XXXII. COMPUTER RESEARCH[*]

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RESEARCH OBJECTIVES

The purpose of this group, which is operated jointly by the Research Laboratory of Electronics, the Electronic Systems Laboratory, and the Department of Electrical Engineering, is threefold:

1. To provide a flexible and readily accessible computation facility oriented toward the Laboratory's research goals.

2. To develop computation techniques, especially in the sense of increasing the convenience with which operating programs for particular tasks may be produced, and allowing the scientist easy communication with the machine about tasks being performed for him.

3. To provide an education facility where students may learn the principles of automatic computation, and undergraduate and graduate theses and projects may be carried out.

Computation Facility

The computation facility consists of two general-purpose digital computers. The TX-0 computer, a fast experimental transistorized machine,[1] was built by Lincoln Laboratory. Since 1958, the TX-0 has been made available for academic research. Its effectiveness has been increased through the expansion of its instruction code,[2] the addition of a flexible in-out facility for communicating with the users' equipment, and the installation of a magnetic tape unit for auxiliary storage. In September 1961, the Digital Equipment Corporation generously donated one of their PDP-1 machines to the Department of Electrical Engineering, M. I. T. This machine is a commercial unit that is similar in many respects to the TX-0 in its design and intended application. The PDP-1 will be used primarily for teaching and thesis or project work, but will be available for research tasks that are particularly suited to its characteristics.

Programming

Since the creation of the computation facility in 1958, the staff has spent a considerable amount of effort in the development of a programming language that is appropriate for the types of computation that will be made in research applications. The outcome of this effort has been the MACRO III assembly program. A description of an earlier version of this program has been prepared.[3] Since the facility is operated on an open-shop basis, it is important that the best possible aids be provided for program testing by users. The utility program FLIT has been prepared for this purpose[4] and represents an important advance in on-line program testing.

Time Sharing

Our experience with TX-0 has shown that on-line communication between the user and machine allows the user to progress faster in his research with less effort on his part than is possible with a closed-shop operation: If the user can interrogate the

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machine at any time to observe the course of the computation and to change parameters of the problem when it is necessary, he can make quicker progress with less computation. A closed-shop operation, of course, will allow much more efficient use of the computer, since it need never stand idle while the user ponders his next step in running a computation experiment, or in testing a program.

The time sharing of one computer by a number of users operating from different consoles would combine the advantages of both modes of computer operation, and is viewed by many as the desirable goal for the future computation facility[5] at the Massachusetts Institute of Technology. Before the donation of the PDP-1, a proposal was made to provide for time-shared use of the TX-0 by as many as eight users at once.[6] This would serve the dual purpose of allowing more efficient utilization of the machine without sacrificing the advantages of the on-line operation, and establishing an operational time-shared computer system from which more could be learned about how a large time-shared computer system should be designed and operated. At present, we plan to set up a time-sharing system for the PDP-1 and TX-0 computers to serve this purpose.

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References

1. J. T. Gilmore, Jr. and H. P. Peterson, A Functional Description of the TX-0 Computer, Memo 6M-4789-1, 1958.

2. J. B. Dennis, The Future TX-0 Instruction Code, Memo M-5001-29, 1960.

3. R. Spinrad, MACRO IIA, Memo M-5001-5-1, 1961.

4. J. B. Dennis and T. Stockham, FLIT — Flexowriter Interrogation Tape: A Symbolic Utility Program for TX-0, Memo M-5001-23, 1960.

5. H. Teager, Report of the Long-Range Computation Study Group, M. I. T., 1961.

6. J. B. Dennis, A Proposal for Time-Shared Operation of TX-0, Memo M-5001-23, 1961.