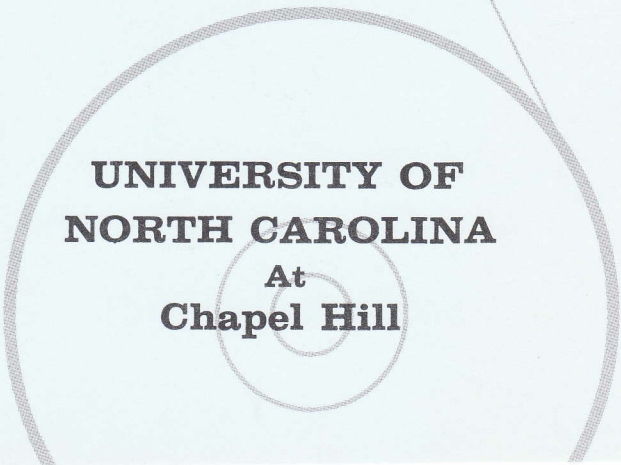
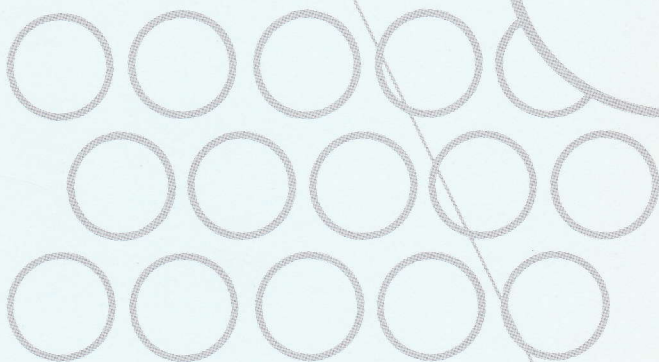




**THE
COMPUTATION
CENTER**



**UNIVERSITY OF
NORTH CAROLINA**
At
Chapel Hill

GLOSSARY OF COMPUTER TERMINOLOGY

Binary: A number system which uses two numbers, zero and one, in arithmetic processes instead of the numbers zero through nine as in the decimal system.

Bit: The abbreviation for binary digit.

Buffer storage: Equipment located between two parts of a computer or between the computer and peripheral equipment which temporarily holds information after it is received from one location and before it is sent to another location. Buffers permit processing to continue in the computer while information is being transferred between peripheral equipment and the central computer.

Compiler: A computer program which translates instructions written in a problem-oriented language into an equivalent program in the machine language of a particular computer.

Computer: Any device capable of accepting information, applying prescribed processes to the information, and supplying the results of these processes; sometimes, more specifically, a device for performing sequences of arithmetic and logical operations; still more specifically, a stored-program digital computer capable of performing sequences of internally-stored instructions, as opposed to calculators on which the sequence is impressed manually (desk calculator) or from tape or cards (cards programmed calculator).

Data: A collection of facts, represented by numbers, letters and symbols, which is processed or produced by the computer.

Digit: A number between zero and nine, inclusive.

Digital computer: A calculating device (e.g., abacus, desk calculator, electronic digital computer) which handles information in discrete numerical form and solves mathematical problems by performing arithmetic and logical operations upon numbers, as opposed to an analog device (e.g., slide rule, analog computer) in which the solution of a mathematical problem involves manipulation and measurement of physical quantities (e.g., electrical current, voltage).

Flow-chart: A schematic representation of the logical steps necessary to solve a particular problem; symbols are frequently used to represent the operations such as compute, substitute, compare, jump, copy, read, write, etc.

Machine language: The code which is used to represent program and data within the computer.

Memory: The sections or units within the computer or peripheral equipment where information is stored pending future use.

Microsecond: One millionth of a second.

Millisecond: One thousandth of a second.

Nanosecond: One billionth of a second.

Peripheral equipment: Various types of machines that are used to prepare and introduce information into the computer, record the results of computations, and transfer information from one type of external storage to another. Familiar terminology around the Computation Center is: Flexowriter—an automatic typewriter and paper-tape punching machine; Card-reader—a machine which transfers information from punched cards to the computer; Highspeed printer (HSP)—an automatic press which reads information from magnetic tape and prints as many as 750 lines per minute.

Program: The precise sequence of operations which the computer must perform on the data in order to solve a given problem.

Programmer: A person who analyzes a given problem and prepares the program necessary for its solution by a computer.

THE COMPUTER AT CHAPEL HILL

In August 1959 the Consolidated University of North Carolina installed a UNIVAC Scientific 1105 Computer, costing \$2,450,000, on the Chapel Hill campus through the cooperation and generosity of the State government, UNIVAC, the National Science Foundation, and the Bureau of the Census. The establishment of the Computation Center provided the University with the capabilities and the power of a modern, large-scale digital computer for use in research and education.

The "Hardware"

The UNIVAC 1105 is a "large-scale" automatic electronic digital computer. It is capable of performing approximately 30,000 additions and subtractions per second; approximately 4,000 multiplications per second; and approximately 2,000 divisions per second. Thus one computer can do the work of approximately 200,000 men solving problems on desk calculators. The 1105 has 12,288 words of magnetic core storage with an access time of 8 microseconds, and over 32,000 words of directly accessible magnetic drum storage with an average access time of 17 milliseconds.

The input/output equipment on the 1105 consists of seventeen UNISERVO II magnetic tape read-write units; a 2000 card-per-minute punched-card reader, high-speed punched paper tape read and punch units, and a high-speed plotter. Hard copy listings of computer output are printed on an off-line high-speed printer which has a printing speed of 750 lines per minute—this is equivalent to about 300 typists typing at full speed. Complete buffering allows independent operation of the main computer and the magnetic tape units, making input/output operations efficient.

The Center maintains an input preparation room where programs and data are prepared for the computer by transferring the information to either punched cards or punched paper tape.

Organization of the Computation Center Administration

The administrative staff of the Computation Center consists of a Director, an Associate Director and

Business Officer, and the necessary secretarial and clerical personnel. The Director reports to the Dean of the Graduate School.

Programming Staff

The programming staff not only assists University members in using the computer in education and research but also carries on programming research and development in order to make the computer a more effective tool in problem solving.

In order to solve any specific problem or perform a desired function with an automatic digital computer, it is necessary to prepare a set of detailed instructions known as a computer program. These instructions must be in a form which will allow the computer to accept and execute them—a form known as "machine-language coding." As can be expected, the format of such coding differs widely from the language of the original problem. Codes are frequently all numeric or may be mixtures of alphabetic and numeric characters. Often an arithmetic base other than the common decimal base is used in these instructions. Much progress has been made in transforming the process of preparing correctly coded programs from a time-consuming manual method requiring considerable training, to a partially automatic procedure employing the computer itself to perform much of the tedious and error-prone generation of machine-language instructions. As a result, a variety of programming languages such as GAT, IPL-V, COBOL, etc., has been made available for the UNIVAC 1105 as well as general programs for the solution of problems in the fields of statistics, numerical analysis, and artificial intelligence.

Operations Staff

The operations staff consists of specialists trained in the operation of the computer and its associated auxiliary equipment. Once the programs and data for the computer have been prepared on cards and/or paper tape, this group takes control and handles all elements of processing which require the use of any hardware. Their knowledge of the computer and of the systems programs often enables them to assist the maintenance and programming staffs.

Maintenance Staff

The maintenance staff has the responsibility of maintaining the Univac 1105 computer and all the auxiliary equipment in the Center. They also contribute to the design, construction and installation of new equipment. A one-year training program for all new staff members is an important function of this department.

Census Operations

The Bureau of the Census processed data from the censuses of Population and Housing (1960), Agriculture (1959), Business, Manufacturing, Mineral Industries and Transportation (1958) on the 1105 at the University of North Carolina and at similar computer installations at the Bureau of the Census, Suitland, Md. and the Armour Research Foundation of Illinois Institute of Technology, Chicago.

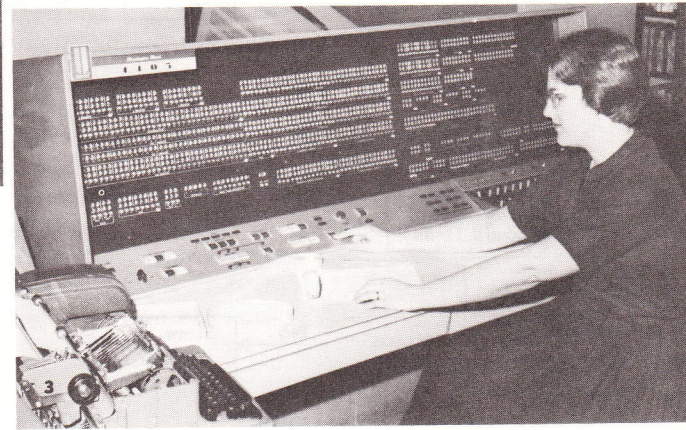
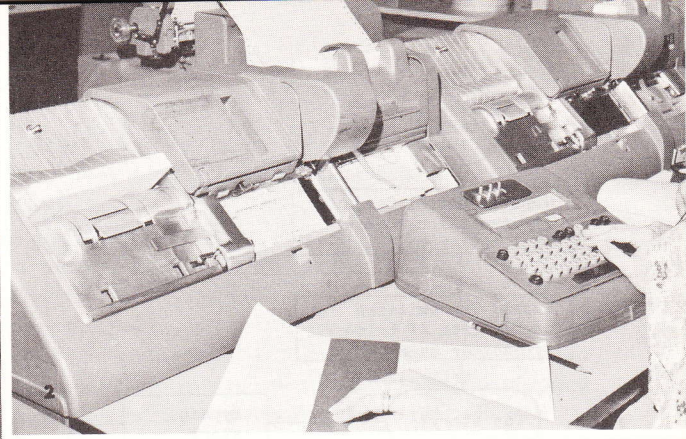
University Uses of the Computer

Educational Activities

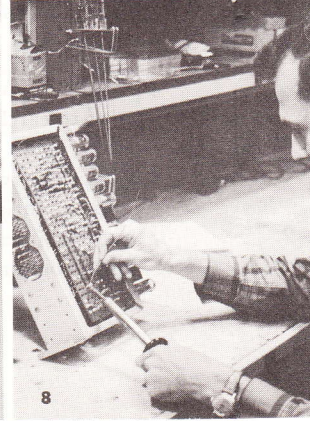
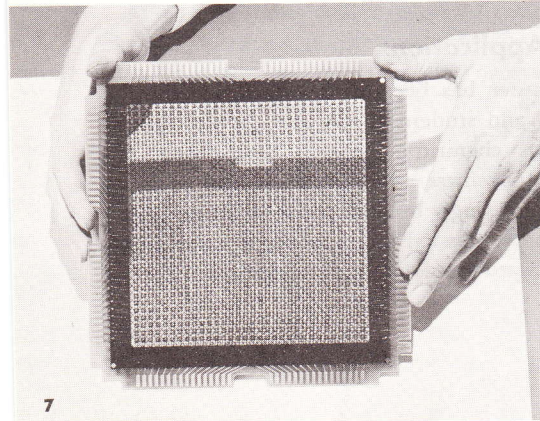
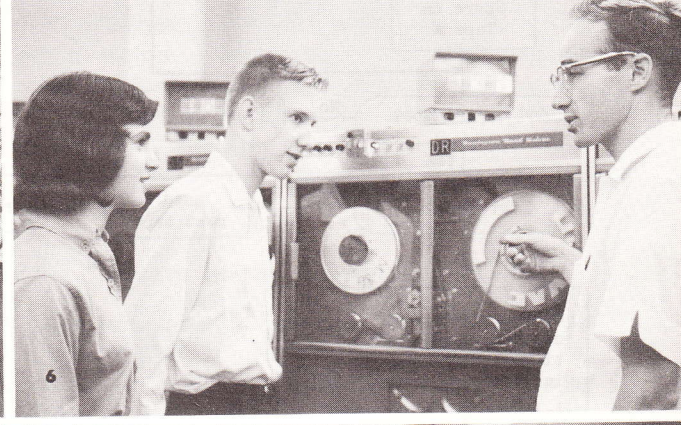
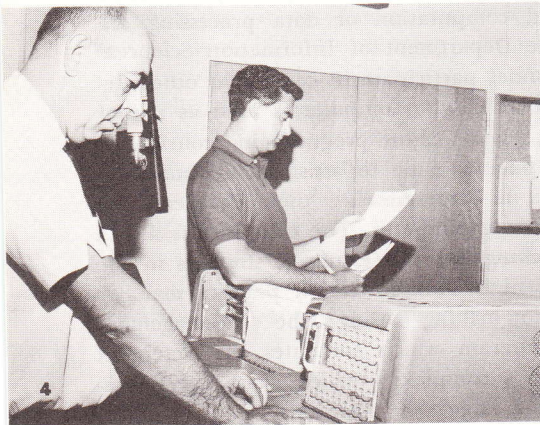
Courses designed for students especially interested in high-speed computation or data processing are taught in the Department of Information Sciences. Center personnel participate in courses in other departments in which the computer is used as a tool for problem solving. Short programming courses are given from time to time to assist faculty members and students in programming their problems for processing on the computer. The computer is also a valuable teaching aid. For example, students in the School of Business Administration practice management decision-making using the "Management Game," a program which simulates the detergent industry with a complexity which would be impossible without a large-scale computer.

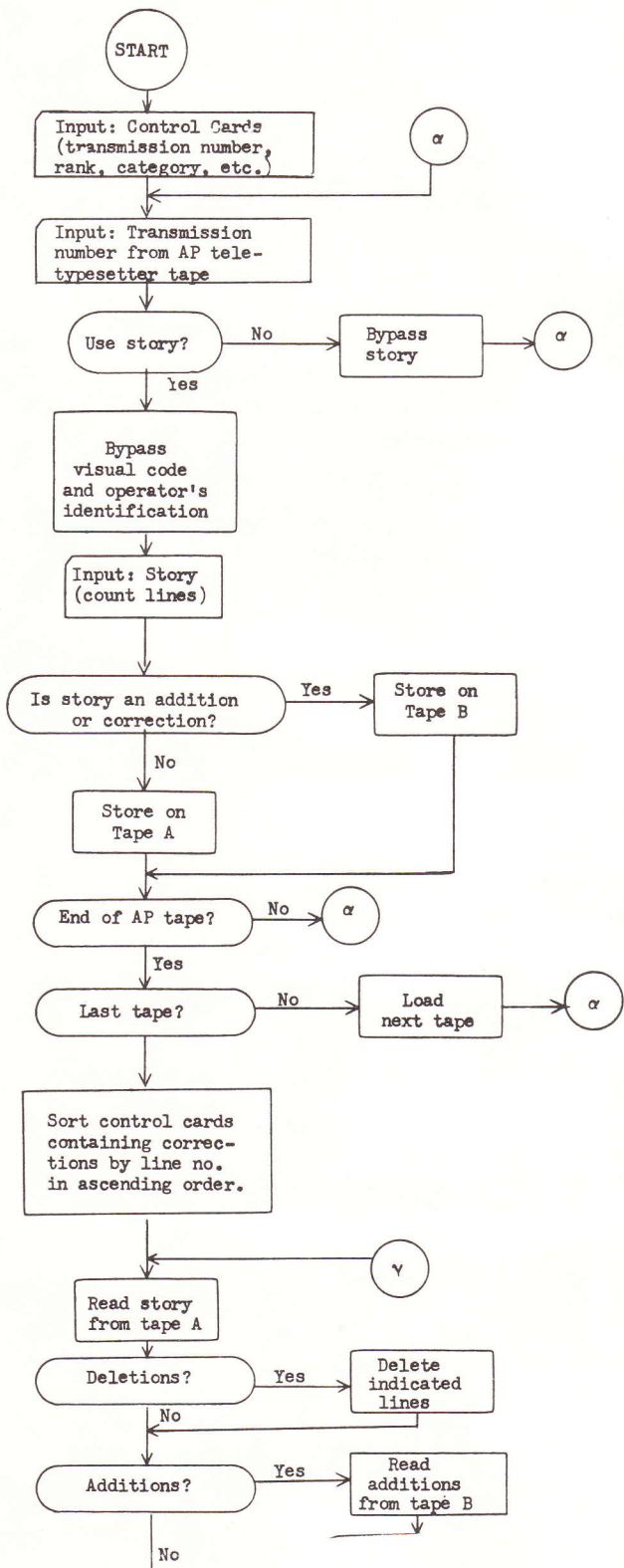
Research Applications

The Computer has been used extensively for faculty research and student theses and dissertations in such fields as chemistry, physics, biostatistics, city planning and business administration, and is being applied in increasingly broader areas of investigation. Among its more unusual applications is a news editing program, produced by the Department of Jour-



- 1 COMPUTER AREA
- 2 CARD PUNCH
- 3 COMPUTER CONSOLE
- 4 HIGH SPEED PRINTER
- 5 PUNCHED CARD READER
- 6 MAGNETIC TAPE UNIT
- 7 CORE MEMORY
- 8 CHASSIS MAINTENANCE
- 9 CHAPEL HILL HIGH SCHOOL COMPUTER CLUB





(Figure 1)

nalism as an aid in its research in communication. The news editing program produces a "newspaper" which is quite easy and satisfying to read. A flow diagram showing some main points of the program is given in Figure (1). In the field of Library Science, KWIC (Key-Word-in-Context), a program which indexes publications and documents by important words in their titles, is available. The program has indexed documents in areas such as medicine, applied mathematics, and chemical patent research.

Professional Computer Programming for the Blind

National computing groups recognize that the profession of computer programmer has special significance for the blind because it opens to them an opportunity to compete on an equal footing with the sighted. The Computation Center at Chapel Hill is developing a training course for the blind in cooperation with the North Carolina State Commission for the Blind.

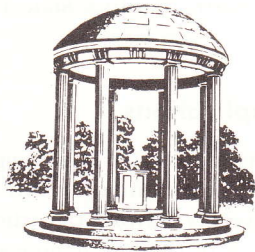
Business Applications

The Computation Center is playing an increasing role in University accounting systems. The computer assists the University Payroll Department in preparing the payroll. A program to handle patient accounting at N. C. Memorial Hospital is under development. This work has stimulated research in data processing.

Careers in the Computing Field

The computing profession is barely twenty years old. From its beginning with the construction of the first automatic digital computer, the Harvard Mark I (Harvard IBM Automatic Sequence Controlled Calculator) in 1944, it has experienced a phenomenal growth, paralleling the computer "population explosion." There are about 13,000 commercial automatic digital computers in operation in this country in 1964. The demand for design engineers, programmers, operations, maintenance and sales personnel is great. It is estimated that 250,000 programmers alone will be needed by 1967. Anyone with an interest in mathematics, puzzle solving, games such as bridge,

checkers and chess, will find programming a challenging profession. A student's interest in radio-building indicates that a career in designing or maintaining computers might be enjoyable. While a background in mathematics or statistics is helpful in programming, computers find application in so many areas that a specialized knowledge of any field may be useful; higher university degrees are an advantage to a programmer.



"The computer's usefulness is... in what it has forced us to do. In order to use the computer, we have had to discard outmoded procedures; we have had to think through systems problems and establish specific decisions, rules and logic. These aspects, together with the tremendous ability to process large amounts of operating business data for analysis, makes it perhaps the most powerful tool for management planning and measurement and decision making yet devised."—Gerald L. Phillippe, president, General Electric Co.

". . . Any philosophy or policy about automation must necessarily start from clear recognition that unrestrained technological advance is not only inexorable, but essential to the maintenance and elevation of the standard of living. Full employment in this country is completely dependent on our being more efficient producers than our competitors in a world where the competition is tougher every day. The alternative to automation would be economic stagnation.

"Machines now have, in general, a high school education—in the sense that they can do most jobs that a high school education qualifies people to do. So machines will get the unskilled jobs, because they work for less than living wages. Machines are, in the most real sense, responsible for putting uneducated people out of work.

"The answers are not to smash the machines. They are to recognize that the individual versus the machine is as unfair a match today as the individual versus the corporation was in the last century, and that advancing technology requires the exercise of collective—public and private—responsibility for its effects and collective measures to carry out this responsibility."—W. Willard Wirtz, Secretary of Labor

"The Second Industrial Revolution is based upon the intense application of the powers of the human brain, amplified and extended by the use of electronic—and perhaps in the future optical—machines, to solve the increasingly complex problems of our modern economic and industrial society. New technology demands the complete discarding of built-in constraints in our thinking which have been ingrained by long experience. It is vital to lift our eyes to the infinite reach of horizons which have now been revealed, and to appraise our new capabilities with the question 'why not?' rather than 'why should we?'"—Dr. Herbert W. Robinson, president and chairman of the board, C-E-I-R, Inc.

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