DIGITAL COMPUTER NEWSLETTER

The purpose of this newsletter is to provide a medium for the interchange, among interested persons, of information concerning recent developments in various digital computer projects

OFFICE OF NAVAL RESEARCH · MATHEMATICAL SCIENCES DIVISION

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National Bureau of Standards Interim Computer

As a result of a continuous evolutionary process growing out of experiences with both programming and machine design, it was decided to locate the binary point between the second and third digits from the left-hand end and to provide for the following instructions: (a) addition, (b) substraction, (c) algebraic comparison, (d) absolute comparison, (e) logical transfer, (f) multiplication (1) major, unrounded, (2) major, rounded (3) minor, unrounded, (g) division, and (h) tape controls (1) input, (2) output.

Design and construction of a complete control system for the Interim machine has been of prime consideration in order that other units and components might be tested immediately on completion. The timing generators, phase-shifting networks, driver units and phase and minor cycle counters have been completed and assembled in the chassis. It has proved possible to design and construct a clock which allows the distribution of power as a sine wave rather than as pulses having sharp corners. Three phases of the clock sine wave are necessary, and the basic oscillator, phase-shifting networks, and driver stages for accomplishing this have been constructed and tested. Power amplifier output stages have been designed, and construction is now under way. Contracts for the procurement of three direct-current power supply units for the computer have been let. The detailed engineering for the acoustic memory system is almost complete and a contract for its construction has been let.

Institute for Numerical Analysis Computer

The logical design of the computer has been frozen and considerable experimental work on components has been performed. A great deal of coding was done using this design and

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the system seemed quite satisfactory. Experimentation with cathode ray tubes, using the F. C. Williams technique, has indicated the use of such tubes as memory unit is feasible for a capacity up to 512 digits per tube. The computer was designed to permit the incorporation into the machine of an intermediate magnetic drum memory of ten thousand word capacity.

Prototype arithmetic organs have been completed and a contract has been let for 80 chassis for the arithmetic unit to be used in the machine. Also, 10 chassis for the control unit are in production. It is expected that the computer will be performing useful problems by the middle of 1950.

EDVAC:

Preparations are under way to move the EDVAC from the Moore School of Electrical Engineering to the Ballistic Research Laboratories, Aberdeen Proving Ground. The two main power switch panels have been tested and shipped to APG as well as the auto transformer necessary for the operation of the EDVAC. Practically all the spare parts necessary for testing and operation of the EDVAC have been assembled and shipped by the Moore School to APG.

ORDVAC:

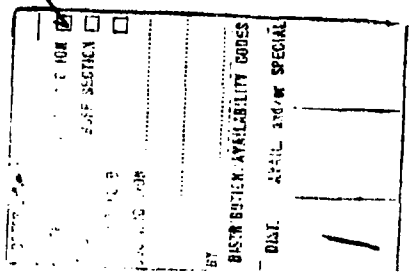
The contract with the University of Illinois for the construction of the ORDVAC has been signed. A breadboard style 8-digit shifting register and associated pulse generator has been built by the University of Illinois according to the circuits furnished by the Institute for Advanced Study. This shifting register has operated with a shift time (up or down) of about 2 microseconds, which gives a total shift time of about 5 microseconds. Two 3-dimensional 10-digit shifting registers have been completed. Both of these 10-digit shifting registers have been mounted in relay racks, connected to the interim power supply, and are awaiting the new signal generator so that adequate tests can be performed on them.

A circuit has been designed and is about 1/2 constructed to test each individual vacuum tube for the shifting registers.

Institute for Advanced Study Computer

Since the last report of the status of the machine under development at the Institute for Advanced Study work has continued on bringing the arithmetic organ to completion. At the present time various local controls for the arithmetic organ are being designed and built. It is hoped that these controls will be completed in the immediate future and that the arithmetic organ will soon be operating as an adder at a high duty cycle.

Work on the Williams tube has been progressing steadily. Life tests are being conducted for a group of several Williams tubes operating in parallel. These tests will continue.



I.B.M. CARD-PROGRAMMED ELECTRONIC CALCULATOR:

The recently-announced I.B.M. Card-Programmed Electronic Calculator makes available to industry a sequence-controlled calculator which should find wide application, especially in engineering calculations. The machine is a combination of several I.B.M. units and can be broken up to utilize these units on normal work when it is not desired to employ the combination for calculating purposes. The units utilized and their functions are described as follows:

1. Type 417 Accounting Machine: This unit acts as the master control, and the 80 mechanical counters with which the machine is normally equipped act as accumulators or as storage for factors. The printing unit provides 88 type bars for the listing of the factors and the result of each computation, as well as the instructions issued to the machine for that step. Printing is at the rate of 150 lines per minute and computations are made within this period.

2. Type 604 Electronic Calculator: The electronic unit permits the setting up of eight sub-programs for the calculation of factors received from the Type 417 machine. The program or programs utilized are called in from the instructions punched in the card in the accounting machine feed.

3. Type 521 Calculator Punch: Summary punching of long-term storage items is provided by the Calculator Punch, which also acts as the controlling unit for the Type 604 machine when the combination is broken into individual units.

4. Type 941 Auxiliary Storage Device: This device provides storage for 16 ten-digit numbers and their signs. Information is read into and out of this unit under control of the instructions sensed in the accounting machine feed.

The Card-Programmed Electronic Calculator requires an 8-digit instructional code punched in each of the sequence-controlling cards. This code may be used exclusively as a control of the combination, thus permitting any problem to be set up solely by coding the cards, or the control may be supplemented by the use of accounting machine selectors and controls to greatly increase the facility and efficiency of the operation.

WHIRLWIND I

All parts of Whirlwind I central control have been constructed and individually tested. The 32 registers of test storage have also been constructed. All the above units were gradually integrated into the system during July and August, replacing the test control which has simulated their functions. Plans for installing storage tubes at the end of the year remain unchanged. For the five week period ending in early August, ten tubes were made with a record yield of five good tubes. Each tube stores 256 binary digits.

CALDIC

The Office of Naval Research has a contract with the University of California for the development of a digital computer of comparatively simple design and slow speed, with

special emphasis on simplicity of coding. The machine will operate in the decimal system, performing the operations of add, subtract, multiply, divide, and shift right or left, in addition to orders required for subprograms, conditional subprograms, modification of commands, input, and output. It will use a magnetic-drum memory of 10,000-word capacity, each word of 10 decimal digits and sign. The drum will be loaded in approximately three minutes from a perforated tape (read photoelectrically) after which computation will be carried out automatically but without further access to the input tape until the machine stops.

The arithmetic unit will contain three shifting registers and an adder capable of complementing an incoming number if required; it will operate at a pulse rate of 300 kilocycles, using a 4-channel serial system. Arithmetic operations will be carried out at a rate of approximately 25 operations per second.

Experimental models of the memory components, shifting registers, band-selection switches, etc., are undergoing tests and construction of these units will begin this fall. The machine will be built on open racks in a form which will allow access to all parts, even while the machine is in operation.

The BINAC

The Binac was successfully demonstrated to the public by the Eckert-Mauchly Computer Corporation during August 1949. Two Binacs were given the same problem and interconnected in such a way as to continuously compare the results of the separate operations in the solution of the problem. According to company engineers, the computers have operated without error in this manner for several hours. The computer employs a pulse repetition frequency of four mcps. It is capable of performing 3,500 additions or subtractions or 1,000 multiplications or divisions per second. If access time to the memory is included, the rate of operation is 1,200 additions or subtractions or 800 multiplications or divisions per second. It is presently contemplated that the efforts of the company will be concentrated on the final design and construction of Univacs and that no more Binacs will be built.

University of Illinois Component Research

A group at the University under the direction of Dr. Samuel and later under Dr. Julian have conducted studies relating to (1) The adaptation of the transistor to digital computer circuits, (2) A new type of digital adder employing cathode-ray techniques, (3) A "master" tube for positioning the read-write beams of electrostatic memory tubes.

The deflection system uses two "master" tubes, one to control the vertical and the other the horizontal positioning of the electron beam in a bank of "slave" electrostatic storage tubes. The advantage of the system is that good reliability in location of storage points can be achieved without special attention to regulation of electric circuits and power supplies. Two types of tubes have been built and tested, one type for a parallel address system and the other for serial operation.

Comments, Letters to the editor, and additional contributions for inclusion in the Newsletter should be addressed to: Code 434, Office of Naval Research, Navy Department, Washington, D. C.