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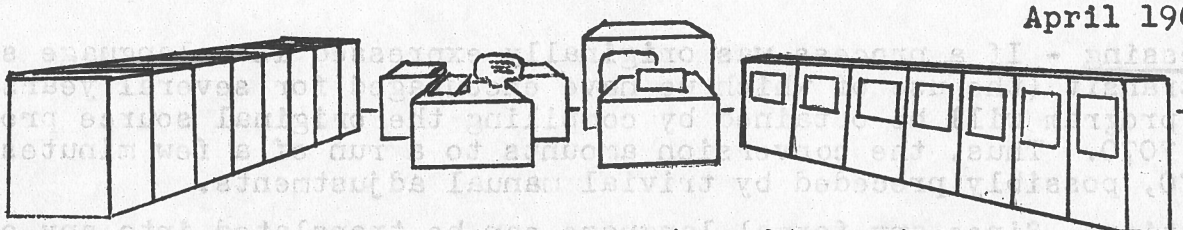

COMPUTING CENTER NEWSLETTER

D. Platnick,
Editor

As noted in the last issue, we are starting a series of articles on the new IBM 7070 system to be installed at this Center. By way of introduction, Vincent Swoyer has contributed an article describing some of the factors which must be considered when planning such an installation. Dr. Keenan's article outlines some of the problems which will be facing 650 users when the time comes to switch over to the 7070. Some of the programs which are already available for the 7070, as well as those being written by our staff, are described by our program librarian, Gill Turner.

One of the latest scientific aids to navigation, recently completed by the staff, is now on display at the Center. It is a map of the U.S.A. and parts of Canada, showing the location of most University Computing Centers. This device was developed in response to the requests of thousands of travelers who always want to know the distance to the nearest 650, 7070, etc.

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CONVERTING COMPUTER PROGRAMS TO THE 7070

T. A. Keenan

Since we announced that the University would have a 7070 Computer in the fall, a number of my friends have said to me, "Why did you have to change?" or "Won't we keep the 650?" or "I don't want to learn to program another machine." In addition to displaying a negative attitude toward the upgrading of our facilities, these remarks demonstrate a lack of information about the program conversion problem and about available program conversion techniques.

There are four ways in which a computer program originating on one machine can be converted to operate on a different machine:

1) Recoding
2) Reprocessing
3) Translation
4) Simulation

It is, of course, always possible to make use of combinations of these techniques.

Recoding - This is the task of manually expressing a process which has been developed in a language of the original machine in a language of the second machine. This is the most expensive of the choices in terms of man hours and the most efficient in terms of computer time. To make use of this method requires a willingness to learn a language of the new computer and an adequate documentation of the process which has already been developed. Since it has been authoritatively estimated that at least 80% of the work connected with the development of a new computer application is in the development of concepts and in the organization of the problem, the recoding of a problem represents a repetition of at most 20% of the original work.

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Reprocessing - If a process was originally expressed in a language such as Fortransit (the use of which we have encouraged for several years), a 7070 program will be obtained by compiling the original source program on the 7070. Thus, the conversion amounts to a run of a few minutes on the 7070, possibly preceded by trivial manual adjustments.

Translation - Since any formal language can be translated into any other formal language, a 650 machine language or SOAP program can theoretically be translated into a 7070 machine language program. At the Computing Center, we have investigated the possibility of such a translation program and concluded that:

1) because of differences in the computers the translation program would be especially complicated;
2) efficient operation of processes (sequences of instructions) in the translated program cannot be assured;
3) the translated program cannot possibly make efficient use of the abilities of the 7070 because many of these abilities are not in the 650;
4) A translation program would have a very limited life.

Therefore, an investment of effort in a 650-7070 translation program is not practical.

Simulation - As compared to translation, it is much easier (and less efficient) to make the 7070 behave as a 650. Programs written for the 650 should then be operable on a 7070 which simulates the 650. Such a program is available to simulate a complete 650 at between 2 to 3 times 650 speed. However, the simulation program requires considerable set-up time and so is inconvenient to use. Moreover, it cannot take advantage of the economies of the new computer.

The conclusion of this discussion of program conversion is that the advantages of a larger faster computer are not available to an existing program without the expenditure of some effort. If the existing program is in a problem-oriented language (e.g., FORTRAN, ALGOL, COBOL, etc.), the required effort is trivial. If the original programmer did not use foresight in choosing such a language but did document his work, the additional effort is small as compared to the original work. If the work has not been documented and has not made use of a problem-oriented language, the only chance is simulation.

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7070 LIBRARY PROGRAMS

The Computing Center has compiled a preliminary listing of abstracts of programs which will be available for use on the IBM 7070. These are basic programs such as trigonometric routines, double precision floating point arithmetic, cube root, square root, Nth root, logarithm, and exponential subroutines. More detailed write-ups will shortly form the basis of the 7070 program library.

An input-output system is currently being written at the Computing Center, which aims at providing the user with flexible and convenient control, while allowing processing to continue simultaneously with the input or output operation. The system will allow editing to specified formats, and by automatic card checking simplifies tape operations. It handles printed output of a single line or blocks of data in numeric or alphabetic format, with provision for carriage control. The user writes only one line in Autocoder, called a macro instruction. A macro instruction produces all the detailed instructions to perform the required op-

eration. Some others already in use are ARITH, LOGIC, COMP, and CYCLE. In due course, the Computing Center will have a much more extensive collection of macro instructions available.

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SELECTION OF A NEW COMPUTER — Vincent Swoyer

Other newsletter articles have been concerned with some comparisons between the IBM 650 and the soon-to-arrive IBM 7070, with some mention of expected use to be made of the new computer. It may be of interest to know some of the considerations made when deciding which computer to select, and to make some comparisons between several computers, including one which we did not select.

After the need for a larger computer was determined, many different machines on the market were studied. Bearing in mind the anticipated needs of known future projects, and budget limitations, the choice of possible computer systems was narrowed down to three - the IBM 709, the IBM 7070, and the Bendix G-20. The Bendix computer, although a fine design, was removed from consideration mainly because its development was still in the early stages. Also, few universities indicated plans to install this machine, which would seriously reduce the very profitable inter-exchange of ideas, research, and programs with other schools. Therefore, our choice lay between the IBM 7070 and the IBM 709 (a more powerful version of the IBM 704). Although the 709 would cost slightly less than the 7070, there was some question of the feasibility of instal ling a 709 within the physical limits of the Computing Center.

Our 650 system with four tape units is installed on a raised platform with about 600 sq. ft. of flooring. Two air-conditioning units provide a total of 22 tons of cooling capacity. The power lines are capable of handling about 60 KVA. These are the basic physical limitations. The 650 requires about 15 tons of air-conditioning and 53 KVA of power.

Both the 7070 and 709 would require more floor area. A continuation of the platform floor through the remainder of the machine room will increase the usable floor area to 1050 square feet. With extreme crowding, a 709 system with 12 tape units could be accommodated. This system, however, would require 27 tons of air-conditioning, which would necessitate at least 5, or to be on the safe side, 10 tons of air-conditioning. The power requirement for the 709 would be roughly 150 KVA, necessitating the installation of a new power line from the power station, which is about a quarter of a mile away.

The 7070, with the addition of an off-line input-output system such as an IBM 1401, involves a slightly greater initial expense than the 709 but it meets all the physical limitations quite nicely. It fits easily within the extended platform area, requires only slightly more than 10 tons of air-conditioning, and needs 44 KVA of power. Selection of the 7070 therefore saves a considerable amount of the cost of installation. It is interesting to note how transistorizing permits as large a computer system as the 7070 to operate with less air-conditi oning and power requirements than even the basic 650!

The 7070 was selected partly because of its physical advantages. However, the maintenance cost of the transistorized 7070 is so much less than for the 709 that all the price advantage of the 709 is lost within two years. Decreased maintenance also implies improved reliability.

Since the 7070 is a more modern computer, there will be up-to-date modifications available for some years. The 709, on the other hand, is

no longer in production so that no further refinements are to be expected. The fact that a number of other universities have also ordered 7070's contributed to the decision to have the 7070 as our next computer.

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ANNOUNCEMENTS

1. There are several summer institutes in programming and numerical analysis, of which the following are a sample -
   a) University of Michigan Engineering Summer Conference, June 19-30; Seven 2-week courses in Computer Engineering, Programming, Numerical Analysis and Systems Engineering.
   b) University of California, Los Angeles; advanced techniques of programming digital systems; concerned with Algorithmic translation, theory of files, data system languages, and load-and-go systems; May 29-June 10.
   c) Moore School of Electrical Engineering, Univ. of Pennsylvania; Special Summer Session on recent developments in Electrical Engineering; June 11-July 1; includes communication theory and information handling.
   d) University of Oklahoma; Summer Conference in Computer Science; June 13 to July 5; Advanced Institute for College Professors of Mathematics, Science and Engineering.

   There are several others sponsored by N.S.F. and described in a separate brochure. For further information, please contact the Computing Center.
2. 16th National Conference of the Association for Computing Machinery, Sept. 5-8, Statler Hilton Hotel, Los Angeles.
3. Western Joint Computer Conference, May 9-10, Ambassador Hotel, Los Angeles.

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RECENTLY RECEIVED MATERIAL

Books - "Electronic Digital Computers", Alt (Academic Press, 1958)

"Adaptive Control Processes, A Guided Tour", Bellman (Princeton University Press, 1961)

"National Symposium on Management Games, Proceedings of,"(Kansas Univ. Press)

"Mathematics and Computers", Stibitz and Larrivee (McGraw-Hill, 1957)

"Finite-Difference Methods for Partial Differential Equations", Forsythe and Wason (Wiley and Sons, 1960)

"Difference Methods for Initial-Value Problems", Richtmyer (Interscience Publishers, 1957)

"Principles of Numerical Analysis", Householder (McGraw-Hill, 1953)

650 Programs - 9.2.061, Profile Grade
9.2.062, Digital Terrain Model System 4-Point Polynomial Interpolation
9.2.063, Digital Terrain Model System Profile Smoothing
9.2.064, Continuous Beam Design
9.2.065, Geodimeter Computations

Miscellaneous Reports (see following two pages)

DATA PROCESSING FOR BUBBLE CHAMBERS
H S WHITE U OF CALIF BERKELEY NOV 1960

GENERAL RULES FOR CREATING MACHINABLE RECORDS
FOR LIBRARIES AND SPECIAL REFERENCE FILES
H P LUHN IBM SEPT 1959

WHY COMPUTERS TAKE UP GAMES
REPRINT FROM BUSINESS WEEK - NOV 26 1960

ALGOL 60 MAINTENACE GROUP
MEMBERSHIP LIST
REPORT ON MEETING AUG 22 1960

IBM COMMERCIAL TRANSLATOR F28-8043 1960

THE COBOL TRANSLATOR - IBM F28-8053 1960

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EXPANSION THEOREMS FOR THE TOTAL WAVE FUNCTION
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- PER-OLOV LOWDIN UNIV OF UPPSALA

EXACT PERTURBATION TREATMENT OF HARTREE-FOCK EQUATIONS
- J LINDERBERG UNIV OF UPPSALA SWEDEN MAR 1960

STUDIES IN PERTURBATION THEORY -
II GENERALIZATION OF THE BRILLOUIN-WIGNER FORMALISM
III SOLUTION OF THE SCHRODINGER EQUATION UNDER A
VARIATION OF A PARAMETER
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ON THE CALCULATION OF THE INVERSE OF THE
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P O LOWDIN, R PAUNCZ AND J DE HEER - UPPSALA UNIVERSITY

MOLECULAR ELECTRONIC INTEGRALS FOR CYCLIC
SYSTEMS - J DE HEER AND R PAUNCZ UPPSALA UNIV
FEB 1960

THE ACCURACY OF ATOMIC WAVE FUNCTIONS AND THEIR SCALE
- FROMAN AND HALL UPPSALA UNIVERSITY MARCH 1960

THEOREM ON SEPARABILITY OF ELECTRON PAIRS
- TADASHI ARAI APRIL 1960 UPPSALA UNIVERSITY

TEST OF THE CONVENTIONAL QUANTUM CHEMISTRY METHODS ON THE HYDROGEN ATOM
T L BAILEY AND J L KINSEY JULY 1960 UPPSALA UNIV

EXCHANGE CORRELATION AND SPIN EFFECTS IN MOLECULAR AND SOLID-STATE THEORY - P O LOWDIN UPPSALA UNIV JULY 1960

QUANTUM THEORY OF ELECTRONIC STRUCTURE OF MOLECULES - PER-OLOV LOWDIN UPPSALA UNIV JAN 1960

RELATIVISTIC CORRECTIONS IN MANY-ELECTRON SYSTEMS - ANDERS FROMAN UPPSALA UNIV FEB 1960

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A THIRD SURVEY OF DOMESTIC ELECTRONIC DIGITAL COMPUTING SYSTEMS BRL 1115 MARCH 1961
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