evening discussions and a Thursday luncheon address by Col. Arthur C. Lowell, Santa Clara, Calif., will complete the program.

Registration may be made at the conference to be held at the Thunderbird Hotel (Los Angeles, Calif.), or by writing Donald Meier, 1401 El Segundo Blvd., Hawthorne, Calif., before April 1.

IFIP CONGRESS 65

The triennial meeting of the 23-nation federation of professional and scientific organizations in the computer and information processing field is to be held in the USA for the first time; previous conferences were held in Paris and Munich. IFIP CONGRESS 65 will be held in New York City from May 24 to 29, 1965.

About 5000 people from all over the world are expected to attend its scientific program; many more will be attracted to Interdata 65 — the IFIP Congress Exhibition. The American Federation of Information Processing Societies (AFIPS) has omitted its own national meeting (the Spring Joint Computer Conference), normally scheduled for that time, so that its members may act as U. S.

hosts and participate fully in IFIP CONGRESS 65.

BUSINESS NEWS

IBM REPORTS INCREASED PROFITS

IBM's consolidated gross income for the year ended December 31, 1964, was $3,239,359,581, an increase of $376,626,854, or 13.2% over 1963. Gross income from domestic operations increased 11.1%, with regular products increasing 13.9% and space and defense products gross income showing a 25.6% decrease compared with 1963. Gross income from foreign operations showed an increase of 18.5%.

Worldwide consolidated net earnings after taxes amounted to $431,159,766, an increase of $66,904,788 over the previous year.

Consolidated gross income included $933,400,319 from foreign operations, an increase of $145,391,008 over 1963. Net earnings from foreign operations were $123,998,898 in 1964, an increase of $19,394,846 over the year before.

IBM's total assets at the end of the year amounted to $3,309,152,915. During 1964, the company's increased volume of business and replacement of obsolete equipment required an investment of $723,906,108 in factories, offices, rental machines and parts.

HONEYWELL SALES, EARNINGS SET RECORDS

Sales and earnings of Honeywell Inc. reached record highs in 1964, the company reports.

Indicated earnings for the year ended December 31 were $41,389,166, up approximately 19 per cent over the previous year. Earnings in 1963 were $34,669,623.

Sales for the year increased 3 per cent to $667,193,406, as against $648,481,914 in 1963.

Indicated fourth quarter earnings were $14,871,531 compared to $10,993,934 in the comparable period last year. Fourth quarter earnings include 11 cents per share arising out of investment credits and other tax adjustments. Fourth quarter sales increased to $188,041,692, as against $178,450,195 in the same quarter in 1963.

Honeywell's Chairman Wishart said the company's electronic data processing activities made major gains -- "in some respects greater than we estimated at the beginning of the year.

"Bookings, shipments and revenues were at all-time highs," he disclosed. "The volume of computer systems shipped during the year exceeded $100 million by a healthy margin.

SCIENTIFIC DATA SYSTEMS REPORTS 1964 RESULTS

A record year of sales and earnings is reported for Scientific Data Systems by SDS President Max Palevsky.

In preliminary results for the year ended December 31, 1964, total revenues at SDS increased to an estimated $20,442,500 from $7,721,500 for 1963. Net income was $2,173,400 for 1964 as compared to $1,310,700 last year.

The total number of employees also rose last year to 1,400 from 450 in 1963.

Mr. Palevsky estimated that on the basis of current increased digital computer shipments, SDS now ranks seventh in the industry.

Commenting on current negotiations to acquire Consolidated Systems Corporation, Mr. Palevsky stated that discussions are proceeding satisfactorily with Allis-Chalmers Manufacturing Company and Bell and Howell Company, joint owners of CSC, a producer of electronic data systems for the industrial and aerospace fields with sales of approximately $10-million in 1964.

DATA PRODUCTS REPORTS EARNINGS

Data Products Corp. reported a profit of $10,554 from sales of $1,856,811.00 for the 3rd Quarter ended December 26, 1964. During the same period in 1963 the company reported a profit of $216,394 from sales of $1,781,938. The company has sustained a loss of $150,342.00 from sales of $5,831,337.00 for the nine months ended December 26, 1964 as compared with a profit of $470,767.00, or 22¢ per share, from sales of $4,932,660.00 for the like period one year ago.

Backlog of firm orders at the end of the 3rd Quarter was $2,913,071.00.

CALCOMP LISTED ON AMEX

Common stock of California Computer Products, Inc., Anaheim-based manufacturer of digital plotting equipment, was listed last month on the American Stock Exchange and on the Pacific Coast Stock Exchange.

Listed on the Exchanges were 659,527 shares of California Computer common stock which was formerly traded over-the-counter. The company currently has more than 1300 shareholders.

California Computer Products, Inc., develops, manufactures and sells digital plotting equipment for business and industrial uses. The company's business is about 25 percent government and 75 percent commercial.

In the fiscal year ended June 30, 1964, California Computer Products, Inc., reported net earnings of $459,000 or 73¢ per share (based upon the average number of shares outstanding, adjusted for stock splits and stock dividends), on sales of $5,157,000.

The company reported net income of $107,307 for the first quarter of fiscal 1965, compared with earnings of $12,585 for the like period last year. Profit for the first quarter was 16½ cents per share on 651,227 shares outstanding, compared with 2 cents per share on 614,250 shares outstanding the prior year.

MONTHLY COMPUTER CENSUS

The number of electronic computers installed or in production at any one time has been increasing at a bewildering pace in the past several years. New vendors have come into the computer market, and familiar machines have gone out of production. Some new machines have been received with open arms by users — others have been given the cold shoulder.

To aid our readers in keeping up with this mushrooming activity, the editors of COMPUTERS AND AUTOMATION present this monthly report on the number of general purpose electronic computers of American-based companies which are installed or on order as of the preceding month. These figures included installations and orders outside the United States. We update this computer census monthly, so that it will serve as a "box-score" of progress for readers interested in following the growth of the American computer industry, and of the computing power it builds.

Most of the installation figures, and some of the unfilled order figures, are verified by the respective manufacturers. In cases where this is not so, estimates are based on information in the market research reference files of COMPUTERS AND AUTOMATION. The figures are then reviewed by a group of computer industry cognoscenti.

Any additions, or corrections, from informed readers will be welcomed.

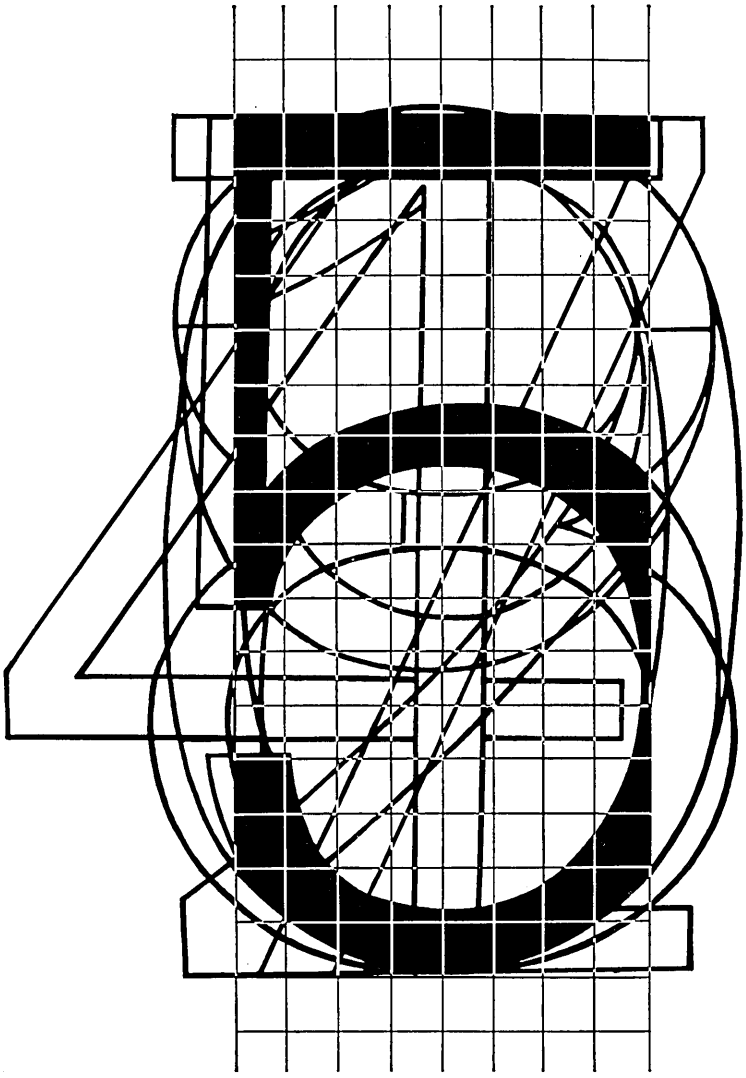
AS OF FEBRUARY 10, 1965

NAME OF MANUFACTURER	NAME OF COMPUTER	SOLID STATE?	AVERAGE MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTALLATIONS	NUMBER OF UNFILLED ORDERS
Addressograph-Multigraph Corporation	EDP 900 system	Y	$7500	2/61	11	1
Advanced Scientific Instruments	ASI 210	Y	$2850	4/62	22	0
	ASI 2100	Y	$3000	12/63	6	0
	ASI 6020	Y	$2200	4/65	0	3
	ASI 6040	Y	$2800	7/65	0	3
Autonetics	RECOMP II	Y	$2495	11/58	60	X
	RECOMP III	Y	$1495	6/61	15	X
Bunker-Ramo Corp.	BR-230	Y	$2680	8/63	7	2
	BR-300	Y	$5000	3/59	40	X
	BR-330	Y	$5000	12/60	30	X
	BR-340	Y	$7000	12/63	13	7
	BR-530	Y	$6000	8/61	12	X
Burroughs	205	N	$4600	1/54	61	X
	220	N	$14,000	10/58	40	X
	E101-103	N	$875	1/56	100	X
	B100	Y	$2800	8/64	23	27
	B250	Y	$4200	11/61	96	5
	B260	Y	$3750	11/62	125	115
	B270	Y	$7000	7/62	122	24
	B280	Y	$6500	7/62	60	30
	B370	Y	$8400	7/65	0	22
	B5000/B5500	Y	$20,000	3/63	35	3
Clary	DE-60/DE-60M	Y	$525	2/60	281	3
Computer Control Co.	DDP-19	Y	$2800	6/61	3	X
	DDP-24	Y	$2500	5/63	51	12
	DDP-116	Y	$900	2/65	0	24
	DDP-224	Y	$3300	2/65	0	14
Control Data Corporation	G-15	N	$1000	7/55	325	X
	G-20	Y	$15,500	4/61	28	X
	160*/160A/160G	Y	$1750/$3400/$12,000	5/60;7/61;3/64	416	8
	924/924A	Y	$11,000	8/61	28	1
	1604/1604A	Y	$38,000	1/60	60	X
	3100	Y	$7350	12/64	2	14
	3200	Y	$12,000	5/64	33	35
	3300	Y	$15,000	7/65	0	25
	3400	Y	$25,000	11/64	3	15
	3600	Y	$58,000	6/63	34	17
	3800	Y	$60,000	5/65	0	16
	6400	Y	$40,000	12/65	0	1
	6600	Y	$110,000	8/64	2	6
	6800	Y	$140,000	4/67	0	0
Digital Equipment Corp.	PDP-1	Y	$3400	11/60	57	2
	PDP-4	Y	$1700	8/62	54	6
	PDP-5	Y	$900	9/63	98	12
	PDP-6	Y	$10,000	10/64	3	8
	PDP-7	Y	$1300	11/64	5	14
	PDP-8	Y	$525	4/65	0	45
El-tronics, Inc.	ALWAC IIIE	N	$1820	2/54	24	X
Friden	6010	Y	$600	6/63	180	165
General Electric	205	Y	$2900	10/64	11	16
	210	Y	$16,000	7/59	57	X
	215	Y	$5500	11/63	38	6
	225	Y	$7000	1/61	135	5
	235	Y	$10,900	12/63	32	12
	415	Y	$5500	5/64	30	75
	425	Y	$7500	7/64	13	40
	435	Y	$12,000	10/64	4	20
	455	Y	$18,000	6/65	0	2
	465	Y	$24,000	6/65	0	1
	625	Y	$50,000	12/64	1	11
	635	Y	$65,000	12/64	1	16
General Precision	LGP-21	Y	$725	12/62	143	X
	LGP-30	semi	$1300	9/56	430	X
	RPC-4000	Y	$1875	1/61	98	X
Honeywell Electronic Data Processing	H-200	Y	$6000	3/64	260	545
	H-300	Y	$3900	7/65	0	10
	H-400	Y	$8500	12/61	108	5
	H-800	Y	$22,000	12/60	70	15

NAME OF MANUFACTURER	NAME OF COMPUTER	SOLID STATE?	AVERAGE MONTHLY RENTAL	DATE OF FIRST INSTALLATION	NUMBER OF INSTALLATIONS	NUMBER OF UNFILLED ORDERS
Honeywell (cont'd.)	H-1400	Y	$14,000	1/64	9	2
	H-1800	Y	$30,000	1/64	5	8
	H-2200	Y	$12,000	10/65	0	26
	DATAmatic 1000	N	$40,000	12/57	4	X
H-W Electronics, Inc.	HW-15K	Y	$490	6/63	3	X
IBM	305	N	$3600	12/57	200	X
	360/20	Y	$1800	12/65	0	1300
	360/30	Y	$4800	5/65	0	2220
	360/40	Y	$9600	5/65	0	555
	360/50	Y	$18,000	7/65	0	280
	360/60	Y	$35,000	8/65	0	45
	360/62	Y	$50,000	9/65	0	20
	360/70	Y	$80,000	10/65	0	60
	650-card	N	$4000	11/54	280	X
	650-RAMAC	N	$9000	11/54	55	X
	1401	Y	$4500	9/60	8050	675
	1401-G	Y	$1900	5/64	625	150
	1410	Y	$12,000	11/61	760	110
	1440	Y	$3500	4/63	1400	780
	1460	Y	$9800	10/63	1000	200
	1620 I, II	Y	$2500	9/60	1700	30
	701	N	$5000	4/53	1	X
	7010	Y	$19,175	10/63	64	25
	702	N	$6900	2/55	8	X
	7030	Y	$160,000	5/61	6	X
	704	N	$32,000	12/55	48	X
	7040	Y	$14,000	6/63	88	50
	7044	Y	$26,000	6/63	40	12
	705	N	$30,000	11/55	65	X
	7070, 2, 4	Y	$24,000	3/60	360	20
	7080	Y	$55,000	8/61	71	2
	709	N	$40,000	8/58	11	X
	7090	Y	$64,000	11/59	80	8
	7094	Y	$70,000	9/62	150	20
	7094 II	Y	$76,000	4/64	40	30
ITT	7300 ADX	Y	$18,000	7/62	9	6
Monroe Calculating Machine Co.	Monrobot IX	N	Sold only - $5800	3/58	155	X
	Monrobot XI	Y	$700	12/60	510	155
National Cash Register Co.	NCR - 304	Y	$14,000	1/60	26	X
	NCR - 310	Y	$2000	5/61	46	1
	NCR - 315	Y	$8500	5/62	270	115
	NCR - 390	Y	$1850	5/61	785	120
	NCR - 500	Y	$1500	9/65	0	130
Philco	1000	Y	$7010	6/63	15	0
	2000-210, 211	Y	$40,000	10/58	19	3
	2000-212	Y	$52,000	1/63	5	2
	2000-213	Y	$68,000	6/65	0	1
Radio Corp. of America	Bizmac	N	$100,000	-/56	3	X
	RCA 301	Y	$6000	2/61	556	40
	RCA 3301	Y	$11,500	7/64	15	33
	RCA 501	Y	$14,000	6/59	97	2
	RCA 601	Y	$35,000	11/62	4	1
	Spectra 70/15	Y	$2600	11/65	0	45
	Spectra 70/25	Y	$5000	11/65	0	25
	Spectra 70/45	Y	$9000	3/66	0	30
	Spectra 70/55	Y	$14,000	5/66	0	12
Raytheon	250	Y	$1200	12/60	160	15
	440	Y	$3500	3/64	9	11
Scientific Data Systems Inc.	SDS-92	Y	$900	2/65	0	22
	SDS-910	Y	$2000	8/62	110	30
	SDS-920	Y	$2700	9/62	70	8
	SDS-925	Y	$2500	12/64	1	10
	SDS-930	Y	$4000	6/64	13	20
	SDS-9300	Y	$7000	11/64	1	6
UNIVAC	I & II	N	$25,000	3/51 & 11/57	30	X
	III	Y	$20,000	8/62	85	10
	File Computers	N	$15,000	8/56	22	X
	Solid-State 80, 90, & Step	Y	$8000	8/58	320	X
	Solid-State II	Y	$8500	9/62	40	2
	418	Y	$11,000	6/63	10	7
	490	Y	$26,000	12/61	39	16
	1004	Y	$1900	2/63	2100	350
	1050	Y	$8000	9/63	130	210
	1100 Series (except 1107)	N	$35,000	12/50	13	X
	1107	Y	$45,000	10/62	24	5
	1108	Y	$50,000	7/65	0	14
	LARC	Y	$135,000	5/60	2	X
				TOTALS	24,813	9549

X = no longer in production.

* To avoid double counting, note that the Control Data 160 serves as the central processor of the NCR 310. Also, many of the orders for the IBM 7044, 7074, and 7094 I and II's are not for new machines but for conversions from existing 7040, 7070 and 7090 computers respectively.



What tells the machine, "I am a 5"?

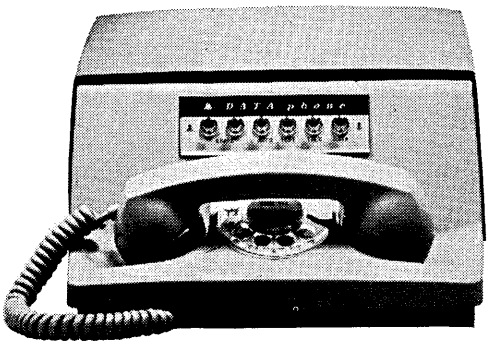
Designing recognition logic is a key to developing systems for recognizing handwriting, multifont printing, or magnetic-ink characters. Engineers face the questions: What minimum information must the scanner sense from a character, and what measurements are necessary to ensure accurate recognition?

There are a number of aspects of character recognition you might work on: computer simulation of new recognition logic, investigation of the probability of accurate recognition for different styles of writing or printing, or development of new methods of scanning the characters.

The field of character recognition and associated areas such as document handling could be of great potential for you at IBM. Write to Manager of Employment, Dept. 539C, IBM Corporate Headquarters, Armonk, New York 10504.

An Equal Opportunity Employer **IBM**®

10 cps
250 cps
5100 cps
62,500 cps



No problem

Bell System data communications services can move your business data at a wide range of speeds; speeds that are compatible with your data processing equipment.

Transmission can be over regular or private-line telephone circuits, across town or nation, by day or by night.

Data communications services can add new scope and usefulness to your present EDP system, or to one you may be planning.

Discuss it with one of our Communications Consultants. He's a trained specialist in data communications. Just call your Bell Telephone Business Office and ask for his services.

Bell System
American Telephone and Telegraph Co.
and Associated Companies

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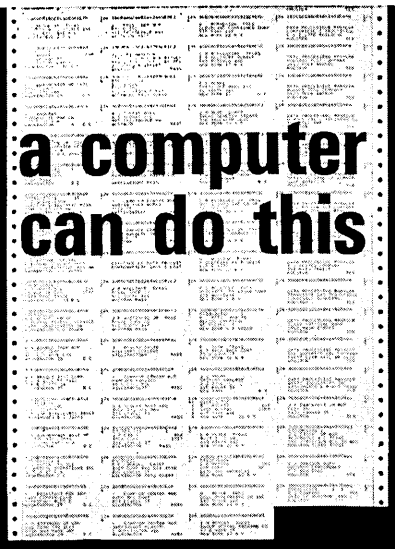
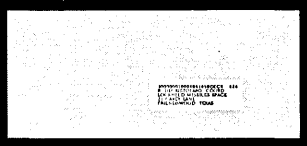
a computer can do this



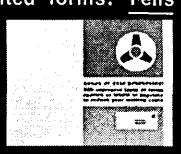
a Cheshire can do this



or this

Your data processing system can store address data as well as other information. It can also "print out" these addresses onto continuous forms. A Cheshire machine can apply these address-printed forms as labels to mail pieces automatically, at high speeds. Or it can heat-transfer the address image from the form for a clear black address image. This reduces mailing costs. It also eliminates the need for separate addressing systems and their costly maintenance.

WRITE FOR NEW BROCHURE!
Shows how Cheshire machines apply computer-printed forms. Tells how this reduces mailing costs!



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Incorporated

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• programmers, business or scientific • numerical analysts • data reduction specialists • logic designers • systems analysts • data communications • memory systems specialists • operation researchers • systems and procedures specialists • circuit designers • mathematicians • information science specialists • simulation specialists NATIONAL COVERAGE/FEE PAID/EXCLUSIVELY FOR THE PROFESSIONAL

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NEW PATENTS

RAYMOND R. SKOLNICK
Reg. Patent Agent
Ford Inst. Co., Div. of Sperry Rand Corp., Long Island City 1, New York

The following is a compilation of patents pertaining to computer and associated equipment from the "Official Gazette of the U. S. Patent Office," dates of issue as indicated. Each entry consists of patent number / inventor(s) / assignee / invention. Printed copies of patents may be obtained from the U. S. Commissioner of Patents, Washington 25, D. C., at a cost of 25 cents each.

December 1, 1964

3,159,810 / Phillip Fire, Sunnyvale, Calif. / Sylvania Electric Products, Inc. / Data Transmission Systems with Error Detection and Correction Capabilities.

3,159,818 / John R. Scantlin, Los Angeles, Calif. / Scantlin Electronics, Inc. / Data Storage System with Selective Readout.

3,159,820 / Hoeckley Oden, Korntal, Wurttenberg, Germany / International Standard Electric Corp. / Information Storage Device.

3,159,821 / Thomas D. Rossing, Northfield, Minn. / Sperry Rand Corp. / Magnetic Core Matrix.

3,159,823 / Frederick J. T. Dow, North Billerica, Richard E. Morley, Bedford

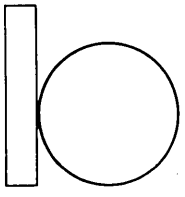
OPPORTUNITIES in data processing

Brandon Applied Systems, Inc., is a technical consulting firm performing project work in data processing for leading users and equipment manufacturers. We also assist our clients in filling challenging positions in data processing management. Periodically we will publish requirements for our clients and for our own Company. There is no fee for this service.

We are presently screening resumes for the following openings:

1. **Computer Systems Specialist** — Top level position in strong methods department. Must have heavy administrative experience in computer systems areas — IBM oriented. Potential manager. National multi-corporate organization. Position in New York City.
2. **Associate** — 6 years of data processing systems experience, including minimum of 2 years of programming. Applications variety, multiple computer knowledge preferred. Technical writing ability highly desirable.
3. **Programming Manager** — Able to direct small systems and programming staff. Minimum 4 years programming and management experience, preferably with IBM systems. Multiple application, software development and consulting experience desirable.
4. **Programming Specialist** — Staff function reporting to Programming and Systems Manager. Develops and maintains standards, software aids, and utility systems for multi-location installations. Studies equipment and makes recommendations to management. 5 years of programming and systems experience required with emphasis on comparable responsibility. New York City location.
5. **Senior Programmer** — Direct a team of programmers in N.Y.C.: commercial EDP installation. 3-5 years of experience in data processing systems including programming on 705-7080 and supervisory responsibility.
6. **Programmers** — 3 years of programming experience. Commercial applications and multiple computer experience desirable. Software design. Growth potential.

Please submit separate resume for each position, including salary requirements and position for which you are applying to:
Vice-President Operations.



BRANDON APPLIED SYSTEMS, INC.

30 East 42nd Street, New York, New York 10017 YUkon 6-1518

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and William J. Gorman, Billerica, Mass. / Laboratory for Electronics, Inc. / Magnetic Disc Storage Device.

3,159,828 / William W. Davis, Minneapolis, Minn., Arthur V. Pohm, Ames, Iowa / Sperry Rand Corp. / Binary to Decimal Matrix Converter.

December 8, 1964

3,160,819 / Cyrus J. Creveling, Oxion Hill, Md. / USA as represented by the Secretary of the Navy / "Exclusive Or" Logical Circuit.

3,160,856 / Byron E. Phelps and Joseph J. Sochor, Poughkeepsie and Arthur A. Kusnick, Peekskill, New York / International Business Machines Corp. / Data Processing Machine.

3,160,857 / Donald I. Frush, Endwell, New York / IBM / Data Transfer Control and Check Apparatus.

C&A MARKET REPORT
(Continued from Page 9)

Answers ranged from a few minutes to several hours, depending on the size and complexity of the program.

Q4: What was the running time of the liberated program on the H-200 compared with the 1400 series machine?

Users found translated programs ran "just a little faster" to "twice as fast" on the H-200. An exception were sorts which in some cases ran five to six times faster on the H-200.

Q5: What areas of improvement are needed?

Generally people were well pleased with the success of the Liberator approach, saying that it was more successful than they had anticipated. Several people mentioned that better documentation was needed so that the user could translate programs without elbow-level guidance from the manufacturer's representative... many of which were described as being still too inexperienced in the industry to be of substantial help.

In sum, the Liberator approach, which was discounted by many when first announced, seems to have been quite successful for the user as a working tool in overcoming the normally costly chore of program conversion.

Considerable user experience with various program conversion approaches will no doubt be logged this year, and we would appreciate receiving from readers brief accounts of their experiences in this important area. From time to time we will try to summarize this experience for the benefit of other users.

Associate Publisher

IBM

EXPERIENCED PROGRAMMERS

Programming Documentation

Recent developments at IBM have created outstanding opportunities for experienced programmers to make significant contributions to the art of programming. Listed below are some of the many areas with immediate requirements.

Programming Systems Testing: In control program systems, multiprocessing systems, multiprogramming systems, and real-time systems with assignments in the following areas: Development and use of tools and techniques for systems testing; evaluation of systems function and performance; systems generation and systems editing; coordination and control of systems development and test activity.

Programming Evaluation: Program coding experience as a user or implementor on medium- to large-scale computers. Prefer experience in COBOL, FORTRAN, assembler sort or control systems.

Supervisory Programs: Development of control program functions such as: Systems Supervisor, Symbolic I/O Interrupt Control, Machine Control, Stack Job Scheduling IOCS, Data Management Functions, Time-Sharing, Peripheral I/O Multiprocessing.

Programming Documentation—Technical Writers: Secure information from technical personnel about programs and their application; analyze the information; organize, write and present it in clear and concise form for publication and presentation to our customers. Computer programming training will be given to all successful applicants. Requires a college degree with a minimum of four years' writing experience, two clearly in a technical or scientific writing field. A writing background in computer documentation, particularly programming documentation, would be highly desirable.

Programming Languages: Development of compilers for assembly language, FORTRAN, COBOL, and new programming language.

Business-Oriented Programming: Advanced development of sorting and merging techniques, report generators, and file-maintenance programs.

Qualifications: A B.S. or advanced degree in the sciences or arts with a minimum of two years' programming experience.

Location: These openings are mainly in Poughkeepsie, New York, a suburban environment 70 miles north of New York City. Other programming facilities are located in White Plains, New York; New York City; and Boston, Massachusetts. A wide range of company-paid personal and family benefits are provided, and relocation expenses are paid. IBM is an Equal Opportunity Employer.

Please write, outlining your experience and qualifications, to: D. B. Calkins, Dept. 539C, IBM Corporation, Box 390, Poughkeepsie, New York.

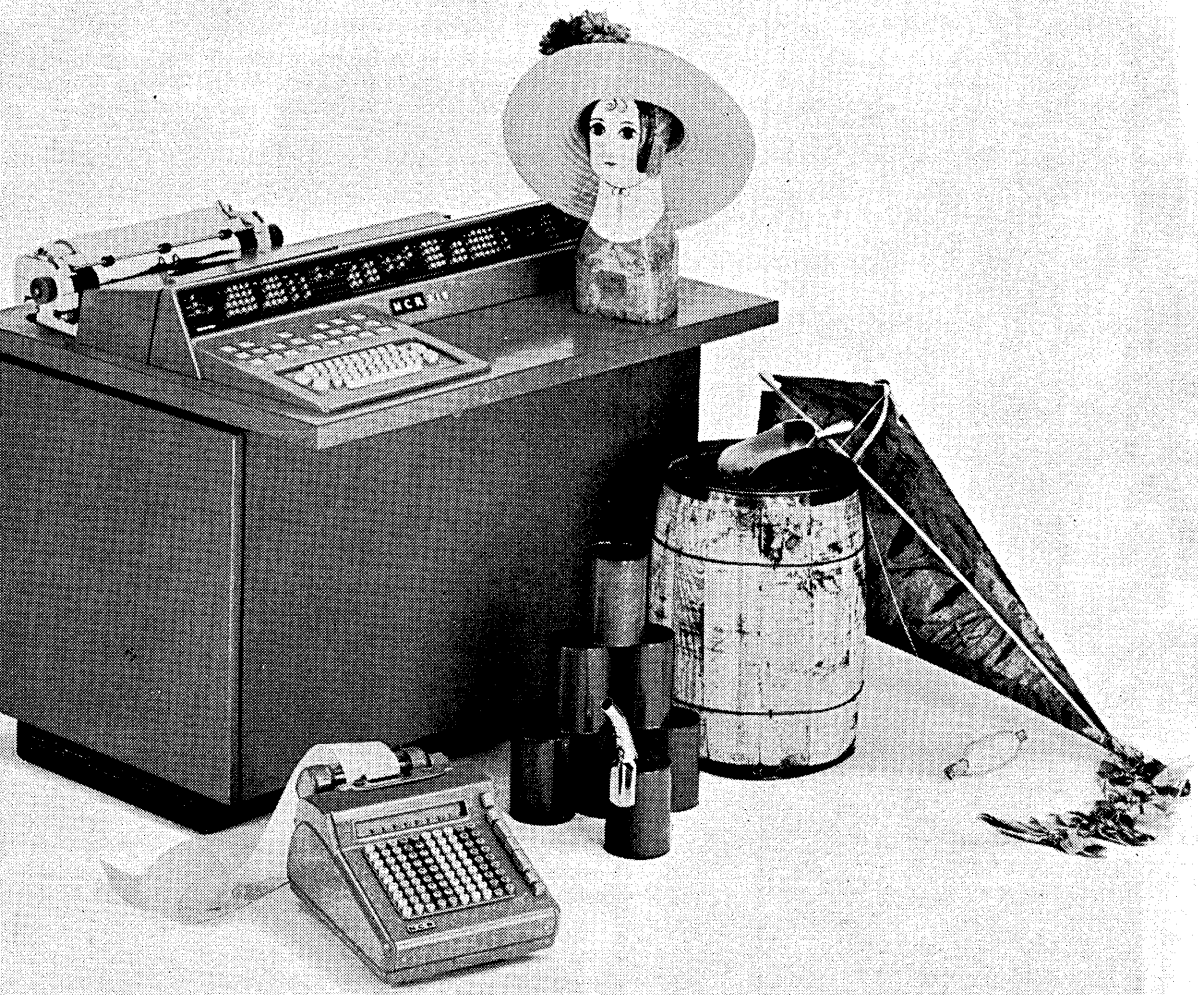
IBM

Electronic computer systems for the small businessman? Why not?

Do you think electronic data processing is for big business only? Well, think again. Now small businessmen (like hardware dealers, variety store owners, stationers)...even doctors and dentists...are using computers to handle tedious paper work. And they're saving money doing it.

The development that makes it all possible is NCR Optical Type Font. A cash register, accounting machine, or adding machine with this feature records every entry in figures that both you and computer systems can read. All you do is send the record tape over to your local NCR Data Processing Center. And that's it. The EDP Center takes care of the rest.

Electronic Data Processing for the professional man and small businessman. That's the sort of thing you can expect from NCR. Because no one knows total business systems like NCR. Wouldn't it be smart to call your local NCR man or write NCR, Dayton, Ohio, before your competition does?



NCR

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THE NATIONAL CASH REGISTER CO. ®

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Before you kick your UNIBIM in its HONEYVAC, read this.

It's a fact that 99% of the errors you are attributing to your computer or data processing system can be traced to errors in the input media.

It's a fact that Addo-X has a unique system of data capture and control featuring 10-key tabulating carriage machines which prepare input media in the form of punched paper tape or punched cards.

It's a fact that the speed of data capture is increased as much as 30% and that controls are simultaneously generated when you use Addo-X.

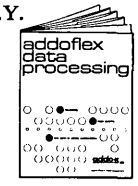
addo-x

It's a fact that if you do 1 job or 10, or even change from a UNIBIM to a HONEYVAC, the versatile programming capabilities of Addo-X enable you to make the changes in procedures and applications or coding structures in a matter of seconds with a minimum of effort.

We'll be pleased to send you our descriptive booklet on Addoflex Data Capture and Control . . . Free.

Addo-X Inc. ADP Div., 270 Park Ave., New York 17, N.Y.
Without obligation, please send me your booklet on Addoflex Data Capture and Control.

*Name*_____
*Company & Title*_____
*Address*_____
*City*_____ *Zone*____ *State*_____



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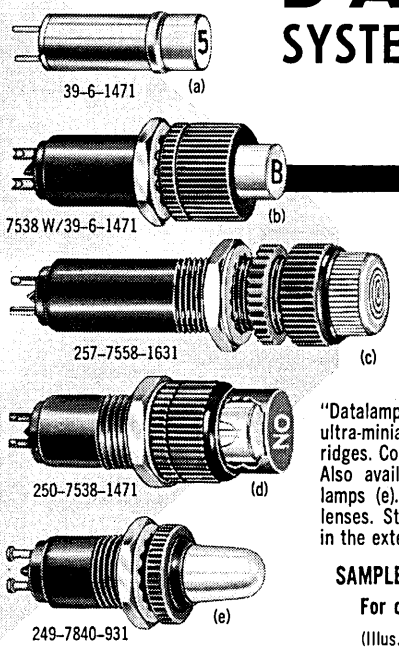

Build your light indicators with a system—the DATALITE system. Here's how: Choose a "Datalamp" Cartridge (a) and combine it with a "Datalamp Holder" (b); or use a screw-on "Data Cap" with a rotatable readout lens (c, d)...For multi-indications, "Datalamp" Cartridges may be mounted on a "Data Strip" or "Data Matrix" in any required configuration.

"Datalamp" Holders accommodate DIALCO's own plug-in ultra-miniature Neon or Incandescent "Datalamp" Cartridges. Complete assembly mounts in 3/8" clearance hole. Also available with permanent (not replaceable) Neon lamps (e). Legends may be hot-stamped on cylindrical lenses. Styles shown here are only typical components in the extensive DATALITE system of light indication.

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C&A CLASSIFIED COLUMN

Use economical C&A Classified Ads to buy or sell your computer and data processing equipment, to offer services to the industry, to offer new business opportunities, to seek new positions or to fill job vacancies, etc.

Rates for Classified Ads: 90¢ per word — minimum, 20 words. First line all capitals — no charge.

Blind Ads: Box Numbers acceptable at $4.00 additional to cover costs of handling and postage.

Send copy to: Computers and Automation, 815 Washington Street, Newtonville, Mass. 02160. Telephone: 617-332-5453.

Deadline for Classified Ads is the 10th of the month preceding issue.

WANTED: KEY PUNCHES #024, 026. Verifiers #056. Sorters 083, 084, 085, 088, 403, 407, 602A, 407, 1401. FOR SALE: 858 Cardatype. 031, 063, 080, 402, 523, 552. 805 Test Scorer. 824 Tape Card Punch. 031, 055. L. A. Pearl Co., 801 Second Ave., New York, N. Y. 10017

ADVERTISING INDEX

Following is the index of advertisements. Each item contains: Name and address of the advertiser / page number where the advertisement appears / name of agency if any.

OPPORTUNITIES IN LOS ANGELES AND HOUSTON WITH TRW SPACE TECHNOLOGY LABORATORIES FOR MATHEMATICIANS, ENGINEERS AND PHYSICISTS IN SCIENTIFIC AND BUSINESS PROGRAMMING

TRW Space Technology Laboratories has openings for Scientific and Business Programmers at its Computation and Data Reduction Centers (CDRC) at TRW Space Technology Center in Redondo Beach, California, and in its new Manned Spaceflight Department in Houston, Texas.

In Redondo Beach near Los Angeles International Airport, you will be working with over 200 programmers and scientists who are applying their background in mathematics, engineering and the physical sciences to resolve problems of the aerospace environment, and to further advance the capability of computers and the computer sciences. Here, their responsibilities include space mission analysis, statistical analysis, data analysis, spacecraft environmental simulation, interpretive computer simulation, automated plotting, business data processing, real-time operations, list processing, and computer system applications.

In Houston in new facilities adjacent to NASA's Manned Space Flight Center, you will be a vital part of the Apollo Program. TRW Space Technology Laboratories has responsibility to NASA for Apollo mission planning, mission analysis and real-time program development. STL's task, in broad terms, consists of "building a computer highway to the moon." STL Programmers will chart the path the Apollo craft must follow and the functions and maneuvers which will be required to remain on that path for manned landing on the lunar surface in 1969.

With this challenging assignment, STL in Houston has ground-floor opportunities that may never be available again. For these exceptional openings, STL requires BS or MS degrees in Aeronautical Engineering, Physics, Applied Math or Astronomy, with experience or training in these areas:

MISSION ANALYSIS: *Strong analytical ability and technical originality with broad background in flight mechanics, astronautics, missile guidance and mission performance.*

TRAJECTORY ANALYSIS: *Familiarity with the use of digital computation, analytically inclined, with background in space mechanics.*

ASTRODYNAMICS: *Theoretical background in celestial mechanics, orbit determination and/or related fields of math, physics or astronomy.*

GUIDANCE ANALYSIS: *Familiarity with techniques for missile guidance and experience in orbital mechanics, random processes and statistics.*

SCIENTIFIC PROGRAMMING: *Background in high speed digital computers. Will assist in the solution of problems arising in missile and space vehicle engineering, with responsibility for direction, programming, debugging and analysis of computer solutions.*

ACT NOW! *Forward your resume immediately to R. J. Brown, TRW Professional Placement, One Space Park, Department CA-3, Redondo Beach, California. TRW is an equal opportunity employer.*

TRW SPACE TECHNOLOGY LABORATORIES

THOMPSON RAMO WOOLDRIDGE INC.

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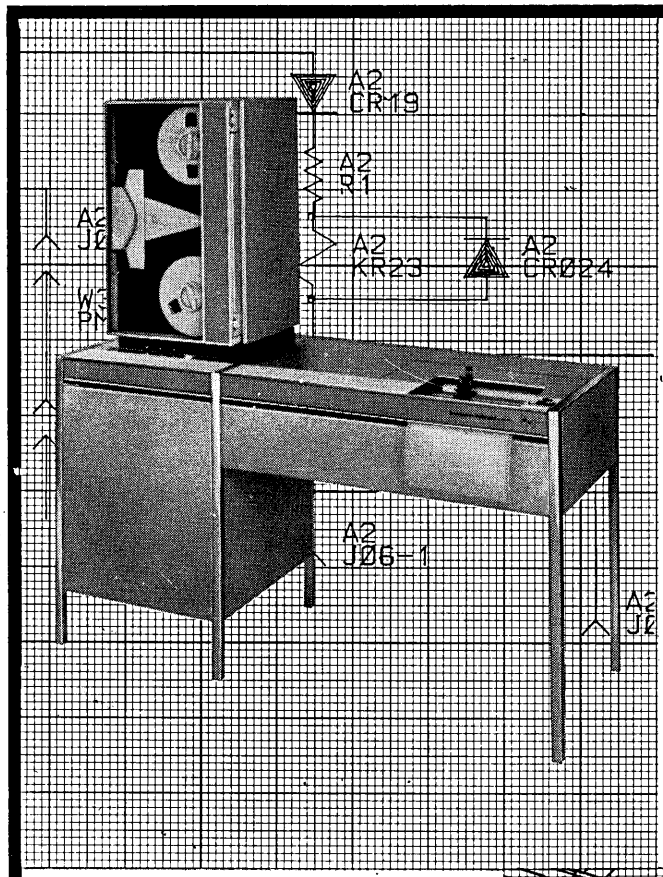

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3. High resolution (.005 inches)
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6. Compatible with all digital computers
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8. Capital outlay is drastically reduced
9. 120 ft. paper roll capability*

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Many computer sub-routines are available in our library for your use. Programming assistance is readily available.

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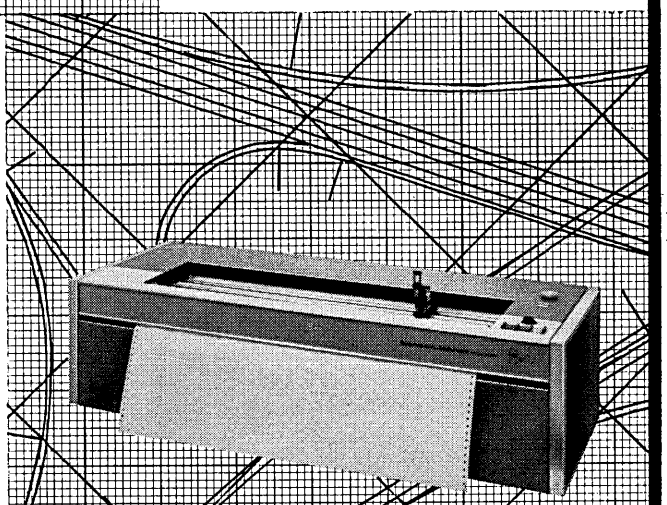

benson lehner

14761 Califa Street, Van Nuys, California

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