

A COMPUTER AND DATA PROCESSING
SYSTEM FOR SMALL COLLEGES

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CHAPTER I

INTRODUCTION TO PROBLEM

Introduction

Within the past five years there has been increasing interest on the part of educators and students in the utilization of computers. This interest in computers has spread throughout our educational system with many high schools introducing computers to their students by educational materials or actual computer operations. This development at the high school level is demonstrated by a report of the High School Advisory Board of the School Mathematics Study Group which recommended (23)¹:

The number of individuals who will work with or be directly affected by digital computers in the next decades will be so great that the entire high school population needs to learn something about computers.

The mathematics department of University High School, University of Minnesota, is presently conducting a two-year experiment to evaluate the contributions of computers to the study of mathematics (34). This experiment is being conducted at various grade levels within the high school with the computer being used as an instructional aid in teaching mathematics. The primary objectives of the program are as follows:

1. Test the following hypothesis:
 - i. The computer is an effective laboratory tool in solving mathematical problems.

¹Numbers in parentheses refer to references in bibliography.

- ii. The computer is an effective instructional aid for demonstrating mathematical concepts.
 - iii. The computer is an effective tool for testing algorithms devised by students.
 - iv. The use of a computer is an effective means of building computational skills.
2. Identify the content in the mathematics program, grades seven through twelve, where computer concepts can be successfully utilized in instruction.

This type of activity at the high school level and the increasing demands of businesses will have a very marked effect on the college and university curricula.

The future will be even more demanding as advances in cybernation continues at a rapid pace and the number of computers in operation continues to increase. This increase is remarkable when it is considered that in 1945, a successful electronic digital computer did not exist and in 1951, there were fewer than one-hundred computers in operation in the United States. Today, a recent study by Booz, Allen and Hamilton, Inc. indicates there are 35,000 computers valued at 10 billion dollars in business and industrial applications and it is estimated by 1970 this will grow to 50,000 computers valued at 20 billion dollars (20).

The time is coming when every college graduate will be poorly prepared if he doesn't have some computer training. This point was stressed in a letter the author recently received from Dr. Robert E. Smith, Director of Educational Research and Development for the Control Data Corporation (36). Dr. Smith made the following statement:

To me the greatest single tragedy lies with the smaller Liberal Arts Colleges.

We have had one instance after another of talented graduates in science and mathematics who have come from these types of schools without one hour of instruction on what a computer is and how it operates. Paradoxically, many of these graduates expect to enter work associated with computers.

The education and training of people to satisfy the demands of our modern computerized American society is a new purpose and goal that higher education can not put aside. This challenge must be accepted and the programs implemented if American higher education is to continue as a leader in the development of our society.

Statement of the Problem

The task of training personnel to work with and in computer and data processing systems is not being faced today in most smaller colleges due either to lack of funds or lack of interest by the college personnel. The demand for personnel by business, government and higher education can not be met by the graduates of a few larger colleges and universities. The smaller colleges must develop programs to give their graduates experience in this important area.

The purpose of this paper is to develop a model computer and unit record system which will provide assistance to small colleges and universities that are in the process of planning such a system. The system is designed to provide assistance in administrative programs and in curriculum development for colleges having an enrollment of approximately one-thousand to five-thousand (1000-5000) students.

It is expected that many colleges already having unit record equipment as well as those colleges just in the planning stage, will find the material of this paper beneficial for future planning.

Procedure

The procedures used in developing the proposed computer and unit record system included (1) a survey and analysis of published material dealing with the subject, (2) a study of the Langston University system, and (3) a review of procedures used at Barrington College, Hamline University, University of Illinois, Mankato State College, Miami University, Oklahoma State University, University of Utah, and Wittenberg University.

The published material consisted mainly of books, articles and dissertations written since 1956, because the application of electronic data processing equipment to college and university campuses is a recent development.

The facilities of Langston University were used for this study since Langston satisfied the requirement of being a small college [present enrollment approximately 1400], was conveniently located, and was interested and very cooperative in developing an electronic data processing system.

A study of the Langston University system was made by reviewing the present procedures in each administrative office of the University. The procedure included interviews with the supervisor and staff of each office and a study of the existing systems and records. A review was also made of the present curriculum to determine where the electronic data processing equipment could be used as a tool to improve and broaden the present course offerings.

The review of procedures used at the college and universities listed above was completed by direct observation or a review of printed material. The author helped develop the system used at Mankato State

College and thus used this experience in developing the recommended system for Langston University.

Scope and Limitations

This study will offer a general outline to Langston University and other small colleges who are interested in developing a unit record system and eventually a computer system. The potential of electronic data processing systems in colleges is great, however most institutions have only begun to scratch the surface of applications. Probably one of the largest road blocks encountered by college administrators is the lack of available information on educational applications of data processing. This is especially true for smaller colleges and universities, since most of the available literature is written for large systems which are not within the economic range of the smaller schools. Thus a small institution establishing a data processing center today is apt to run into the same trial-and-error problems that faced larger colleges over the past several years. It is the scope and purpose of this paper to help contribute toward this need.

This paper is limited to the procedures used at Langston University and to the additional applications which the author felt would contribute to the needs of other small colleges. There are many applications which have not been mentioned in this paper due to the limitations of the author, available information about educational applications and in general due to the infancy of the computer science field. However, the development outlined in this paper should provide a basis for future applications in small colleges and universities.

Definition of Terms

Data processing terms will be used throughout this paper. To avoid confusion a partial listing of these terms and their definitions, which are currently accepted in the field of data processing, is included for the reader's benefit (26).

Abacus is a device for performing calculations by sliding beads or counters along rods.

Alphanumeric is a generic term for alphabetic letters, numerical digits, and special characters which are machine-processable.

Alpha-number is a number assigned to names such that when the numbers are in numeric sequence the names are in alphabetic order.

Automata is the plural of automation.

Automatic check is a check performed by equipment built into the equipment specifically for checking purposes. Synonymous with built-in check. Contrasted with programmed check.

Automation refers to the investigation, design, development and application of methods of rendering processes automatic, self-moving or self-controlling.

Auxiliary equipment is equipment not under direct control of the central processing unit.

Batch processing is a system approach to processing where a number of similar input items are grouped for processing during the same machine run.

Block sort refers to sorting by separation of the entire file on the highest order portion of the key, usually implying separate ordering of these segments and then adjoining the entire file.

Brush station is a location in a device where the holes in a punched card are sensed by brushes sweeping electrical contacts.

Cathode ray tube is a vacuum tube used as a storage or a visual display device.

Central processing unit refers to the unit of a computing system that contains the circuits that control and perform the execution of instructions.

Closed shop is a term used in the computer science field to indicate that the computing installation staff performs all computer programming, coding and operating functions, or any combination of these functions.

Cobol refers to the data processing language that makes use of English-language statements (Co-mmon B-business O-oriented L-language).

Collate is to compare and merge two or more similarly ordered sets of items into one ordered set.

Computer science is defined in Chapter V.

Core storage refers to a form of high speed storage using magnetic cores.

Cybernetics is the theory of control and communication in the machine and the animal.

Data processing system is the network of machine components capable of accepting information, processing it according to a plan, and producing the desired results.

Debug means to detect, locate, and remove mistakes from a routine or malfunctions from a computer.

Differential analyzer is a mechanical or electrical analog device primarily designed and used to solve differential equations.

Digital computer refers to a computer that solves problems by operating on discrete data representing variables by performing arithmetic and logical processes on these data.

Double punch is a term which usually refers to more than one numeric punch in any one column of an IBM card.

Electrographic pencil is a pencil with a soft lead that is a good conductor of electricity.

Eleven punch is a punched hole in an IBM card which is located in the second row of the card.

Electronic data processing refers to data processing largely performed by electronic means (abbreviated as EDP).

Flowchart is a graphical representation for the definition, analysis, or solution of a problem in which symbols are used to represent operations, data, flow, and equipment.

Fortran is the data processing language that closely resembles mathematical language (For-mula Tran-slating system).

Gang-punch is to punch all or part of the information from one punched card into succeeding cards.

General purpose computer is a computer that is designed to solve a wide class of problems.

Hardware refers to the mechanical, magnetic, electrical and electronic devices or components of a computer.

Mark-sense is to mark a position on a punched card with an electrically conductive pencil, for later conversion by machine punching.

Numeric punch is a punch in any of rows 0 thru 9 on an IBM card, with a punch in the zero row indicating a numeric punch if and only if it is the only punch in the column.

Optical scanning is a technique for machine recognition of characters by their image.

Remote stations consists of sending and receiving equipment connected by wire to a central processing unit. The equipment is normally located some distance from the processing unit.

Software refers to the collection of programs and routines associated with a computer, (compilers and library routines).

Summary punch implies a card-punching machine which can be connected to an accounting machine to punch totals for balance cards (noun), or it means to punch summary information into cards (verb).

System implies a collection of consecutive operations and procedures required to accomplish a specific objective. It also implies an assembly of objects united to form a functional unit.

Terminal stations are the same as remote stations.

Turn-around-time is the time it takes, after receipt, to process a computer program and return it to the pick up station.

Unit record historically, refers to a card containing one complete record, usually the punched card.

Zone punch is an additional punch or punches in a card column for purposes of expanding the number of characters which may be represented. These punches are usually called the 12, 11 and 0 zone punches.

CHAPTER II

BACKGROUND OF ELECTRONIC DATA PROCESSING EQUIPMENT

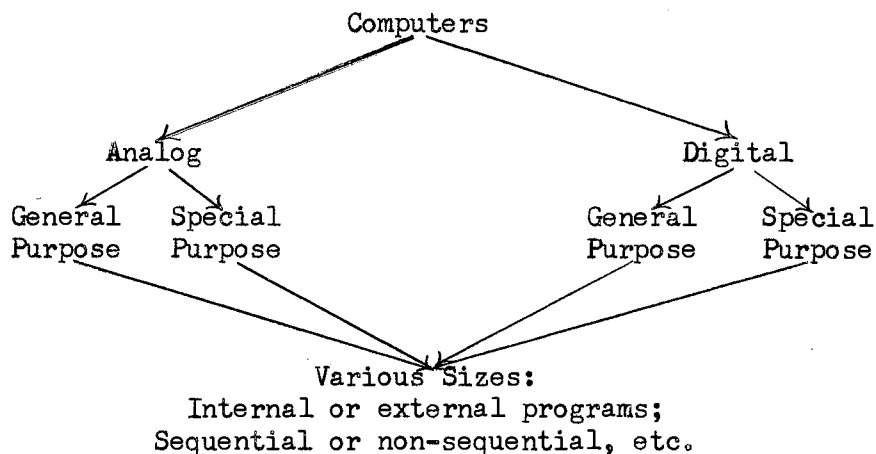
Early History

The contemporary electronic data processing equipment is a product of our age. However, in the broadest sense, this equipment represents the tools developed to help man calculate, standardize, and understand the events that occur in the world around him. Thus the early history of computers and unit record equipment is in part the history of man's progress in understanding his environment. In this sense the early history of this equipment can be traced back to those devices and principles that were developed before the introduction of electronics in the late 1930's.

A complete development of this early history is beyond the scope of this paper. Rather, a brief resume' is presented to acquaint the reader with this interesting part of man's history. An interested researcher could provide a great service to mankind by completing a thorough investigation of the historical development of each device and machine listed in Table II.

Modern data processing equipment and its predecessors can be classified by certain characteristics. In general we can consider two classes of computers, the analog and the digital, as outlined in Table I. These two classes of computers had a long history of development before they reached their present electronic stage of refinement.

TABLE I
COMPUTER CLASSIFICATIONS



Analog Computer: The analog computer is considered to be a continuous function computer and is probably the very earliest form of counting or numerical manipulation. It sets up a direct relationship between a variable in a problem and a physical quantity in the computation device. Numbers are represented by lengths, such as on a slide rule, or the electrical current in a conductor. The analog computers, in general, are limited in their accuracy by the precision in which measurements of length, volume or other physical quantities can be made.

Primitive man scratched a mark on the wall of his cave to represent one deer killed and thus established a one-to-one relationship between the symbol and the event. This could be considered the first calculation by analogy. Many years later we have an even better analogy when man began surveying and making maps of the land on which he lived. Hence, we have the beginning of the analog computer.

An analog computer more than 2000 years old, was discovered by divers near the Isle of Antikythera, off the coast of Greece, around

the turn of the twentieth century. This computer was rebuilt and determined to be an analog computer of the solar system built by the Greeks, around the year 100 B. C. (4).

The development of the analog computer continued from this early beginning, to the present, by the efforts of several prominent men. These outstanding individuals are listed with their inventions in Table II.

This class of computer is used to great advantage in solving engineering problems where many differential equations are involved. It is not a general multi-purpose computer which can be used to advantage in the business world as well as the scientific area, and thus, is normally found in the engineering schools of higher education and in research centers.

Digital Computer: The digital computer is considered a discrete computer since it does its calculations by manipulating digits. The distinguishing feature of the digital computer is the capacity to store a chain of instructions, called a stored program, and manipulate data electronically by using these instructions. "To put it briefly: an analog computer measures while a digital computer counts" (7). This comparison will give the reader some idea of the difference between the two classes of computers and also some insight as to why the digital computer is considered a multi-purpose machine. The inner manipulations of the digital machine corresponds to the everyday manipulations in businesses as well as the area of science.

The historical development of the digital computer has been traced back to the "Abacus" which is an ancient, versatile mathematical tool that was used many hundreds of years before Christ. This tool is still

TABLE II
THE HISTORICAL DEVELOPMENT OF ELECTRONIC
DATA PROCESSING EQUIPMENT

Analog Computers:

1.	Surveying and Map Making in Babylonia.	3800 B.C.
2.	Greek Computers.	100 B.C.
3.	Slide Rule by William Oughtred	1621
4.	Flyball Governor by James Walt	1788
5.	Planimeter by J. H. Hermann	1814
6.	Harmonic Analyzers & Synthesizers by Lord Kelvin .	1892
7.	Mechanical Differential Analyzer by Vannevar Bush.	1931
8.	Mechanical Differential Analyzer (Improved Version) by Vannevar Bush	1940
9.	Electronic Differential Analyzers (BOEING by Boeing Airplane Company; EASE by Berkeley Scientific Company; GEDA by Goodyear Aircraft Company, etc).	1945-1966

Digital Computers:

1.	Abacus	3000 B.C.
2.	Napiers' Bones by John Napier	1617
3.	Adding Machine by Blaise Pascal	1642
4.	Multiplication Machine by Galtfried Wilhelm Leibnitz	1671
5.	Difference and Analytic Engines by Charles Babbage	1812
6.	Punched-Card Machines by Herman Hollerith	1890
7.	Mark I by Howard H. Aiken	1944
8.	Electronic Numerical Integrator and Calculator by J. P. Eckert and J. W. Mauchly	1946
9.	Electronic Delay Storage Automatic Calculator by M. V. Willkes	1949
10.	Electronic Discrete Variable Automatic Calculator by John VonNeumann	1952
11.	Whirlwind I by M. I. T.	1953
12.	Second Generation Computers (transistors replaced vacuum tubes).	Late 1950's
13.	Third Generation Computers (miniaturized and refined transistors, known as "Solid State Components")	Early 1960's
14.	Future Generation Computers (Include the use of microwaves, lasers, and the study of cryo- genics)	1966

used in Japan where it is called a Saroben. In fact a unique contest was held in Japan in November, 1946: "Kiyoshi Mastuzaki, a clerk in a Japanese communications department, using the Abacus, challenged Private Thomas Wood of the U. S. Army, using a desk calculating machine, and defeated him in a speed contest involving additions, subtractions, multiplications, and divisions" (6).

The digital computer has developed, from this interesting historical beginning, into a highly versatile piece of equipment. Various forms and sizes of the digital computer can be found throughout our businesses and educational institutions. A brief outline of the digital computer development is presented in Table II.

Historical Development in Higher Education

The historical development of computers in higher education started with the introduction of data processing systems ["A network of machine components capable of accepting information, processing it according to a plan, and producing the desired results" (26:5).] which did not contain computers. The first systems included punch card equipment; such as, sorters, key-punches, reproducers, and accounting machines. These systems were installed in statistical departments of some of the larger universities and colleges for the processing of statistical data, and in registrar and business offices to handle the volumes of records common to that type of work. Some of the first schools in the United States to have this equipment were University of Iowa in 1925, by the Registrar; Texas A & M University in 1927, by the Agricultural Economics Department; Virginia Polytechnic Institute in 1934, by the Agricultural Experiment Station; and the State College of Iowa in 1938, by

the Registrar (31).

The introduction of punched card equipment in colleges and universities was not very surprising after Dr. Herman Hollerith had demonstrated the practical use of such machines in the 1890 United States Census. He was working with the monumental task of the census in 1887, when he invented a machine designed to record, compile and tabulate census data by the use of a punched paper tape (55). The machines improved the process to the point that the 1890 census was completed in one-fourth the time it took to finish the 1880 census. This was a great step forward for anyone working with large volumes of statistical data.

The establishment of computers on college and university campuses did not follow data processing until the introduction of electronics in the 1940's. The first computer was built in 1944, on the Harvard College campus by Howard H. Aiken with the support of the International Business Machines Corporation (4). This machine was an Automatic Sequence Controlled Calculator called Mark I. The introduction of Mark I to the college campus was soon followed by the ENIAC at the Moore School of Engineering, University of Pennsylvania in 1946, and Whirlwind I at M.I.T. in 1950. These computers were soon followed by the hundreds of makes and models we know today.

Related Research

A review of the literature reveals how new the electronic data processing field is to higher education. There were very few studies completed before 1960 that were concerned with data processing and data processing instruction at the college or university level. However, since that date, studies and research projects have increased each year.

At the present time, electronic data processing in colleges and universities is developing very rapidly with many schools introducing computer science courses to help train their students in this important area.

The role of data processing in education was recently reviewed by Associate Commissioner Flynt (22) in the United States Office of Education. This educational authority identified "five factors which must be recognized and accepted if there is to be any successful modern data processing in education at all" (22:7). These factors were expressed as follows:

1. The development of a common technical language which can serve as a basis for communication in the area of educational data processing.

2. The need to keep units of information in data processing as small as possible. Commissioner Flynt stated: "You can develop data for the larger units from the smaller, but can rarely extract data for the smaller, if you start with the larger" (22:7).

3. The importance of using modern machinery for transcribing, processing, and communicating data.

4. The need for understanding, acceptance and cooperation from all people associated with the phenomena of data processing.

5. The realization by the institution of education that it can well afford the costs in order to enjoy the benefits of this technological innovation.

The United States Department of Education and the California State Department of Education have jointly sponsored a project to develop a total system for processing pupil personnel and curriculum data for the State of California (28). The goals for this project are as follows:

1. The design and development of model systems for selecting and handling data;
2. The conduct and support of simulation studies;
3. Evaluation and analysis of data processing equipment.

An important part of the project is the development of remote equipment to be used with a central computer system to provide for increased individualized instruction in the classrooms of the future. The remote terminal stations will permit students to send information to the computer and receive a response from the machine.

The State of Washington recently established a statewide data processing program to help solve the problem of a shortage in qualified data processing personnel (14). A curriculum has been established in eighteen vocational schools and community colleges with a primary emphasis upon electronic data processing technology as used in business.

Spaars (48) recently completed a survey of 97 colleges and universities having computers. The survey had two central purposes; (1) to describe the experiences which colleges and universities have had to date with electronic digital computer systems and (2) to make explicit the implications which this accumulated experience has for the future, especially for those higher education institutions not now possessing such computer systems. The implications suggested for administrators of institutions not now possessing computer systems were as follows:

1. The potential uses of a computer should be identified prior to the selection and installation of a system.
2. The number and types of employees required to staff a computer installation should be identified.
3. Potential sources of aid and potential outside users should be

contacted in order to determine the extent to which the costs of a computer installation can be defrayed.

4. In calculating costs for a computer installation the quality and quantity of space required to house the computer system should be taken into consideration.

5. Certain card punch equipment is normally required to support a computer system, and the cost of this equipment should be included in the total cost of a computer installation.

6. Institutions should be aware of the limitations associated with using computer facilities other than their own.

7. Without the establishment of institutional priorities for the use of a computer system before the system is installed, conflict can develop over control of the computer facility.

Ivey (33) found in a 1965 study that college administrators were concerned with several questions in trying to determine if they should install electronic data processing equipment in their college or university. These concerns were as follows:

1. Is my institution falling behind in a technological age?
2. Will future students be missing an important part of an adequate educational program?
3. Will I experience difficulty in recruiting and retaining staff members without a computer?
4. Is it possible that the enrollment will begin to drop for the above reasons?
5. Will it be possible to secure research grants without a computer on the campus and would a computer help in securing them?

Ivey suggested that the process of establishing an electronic data

processing center on a campus can be divided into three distinct phases; (1) a feasibility study, (2) a planning phase, and (3) the implementation of services. The following recommendations were presented under these phases:

1. A formal feasibility study should always be undertaken prior to the establishment of a data processing center.
2. Allow sufficient lead time to prepare for implementation of the center.
3. Establish the computer center as a separate department of the college.
4. Employ a full-time director early in the planning phase and qualified personnel as they are needed.
5. Provide potential users with information relative to the applicability of electronic data processing to their areas of concern.
6. Do not overlook human factors when introducing a technological innovation to the institution.
7. Choose the equipment which meets the needs of the institution.
8. Establish means of adequate financial support for the facility prior to contracting for the equipment.
9. Choose a location for the center which is appropriate for its intended use.
10. Make use of available training programs for staff members and insist on personnel keeping abreast in the area of electronic data processing.
11. Capitalize upon the efforts of other colleges in the area of program development.

12. Use the computer's full potential as a model in visualizing the administrator's roles in a growing institution.

The installation of data processing equipment has generally followed the rise in enrollments on large university campuses. However, a recent study by Stein (49) found that institutions with enrollments exceeding 500 students should make plans for installing electronic data processing facilities. The recommendation encouraged joint participation with other small colleges in the rental or purchase of expensive data processing equipment.

A recently completed research project by Hamblen (29) identified several applications of electronic data processing in the administration of a college or university. These applications are as follows:

1. Business Administration
 - a. Payroll calculations
 - b. Bank reconciliations
 - c. Fee assessment
 - d. Accounts receivable
 - e. Scholarships
 - f. General accounting
2. Institutional Accounting
 - a. Test scoring and analysis
 - b. Statistical studies with respect to student testing and performance
 - c. Institutional studies with respect to staff loads and physical plant utilization
3. Registrar
 - a. Student records

- b. Student sectioning--(To do this on a 1620 might require 40,000 storage positions or a 1311 disk unit.)
 - c. Class lists
 - d. Class schedules
 - e. Grade reports
 - f. Semester and accumulative average
 - g. Additions to permanent records
 - h. Student and parent mailing lists
4. Purchasing
- a. Vendors summary
 - b. Equipment
5. Admissions and Student Aid
- a. Basic data from the student should be obtained from the admissions form and subsequently supplied to the other offices by data processing. This could best be done through the use of continuous form records for the other departments or form headers printed on pressure sensitive labels.
 - b. Student loans
6. Physical Plant
- a. Supplies inventory
 - b. Space inventory
7. Alumni Association
- a. Alumni studies
 - b. Mailing lists
 - c. Alumni directory
 - d. Gift records

8. Library
 - a. Book orders
 - b. Serials inventory control
9. Athletics
 - a. Player statistics
10. Development Office
 - a. Gift records
 - b. Donor records
 - c. Mailing lists

In the same report Hamblen suggested the most efficient way to coordinate administrative, research, and instructional uses of data processing equipment on college and university campuses. A summary of these suggestions are illustrated in Figures 1 and 2. Figure 1 illustrates the recommended initial organizational arrangement for a centralized college data processing center and Figure 2 demonstrates the recommended ultimate organizational structure. These organizational structures are considered essential for maximum utilization of electronic data processing facilities on a college campus.

The electronic data processing installation on a college campus must have support from the president's office to develop and function as an asset to the whole campus. This support does not necessarily mean the college or university president must completely understand the system, but he should develop a sufficient knowledge to gain maximum potential from the system. A means of developing this knowledge was suggested by Martin (37) in his article, called "EDP 10 Commandments for Executives." These rules were written with the business executive in mind; however, in most college communities the college president

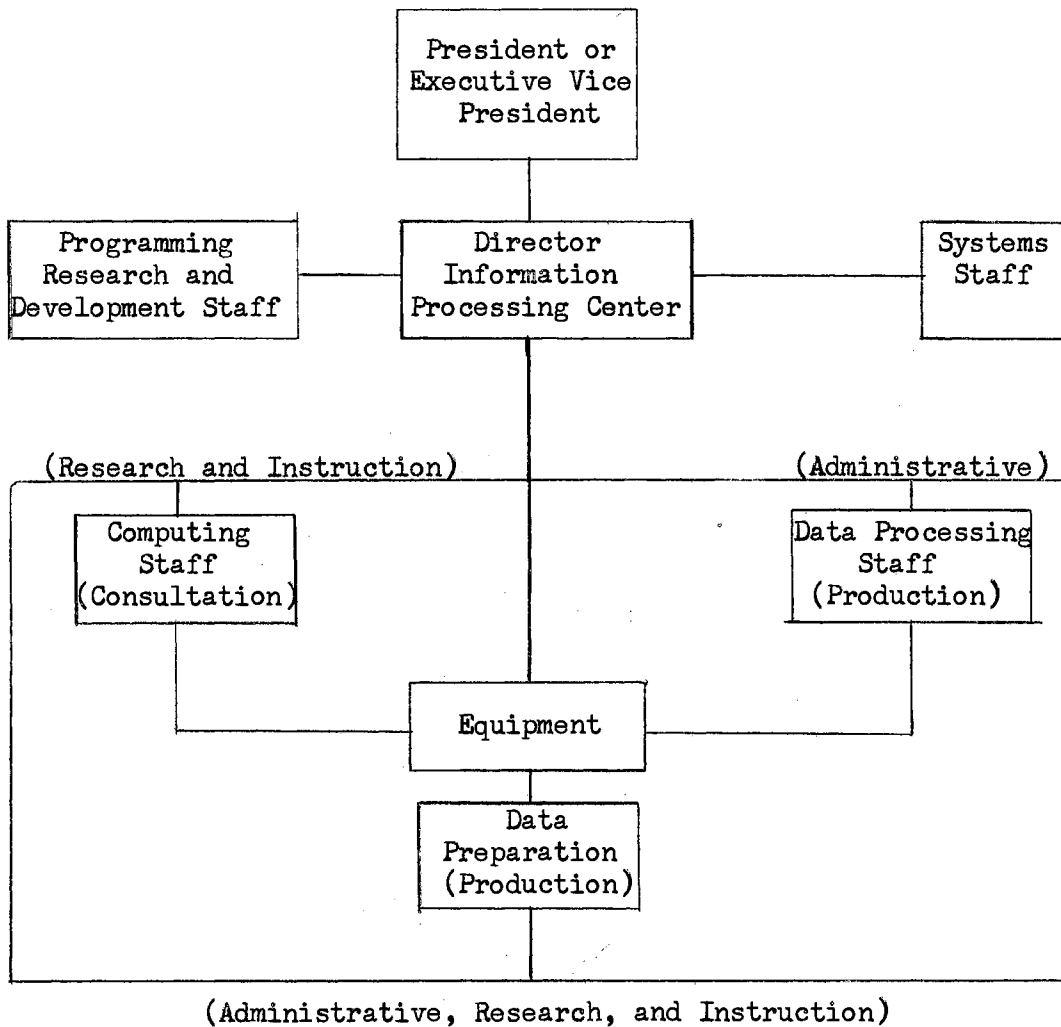


Figure 1. Recommended Initial Organizational Chart for a Coordinated College Information Processing Center

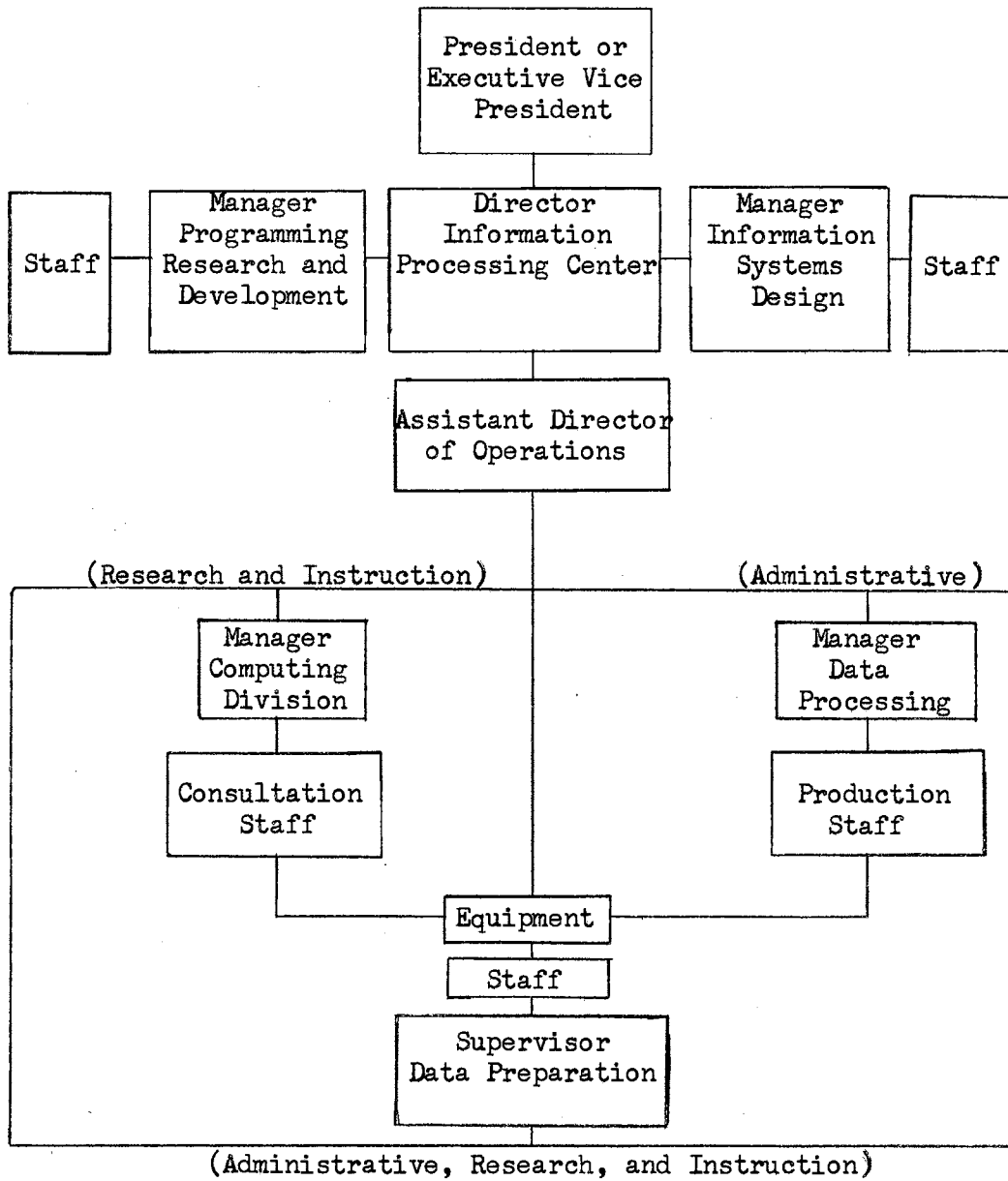


Figure 2. Recommended Ultimate Organizational Chart for a Coordinated College Information Processing Center

administers the largest business of the community. Thus the following rules would seem to be relevant to the college or university president also:

1. Know the capabilities and limitations of your computer installation.
2. Have a staff capable of keeping the command current concerning new concepts and equipment.
3. Know what managerial, organizational, and technical experts are available to advise you on matters concerning electronic data processing policies and procedures.
4. Conduct periodic reviews of your organization to determine if new areas can be automated.
5. Obtain from your data processing manager only the amount of detailed information necessary for decision making.
6. Ensure that you don't develop a stereotyped approach to all data processing problems.
7. Realize that electronic data processing is not the cure-all for all organizational problems.
8. Recognize that feasibility studies which reveal that electronic data processing is not practical may also reveal where improvements in the existing system can be made.
9. Remember that it is seldom possible to include new areas in electronic data processing without having a consequence on other organizational elements.
10. Never try to use the computer for jobs which people can do better, and never become disillusioned with electronic data processing when occasional failures occur.

Wagner (56) completed a study in 1952 which had the purpose of determining the scope and effectiveness of punched card procedures in student personnel programs of colleges and universities. He also wanted to develop and propose a plan for the installation of such procedures in the student personnel office of Stanford University.

As a result of his study Wagner suggested two basic premises in developing the plan for the use of punched cards in the student personnel area; (1) "The new method of operation must be wrapped up in as much of the old as is possible" (56:111), and (2) segments of a complete operation must be installed as circumstances permit or indicate rather than have a complete operation installed at one time. Several advantages suggested as a result of the new data processing system were as follows:

1. Closer control over the student through the use of the instructor class cards.
2. Closer control over drops and adds through the use of student course cards.
3. Improved coordination of instructor and Registrar student records through the use of grade lists originated by Registrar.
4. Statistical information will be readily available. Present statistics are limited to tedious and expensive manual methods.
5. Sufficient copies of student grade reports for all interested offices.
6. Readily adaptable for future uses at little increase in cost-- such as directories, time schedules, and additional statistics.
7. Reduction in tedious manual postings and computations, thus reducing errors inherent in all manual operations.

Nelson's (40) 1965 study describes and analyzes the procedures used in converting the business operation of a school system from a punch card unit record data processing installation to an electronic computer data processing installation. The sub-purposes were outlined as follows:

1. To describe the basic school business operations performed on punch card unit record equipment.
2. To describe the basic school business operations performed on an electronic computer.
3. To show the advantages of a computer installation over a punch card unit record installation in performing school business operations.
4. To describe the role of school business management in changing from a unit record installation to an electronic computer installation.
5. To develop guidelines for school business administrators to use in converting a unit record installation to an electronic computer installation.

Nelson found that a computer system offered faster service, more detailed and timely reports, and additional flexibility. He also states that a year was the minimum time needed for converting from the unit record system to the computer system and points out that space should be planned well in advance of the computer delivery. He suggests the following guidelines for converting a unit record installation to a computer installation for processing school business information:

1. As an initial step to any conversion from a unit record installation to a computer installation, a detailed study of the data processing needs of the school system should be made.

2. A feasibility study should be conducted after the need for a computer is determined.
3. A separate department for data processing should be organized when converting from a unit record installation to a computer.
4. Physical facilities for the computer installation should be planned immediately after the decision is made to obtain a computer.
5. A systems approach should be taken in planning and writing computer programs for school business operations.
6. Paralleling operations of the unit record installation and the computer installation should be conducted to insure adequacy and accuracy of computer operations.

The Massachusetts Institute of Technology developed a new computer program to simulate a college operation before the college is built. The new program called GASP [Generalized Academic Simulation Program] is very successful in applying computers to school scheduling. This program was recently used in Missouri to simulate the operations of junior colleges before they were built (51). The use of the program saved millions of dollars by reducing the number of classrooms needed for a specified enrollment.

The recommendation to use punched card and computer systems for building class schedules and for rapid registrations of students was made in an article, "Data Processing for Building Schedules and Student Registration," by Robert E. Rolens (45). He suggests that caution be used in computer selection of student courses, but admits the computer will do the following:

1. Determine the frequency of course selection.
2. Spot the frequency of conflicting course selections.

3. List the students requesting single and double course offerings.

4. List the student's frequency of first and second alternative courses.

Gibson (25) suggested in a recent report that Schools of Business should consider the following points in their educational business programs:

1. Repetitive type jobs such as typing, filing, sales, bookkeeping, figuring, bookkeeping machine work, punched-card operation will be affected by integrated electronic data processing.

2. General background in this area is necessary for future office workers.

3. Business prefers to train business personnel in programming instead of engineers and other non-business people.

4. Course revisions and additions are needed to direct students in areas of logical thinking, mathematics, statistical methods, and systems operation.

5. Business prefers a broad education.

6. Business graduates who have a partial engineering background are those best fitted to adapt to the data processing areas.

7. Business has need for a higher type or better quality business graduate.

8. Schools of Business should teach fundamentals of data processing.

9. The auditor and the systems manager may seem the ones destined to arrive at the top of the business heap after the integrated electronic data processing shakedown.

A study by Frisbie (24) found office jobs are being affected by the

EDP installations and at the time of that writing the personnel needs of businesses employing electronic equipment were in a transitional stage.

Frisbie suggested a twofold responsibility is charged to colleges and universities in preparing those who will eventually fill posts as office managers or accountants in companies whose data is manipulated by electronics. These responsibilities are; (1) it is the responsibility of the colleges to give both of these groups the broad training needed to encourage them to engage in logical thinking and in decision-making based upon quantitative data, and (2) to the colleges goes the responsibility of orienting these students in the areas of current technological developments so that they are aware of the ways in which electronics of today can and will affect their work. She also made the following recommendations to help meet these responsibilities:

1. Careful study of existing EDP systems and the personnel operating them should be made to determine just what content a course of higher mathematics should include to adequately prepare those who will work with electronic equipment.

2. Also, for the office manager of the future required work in logic will assist the student in pursuing logical thinking patterns until they become routine reactions to be followed whenever the occasion calls for a logical decision.

3. For both of these groups trained in colleges, basic work in statistics with the use of assumptions will give the students the opportunity to use quantitative data to promote proficiency in decision-making.

4. All School of Business graduates should have a basic understanding of electronic data processing, including orientation to the

basic principles, flow charting, coding, and an overview of programming with no attempt to turn out skilled programmers.

5. The integration of electronic data processing in each subject to which it relates will aid students to see the relationship between the over all area and the uses to which it is subjected.

6. Further, in preparing the students to enter the dynamic field of business, colleges have a responsibility to extend vocational guidance to students in order that they may be cognizant of opportunities open and the aptitudes and knowledges essential to success in electronic systems work.

7. Adult education is a service which colleges may extend to those in business who wish to become more closely associated with the computer installations and operations and to the secondary teachers who need to learn more about the field in order to orient their own students.

The future of electronic data processing in education was suggested by Bushnell (10) in his article "The Role of the Computer in Future Instructional Systems." He states:

Our studies have led us to believe that computer technology will relate to education in several ways:

1. Educational data processing, including both administrative functions and student personnel functions.
2. Simulation and gaming as important teaching techniques.
3. Information storage and retrieval, affecting most library functions and, hence, most educational functions.
4. Information transmission and display, affecting audiovisual and broadcasting functions.
5. Information analysis, breakdown, and resynthesis. This is the area of machine translation, character reading, generation of printed and oral information, etc. The exact effects of these developments are

not clearly understood, but changes are likely to occur in language teaching and learning, learning for the blind and deaf, etc.

6. As a control for teaching sequences where the computer acts as a teaching machine or the control for a whole instructional system.

There are other areas, but these are the most important, and, of these six, the last--control of learning sequences-- is central.

The above reports and research suggest that electronic data processing equipment is rapidly entering the educational area of higher education, both in the administrative areas and the instructional and research areas. This equipment and associated procedures will bring about many changes in higher education as this development continues. An indication of this is suggested by Smith (47) when he recently pointed out that each year has brought about changes and improvements in data processing techniques so that no two years have remained the same.

This review of the literature has disclosed no criteria for a college or university to use in developing a unit record system from a manual system and then projecting the unit record system to a computer system. References in this section have been made to factors which should be considered in the establishment of an electronic data processing system.

CHAPTER III

PRELIMINARIES TO ELECTRONIC DATA PROCESSING

An EDP System

An electronic data processing system involves a series of planned operations upon information to obtain a desired result. The series consists of four rather well-defined steps which are very similar to those followed in a manual system. These steps are as follows:

1. Data Origination: Source documents are prepared manually and contain the source data.
2. Input: The source data is punched into cards in coded form and represents the input data for the EDP system.
3. Processing: The data is read from the cards and manipulated within the system to obtain the desired information.
4. Output: The processed data is printed or punched into cards in the form desired.

The above steps constitute a data processing system and remain basically the same whether the processing device is (1) pencil and paper, (2) key-driven machines, (3) unit record equipment, or (4) a computerized system. The main difference between the first two systems and the last two is the numeric coding used to represent the data in step number two. The use of a numeric code usually permits faster machine processing in classifying and arranging data. This results from the ability of the equip-

ment to act upon the code number rather than the raw data which generally has a longer designation. A good example of this is the student number which is discussed in section three of this chapter. The arrangement of student names into alphabetical order can be accomplished mechanically much faster if the processing is done on the alpha-number rather than on a 20 to 25 column alphabetical field containing the student's name.

Numerical Coding

The normal route to follow from step number one to step number two, in the preceding section on systems, is the numerical coding of the source data so that it may be recorded into a punch card in the form of punched holes. The holes in the cards actuate the data processing machines to automatically perform various operations for tabulating, processing and recording data.

The punch cards considered in this paper are the standard IBM cards which measure $7 \frac{3}{8}$ inches by $3 \frac{1}{4}$ inches and are .007 inches thick (32). The cards are divided into 80 vertical areas called card columns which are numbered from 1 through 80 from the left side of the card to the right. Each of these columns is divided into 12 punching positions, designated from the top to the bottom of the card by 12, 11 (or X), 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9. The position of these codes and the punch codes for alphabetic information can be seen in Figure 3. Other physical characteristics of these cards include various colors and corner cuts which are used for visual identification.

The numerical coding of information into punch cards requires the coder to pre-determine the card area that is to be used for each piece of data. Each segment of the card reserved for punching specific data

is called a field. A field may consist of one column or eighty columns, depending upon the length of the particular type of information.

The designation of fields in the punch cards and the coding of the data is an initial problem facing colleges and universities installing electronic data processing systems. The complete power of these systems is not used unless a good coding system has been developed. However, once the coding system is developed and the coded data recorded in a punch card, the card becomes a permanent record that can be used over and over again. This factor leads us to what is normally called the unit record; consequently, punched-card equipment is sometimes referred to as unit record equipment.

Due to the importance of numerical coding in college and university administrative applications, the next two sections of this chapter will describe two important code systems in the realm of college and univer-

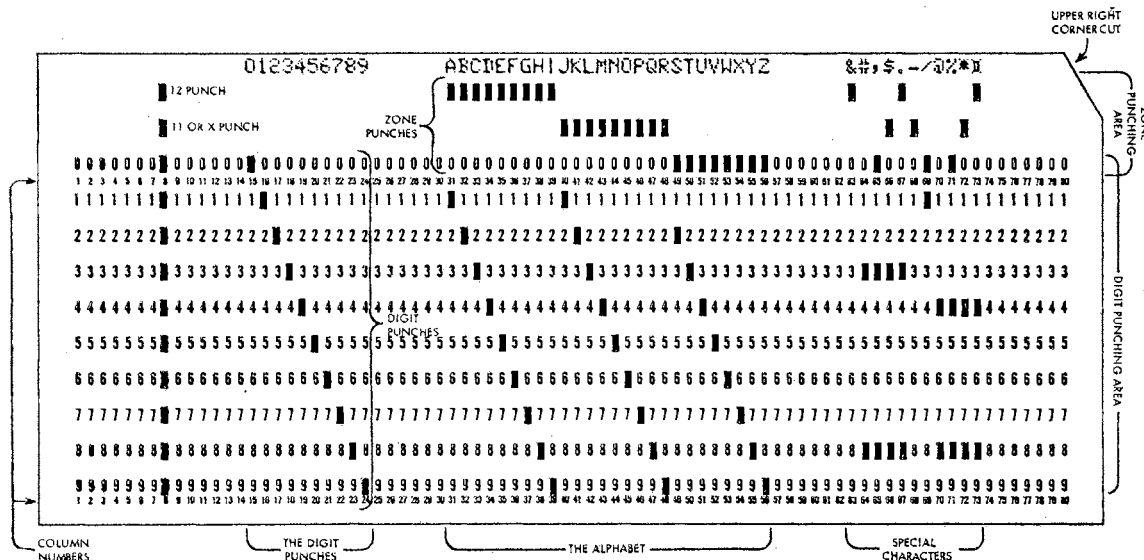


Figure 3: IBM Card

sity administrative applications. Additional suggestions on coding are discussed in Chapter IV, as the administrative systems are developed.

A Student Numbering System

A sound student numbering system is essential to the development of an efficient integrated data processing system which is the ultimate goal whenever electronic data processing equipment is used in a college or university system. The term "integrated data processing system" is defined for this paper as the logical arrangement of all data connected with or dependent upon student data. This type of system permits all functional parts of a college or university the mutual utilization of applicable data.

The identification of students by some method other than name is a necessity if the above requirements are to be satisfied. This identification procedure can be developed in several ways. The student may be assigned his social security number when he is admitted to the college or university for the first time. Another method is the assignment of a sequence number determined by the number of students who have enrolled at the school. For example, if the last new student enrolled in the fall semester receives number 25001, then the first new student enrolled for the spring semester would receive number 25002 and so forth. There are several other methods which generate a permanent student number by using parts of the student's name, birth date and the student admission date.

Each of the above methods of generating a permanent student number has certain advantages; however, a student number should include something besides the identification of the student. This something should

include an alpha-number which makes possible the high-speed sorting of student record cards, the student admission date and a number which is not extremely long. The social security number and sequence number require the generation of an alpha-number each semester. The methods using codes from the student name, birth date and admission date are somewhat difficult, sometimes involve an alphabetic character and are generally too lengthy.

The system developed by the author involves the admission date and an alpha-number which is determined by the size of the college or university concerned. The alpha-number is obtained by counting the number of students that have attended the school since a certain date. It is recommended this date be chosen so that students with an earlier admission date would not, under normal conditions, be returning to college. Next, the number of digits that are wanted in the alpha-number should be determined. Once these two figures are obtained the interval of assignment can be found by dividing the maximum alpha-number by the number of students. For example, it was determined that 40,000 different students had enrolled at Langston University since 1906 and that a seven digit alpha-number should be used. This meant the interval of assignment would contain approximately 250 positions $\lceil \frac{9999999}{40,000} \rceil = 250$. The first A in the permanent record files would therefore receive the alpha-number 0000 250, the next A would receive the alpha-number 000 500 and so forth. The complete student number for the first A, assuming he was admitted the fall semester of 1933, would be 233 0000 250 where the high order 2 stands for fall semester and the 33 for the year, 1933. When a new student enrolls whose name falls between 0000 250 and 0000 500, he will be assigned the number 0000 375.

This system will accomodate Langston University for several years before some of the intervals are filled. Once an interval is filled however, a decision must be reached as to what steps should be taken to allow additional student number assignments. There are several routes to take at this point, such as, (1) assign an alpha-number each semester, (2) use a computer and sort alphabetically within the memory core if a large enough system is available, (3) or reassign numbers and create new intervals as before. The latter suggestion would seem to be best in a small college or university which does not have a large computer system available. It should be noted, that it is highly desirable to develop large intervals of assignment at the beginning to allow for expected enrollments for several years into the future.

Once a student numbering system, of the type outlined above, is installed in a college or university system it is possible to interrelate data from the various offices and departments dealing with student data. The connecting link is the student number which every student will have with him on his student ID card identification card defined in Chapter IV.

A Course Numbering System

The installation of a student numbering system is essential in developing an efficient data processing system in an educational institution. Another coding system that is not as essential, but very important, is a course numbering system which can be efficiently machine processed and still meet all the necessary requirements of a college curriculum.

Generally, a course number is used to describe (1) the level of the course offering and (2) the course sequence within the academic department. The Langston University system is of this form, with a three digit code number for each course in the curriculum.

Some of the problems associated with this system are the separation of the course number and the course credit hours, and the lack of flexibility when graduate credit is involved.

The determination of credit hours, by the administrative staffs in the college or university offices is a very frustrating experience when credit hours are not recorded on registration forms or credit hours are changed without changing the course number. Also, many times the courses offered in a semester are new and thus are not listed in the college or university catalogue.

The second problem develops when a graduate program is offered at a school. In many cases it is necessary that undergraduate and graduate students enroll in the same courses and unless the college or university has separate graduate permanent records, it is necessary to identify those courses taken for graduate credit. The general procedure in making this identification is to use a letter G after the course number.

A system which solves these problems was developed by the author and has been successfully used for the last three years at Mankato State College, Mankato, Minnesota. This system uses a four digit code number with the high order digit indicating level of course work, the middle two digits describing the department course sequence and the low order digit identifying the course credit. For example, Math 4203 is a senior level course with department number 20, at this level, and the course carries 3 credit hours. A course which carries variable credit is

numbered in the same way except the low order digit varies over the allowed range of credits.

The identification of graduate credits is obtained by numbering the courses at the 5 or 6 level. A course numbered at the 6 level is restricted to graduate students. If a course is numbered at the 5 level, there is a corresponding course at the 3 or 4 level in which qualified juniors and seniors may enroll.

Hence, the recommended course numbering system has the form outlined in Table III. This system alleviates the problems that were present in the other system without losing any of the desirable properties.

TABLE III
COURSE NUMBERING SYSTEM

Freshman Level:	1013	
Sophomore Level:	2013	
Junior Level:	3013	
Senior Level:	4023	] (same course)
Graduate Level:	5023	
	6011-6	(Credits vary from 1 to 6).

The Data Processing Center

The planning and development of an effective integrated data processing system must include plans for the organization and operation of the office which should be at the heart of the system, namely, the Data Processing Center. This office has the responsibility to see that the data processing system has the proper perspective and can carry out the five functions which should be present in every data processing system.

These five functions are listed below (46):

1. Systems planning
2. Programming
3. Operations
4. Training and Information
5. Research

The administrative control of a data processing system is an important factor in determining the success of the system. Generally, such a system represents a sizeable investment to a college or university and thus the responsibility for its operation should not be taken lightly.

A recent survey of 439 colleges and universities by the American Association of Collegiate Registrars and Admission Officers listed six areas where this responsibility is being placed today for those computer centers which are responsible for processing admissions and registrar functions (21). A summary of these results is outlined in Table IV. An analysis of this table would indicate a trend toward centralized control under one administrative unit as schools increase in size.

This trend was also indicated in general by the "Seventy College Survey" where administrators in academic administration and computer science administration were in favor of one administrative head to coordinate all computer science areas on campus (31). The results of this survey were three to one $\overline{3-1}$ in favor of one administrator even though the actual control on the college and university campuses surveyed was approximately fifty-five percent under one administrator and forty-five percent under more than one.

To analyze this trend it is more helpful to look at the types of organization being used in colleges and universities. The organization

TABLE IV
ADMINISTRATION OF COMPUTER FACILITIES
BY SIZE OF INSTITUTION

Size of Institution	Under 1000	1000- 4999	5000- 9999	10,000 and over	Totals Number	%
A. Admissions and/or Registrar's Offices	2	21	8	12	43	9.8
B. Business Office	2	19	10	23	54	12.3
C. Combined Research-Administrative Units	3	38	33	27	101	23.0
D. Centralized Administrative Units	0	30	26	41	97	22.1
E. Departments within the Institution	8	51	35	21	115	26.2
F. Private Service Bureau	5	20	4	0	29	6.6
TOTALS						
Number	20	179	116	124	439	
Percentage	4.6	40.8	26.4	28.2	100.0	100.0

of data processing centers has followed two lines of thought, (1) the decentralized control approach and (2) the centralized control approach.

The decentralized approach developed historically from the first applications of data processing equipment. Due to the nature of computer development in departments of electronics, the desire for ways to process large volumes of statistics in statistical laboratories, and the needs of the registrar and business offices, the first machine systems were applied mainly in these areas. This resulted in a decentralized machine system on most campuses with the various academic departments and administrative offices each budgeting for their own computer or unit record system.

The decentralized approach has the advantage of the equipment being physically located in the area of the administering office and thus provides a ready access for members of that office. The turn-around-time on programs is generally small and normally the administrative regulations are less involved. Since the system is controlled by the department or administrative office, changes in the system may be implemented without conferring with other offices. This results in very little time being spent in considering proposals from other areas. If the department or office has the money and personnel to handle their own proposals, they have the freedom to move immediately.

Four of the major disadvantages of a decentralized system are (1) cost, (2) lack of an integrated system, (3) less qualified personnel and poor service, and (4) restrictive control over other departments or offices.

The first disadvantage comes from the additional cost of duplicating equipment, and personnel to operate and supervise the equipment. The high cost of equipment and physical area to complete the furnishings for one data processing center is a strain on most colleges or university budgets. When additional centers are installed, an unnecessary strain is placed on the school budget and thus deletes from those funds needed in other areas of the overall program. In addition to this economic strain, multiple centers place a strain on the number of operators and supervisors that are available to the college or university program. Faculty members who could be teaching, doing research, or helping coordinate their departments' data processing activities with the data processing center are consumed in the supervisory duties of the departmental center. These people could be of much greater value to

the college or university if they would help other faculty members arrange and program their problems for processing at a central data processing center.

The second major disadvantage is the lack of a totally integrated system. If several centers exist on campus without a central control, it is impossible to develop an integrated data processing system. For example, the Business Office, Student Personnel Office and Registrar's Office all contribute to the student data collection; however, if each office has its own data processing system, the consolidation of this data will be extremely difficult. The advantage of having a centralized system is quite apparent in this case since all of the data for each student could be filed together. Another advantage is the consolidation of requests where one request may be filled as a side result of a much larger data processing application.

The centralized system does provide the possibility of a totally integrated system where multiple applications can be consolidated as well as the consolidation of data on students, research grant applications, library of available programs, and many other advantages not available in a decentralized system.

The third disadvantage is less qualified personnel and poor service resulting from the shortage of qualified personnel, equipment being available fewer hours each day, a smaller equipment inventory, and possibly slower equipment.

The electronic data processing field is presently at the point of development where a shortage of qualified personnel exists. Thus, if a college or university must spread the available personnel over several

data processing centers, the result is less qualified personnel at some of the centers.

In general the equipment is available fewer hours each day since the supervisor does not usually have an assistant and thus when he leaves for meals or teaches a class the center is closed or under the supervision of a less qualified individual. This is not necessarily true in a centralized system since there are usually two or three complete shifts for the center which provide an eight to twenty-four [8-24] hour service day.

Additional advantages of a centralized system are inherent in the system since the staff of the center becomes better trained by dealing with applications from all areas of the campus and the consolidation of the equipment will in some cases justify larger and faster machines as replacements. This in turn provides broader capabilities and a faster turn-around-time which counteracts one of the proposed advantages of the decentralized system.

The fourth major disadvantage of the decentralized system is self-explanatory, restrictive control over other departments or offices. It is a natural human characteristic to develop and promote those areas of personal responsibility before considering the interests of others. This sometimes results in the controlling department's promotion of programs which are not in the best interests of the entire college or university. In addition there exists the inter-departmental competition for status which tends to add to the proliferation of equipment centers and at the same time place additional strain on the school budget. The centralized system would be less likely to foster either one of these problems.

This brief review of the decentralized system demonstrates several shortcomings which tend to outweigh the advantages of the system. In addition it has been demonstrated that the centralized control approach does solve these problems with the only possible disadvantages being location, turn-around-time on programs and similar administrative regulations for all users of the center.

The problem of location is a difficult one to handle on some campuses; however, in most cases it should be possible to locate the center where it is readily accessible to a large number of users, both during the night and during the day.

The problem of turn-around-time may be longer due to the larger number of users of the system but there is the possibility it could be less due to a larger system or faster equipment, as suggested previously, and/or longer service hours of the center.

The last problem is really not a problem but an advantage, except for those departments which would promote the needs of the department ahead of those of the overall college or university.

Hence, it is the definite opinion of the author and many others in the field that the centralized control system, with one administrative head and one central data processing center with possible remote or terminal stations, is the best system for a college or university (29, 30, 31, 33, 48, 57). This control system will allow the formation of an overall integrated data processing system with many subsystems, each having a logical place within the total system.

The decentralized system had its historical beginning before the centralized approach but today, due to the high cost involved, the centralized system seems to offer a better arrangement for colleges and universities.

Rules for a Data Processing Systems Staff

The development of an effective data processing system on a college or university campus must necessarily include well qualified personnel and, as outlined in the preceding section, a definite type of structural organization. However, in addition to these necessities, a good system should have a uniform set of rules for the staff of the data processing center.

A set of ten commandments for systems analysts which Mr. Ted J. McGoren (39) recently published, would seem to apply to all members of a data processing center. These rules are as follows:

1. Record everything: All requests should be written down. All conclusions should be documented. Request forms and documentation forms should be as simple as possible to encourage the recording of pertinent information.

2. Talk directly with the people involved: If it is possible, go through a complete cycle with the people operating the existing system. Don't assume you can learn in an hour what someone else has devoted years to develop. Remember that existing manual procedures are not often written down, and even less often is the documentation kept up to date. Collect actual samples or copies of forms and be sure they are typical, especially if the present system is manual. Avoid blank forms.

3. In designing work flow, avoid using names: Using titles forces recognition of the chain of command and helps to define the work flow by showing the connection between levels of management, and between stations in the same section or department. The use of an individual's name on forms and procedures makes it necessary to frequently redesign forms whenever the individual is promoted or moved.

4. Some things are better done manually: There is no better "random access" file than a tray of cards. Manual methods allow the transfer of production units (personnel) for peak loads. Manual methods sometimes require less specialized training, as in an assembly line type of operation.

5. Always make sure you have the best system: There is no substitute for the patient analysis of pertinent information. Sometimes it is better to eliminate an operation than to try to improve it. The analyst must always be willing to adopt the best method available regardless of how much work he has done on an alternate less desirable system. There should be no "pets" or "my babies."

6. Try it first: Hold out for a parallel run, of course, but even before that, dry run if possible, if not, then simulate.

7. Tell the people involved what to expect: A good deal of consideration must be given to the training of personnel. Make them feel they are part of the new operation.

8. Anticipate crisis areas: They cannot always be eliminated but preparation can help solve the problems. Everything should be scheduled in such a way that checking and correction will not interfere with the timetable.

9. Allow enough time: Don't sacrifice accuracy for time or you may find it necessary to take the time to run over again what you did not allow enough time to do correctly in the first place.

10. Follow up: This is very important. Check the system at regular intervals. Make sure it is doing what you wanted--when you wanted it, and document everything.

There are definitely other important rules common to the individual centers, but the above ten rules summarize many of the basic techniques that should be followed.

Flow Charting

The development of an effective data processing system will include systems design and the accompanying system flow charts. These charts are a graphic representation of the procedure in which information from source documents is converted to final documents. Their importance results from the standardization of this graphic representation into uniform pictures of a data processing application.

Standardized symbols are used to represent clerical functions, unit record machines and functions, and types of documents. Some of the standard symbols used in Chapters IV and V are shown in Figure 4 (32).

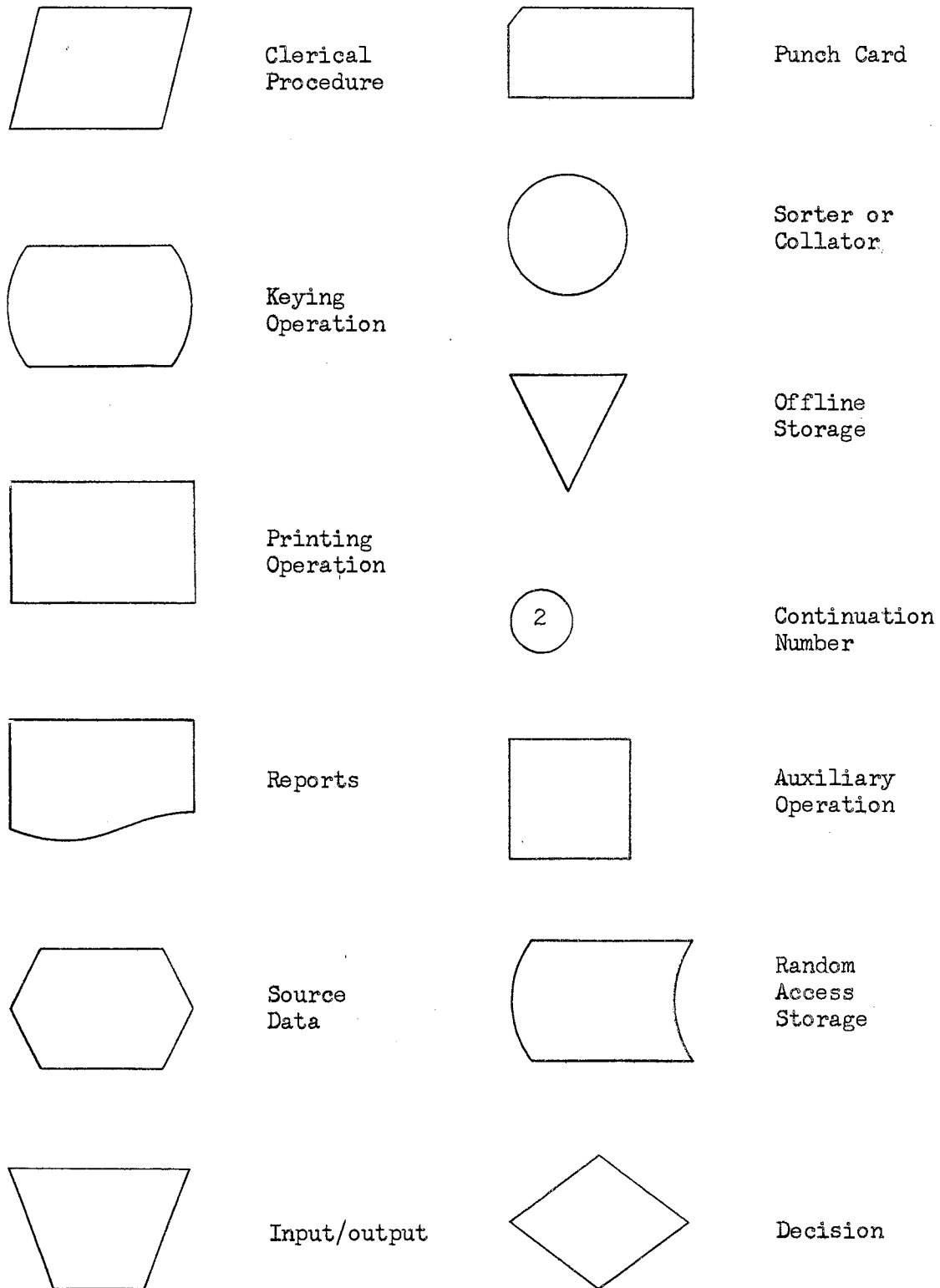


Figure 4. Flow Charting Symbols

CHAPTER IV

EDP IN THE ADMINISTRATIVE OFFICES

Introduction

The administrative operations of today's university or college are becoming more and more complex due to the expansion of services, academic activities and the multitude of reports requested by various agencies, as well as the continuing growth in enrollments. This development has presented a great challenge for administrators to apply the techniques of electronic data processing to all phases of the administrative operations.

This chapter outlines several of the basic administrative applications of electronic data processing equipment.¹ These applications have been developed in the following pattern: reviewing the manual system used at Langston University [at the time of this study], developing procedures which use unit record equipment, and finally extending these to a computer oriented system.

The chapter has been sectioned into the various administrative activities, since the development of the applications in this way provides an insight into the operational beginnings of an integrated system

¹The term electronic data processing equipment has been used in Chapter I-III to mean both a unit record system and a computer system. In this chapter, these two systems will be developed separately.

where the data processing installation is working with one or more offices on each administrative application. This approach should help the administration of a college or university better perform its function in guidance, coordination, and support of the faculty and the students throughout the instruction, research and other activities which are the essence of the institution.

The development of each application includes forms used under the manual system and suggested form revision for a unit record system. Also, punch cards have been designed and are illustrated in each section along with the card formats which are listed immediately after each card illustration.

At the end of each section a pictorial representation of the unit record system has been demonstrated by systems flow charts. The symbols used in the flow charts are the same as those defined in the last section of Chapter III.

Admissions

The first contact a prospective student has with a college or university is generally with the Office of Admissions which has three main functions within the college or university structure:

1. Gathering all information about the prospective student.
2. Analyzing the information and making a decision to accept or reject the applicant.
3. Notifying the applicant of the decision and what additional steps should be followed.

The Office of Admissions at Langston University is a part of the Registrar's Office with the Registrar serving the dual role of Director of Admissions and Registrar.

The first function, gathering information, is performed by having the application for admission (Figures 5 a, b, c), and health service (Figure 6) forms completed and sent to the Registrar's Office along with the ACT [or comparable tests] test results. This information is analyzed for each individual and then an official notification is sent to the applicant of his acceptance or rejection. The official acceptance is in the form of a letter from the Registrar and a certificate of admission form (Figure 7). The applicant is in some cases tentatively accepted until he has submitted all of the required records. This tentative acceptance and the accompanying conditions are illustrated on the certificate of admission form.

The application folders are filed alphabetically in an admissions file as the new applicants are accepted or rejected. The rejected applicant folders are kept separate from the other folders and analyzed each semester. The accepted applicant folders are pulled from the file when the time arrives to notify these students of the pre-registration and regular registration dates. At this time, the students are also asked to fill out housing requests and return them to the Registrar's Office with their choice of registration dates. When these forms are received by the Registrar, the housing requests are sent to the Housing Office and the choice of registration dates is recorded. The Housing Office notifies the student of his housing assignment and then the cycle is complete until the student arrives for registration and submits the certificate of admission form.

The conversion to unit record equipment provides no drastic changes in the above admission procedure, except to complete some records that will be needed later in the school year. To help develop these records,

a revision of the admission forms is suggested and illustrated in Figures 5 a, b, c, revised. Also, to help develop an integrated system, a permanent student ID number is assigned and recorded on the application form when the student is accepted. An index card is made when the ID number is assigned to provide a cross reference file and to avoid duplication of ID numbers. This index card should include the student's name and ID number, and can be typed on 3 x 5 index cards or punched and printed on IBM cards.

The accepted and rejected application forms are sent to the data processing center where several unit records are prepared, and a set of mailing labels (Figure 8) and the certificates of admission (Figure 7 revised) are printed.

The only unit records obtained from the rejected applications are the statistics cards (Figure 9) which are used in the analysis of these applications each semester. These applications and cards are returned to the admissions office as soon as the statistics cards are punched and verified.

The accepted applications provide the information for preparing the mailing labels, the statistics cards, certificates of admission, and the following unit records:

1. Student Master Card (Figure 10)
2. Student Name and Address Cards (Figure 11)
3. Housing Card (Figure 12).

These cards are used to run lists, analyze new student data, supply information to other college offices, and to initiate housing assignment procedures by providing the Housing Office new student names and ID numbers in the housing cards. The student master cards, statistic cards,

and student name and address cards are filed in the data processing center files for future processing. The applications are returned to the admissions office along with the set of mailing labels and certificates of admission. The labels provide an easy, economical way of mailing to the student his certificate of admission form, housing information and other information which must be sent before registration time. The housing information includes general housing information and the housing contract card (Figure 13 revised).

The extension of the unit record system to an electronic data processing system could include an optical scanning machine which will scan specially designed admission forms and punch the unit record cards automatically.² These cards are then read into the computer system where each student's file is accumulated together on tape or disc files. The computer analyzes the student's record against the entrance requirements of the college and then prints a summary report for the Admissions Officer to review. The printed forms and reports are readily available by programming the computer to print or punch the information desired at speeds of several hundred lines per minute.

This extension is not possible or practical unless a large computer system is available and large volumes of applications must be processed. It is, however, a future possibility for those schools which have the random access storage capabilities and wish to experiment in this area. This type of experimentation is needed in the area of college administration to help provide answers to questions resulting from the rising

²The possibilities of this procedure are tremendous and certainly possible with the introduction of optical scanning equipment similar to the IBM 1230 series. For additional information see IBM Reference Manual No. A21-9008-3.

enrollments.

The admissions system, using unit record equipment, is illustrated by a systems flow chart in Figure 14.

APPLICATION FOR ADMISSION TO

(To be filled out in ink)

LANGSTON UNIVERSITY

LANGSTON, OKLAHOMA

The information given in this blank will be treated as confidential. Misrepresentation in any statement by the Applicant will be considered adequate grounds for denying Admission.

1. NAME _____ Date blank is filled out _____
Last First Middle

2. Home Address _____ Telephone _____
Street and No., or R. F. D. City State

3. When do you expect to enroll? _____ Single Married Male Female

4. Age in years _____ Birthplace _____ Date of Birth _____
City or County, State or Country Mo. Day Year

Religion (Optional) _____

5.	Name	Year of Birth	Place of Birth	Year of Death	Health
	Father				
	Mother				
	Step-parent or Guardian				

6.	Highest Grade Completed	Kind of Degree	Occupation	Address	Religion*

7. Are parents separated? _____

8. Give names and addresses of three (3) persons, other than relatives, with whom you are well acquainted, who can supply information about you.

Name _____ Address _____

Name _____ Address _____

Name _____ Address _____

9. BROTHERS	Age	Living at Home?	Highest Grade Completed	Student or Kind of Occupation
1.				
2.				
3.				
4.				

10. SISTERS	Age	Living at Home?	Highest Grade Completed	Student or Kind of Occupation
1.				
2.				
3.				
4.				

11. Give the names of any members of your family who have attended this institution and the approximate dates of their attendance

Figure 5a. Application for Admission Form

APPLICATION FOR ADMISSION TO
 LANGSTON UNIVERSITY
 Langston, Oklahoma

ID Number
 Office use Only?

The information given in this blank will be treated as confidential. Misrepresentation in any statement by the applicant will be considered adequate ground for denying admission. (Please fill out in ink!) Date _____

For Office Use Only!	
Col.	Code
1-10	I.D. Number
11-30	Name (1)
31-33	City (2)
34-36	County (2)
37	Marital Status(4)
38	Sex (5)
39-42	Birth Date (6)
43-45	High School (8)
46	Admission Basis(E-9)
47	Classification(10)
48	Curriculum (11)
49-50	Major - 1 (12)
51-52	Major - 2 (12)
53-54	Minor - 1 (12)
55-56	Minor - 2 (12)
57	Veteran (13)
58	Res. Status (14)
59-61	Class Rank(H.S.T.)
62-64	Class Total(H.S.T.)
65-66	Scholarship
67-69	Adviser
70	Health Form Complete 1
71	ACT Scores Complete 1
72	Clear To Enroll 1
73-78	Blank
79	X-Punch
80	Card Code 1

Coded by: _____
 Punched by: _____
 Verified by: _____

1. Name Mr.
 Miss Last First Middle (maiden name if married)
2. Permanent Home Address _____
 Street and Number City State or Country
 County Zip Code Telephone Number
3. Parents () or Guardian (): Please check one.
 Name Address: Street & Number City & State Zip Code
4. Marital Status: Single Married 5. Sex: Male Female
6. Date of Birth _____ 7. Place of Birth _____
 Month Day Year City State or Country
8. Are you a high school graduate? Yes No. If yes please complete the following:
 Name and Address of High School Date of Graduation
 If No please give qualifications for entrance: _____
 G.E.D. Certificate or Other
9. Have you attended another college? Yes No. If yes please complete the following: 1. _____
 Name and Address of College Dates of Attendance Degree
 2. _____
 Name and Address of College Dates of Attendance Degree
- Are you eligible to return to the last college you attended? Yes No
 If No, why are you ineligible? _____

Please have an official copy of your high school transcript (or certificate) and college transcripts (transfer students only) sent to the Office of the Registrar, Langston University. Note: Your application can not be processed until these records are received! You must also send to the Registrar a record of your ACT Scores (or other national examinations) and a Health Record (form can be obtained from the Registrar's Office) before you enroll at Langston University.

10. What is your college classification? Freshman (0-30) Sophomore (31-60)
 Junior (61-90) Senior (91-) semester hours. Office Use Only: / /
 A.O. G.F. E.C.
11. What degree program (curriculum) do you plan to follow? _____
12. Please list the major areas of study you plan to pursue: (See College Catalogue)
 First Major _____ Second Major _____
 First Minor _____ Second Minor _____
13. Have you served on active duty with the armed forces? Yes No
 If Yes: Branch _____ Dates of duty: Entry _____ Separation _____
14. Are you an American Citizen? Yes No. If yes, what state is your legal residence? _____
 If No, what country is your official residence? _____

Figure 5a. Revised Application for Admission Form

12. List below in chronological order all high schools and colleges attended:

Name and Location of Institutions Attended	Date of Attendance	Date of Graduation	Degree or Diploma
1.			
2.			
3.			

13. Have you attended any institution (college or university) since graduating from high school? Answer YES or NO _____

14. How have you spent your time since you last attended school? _____

15. Name the high school studies liked the best _____
 Name the high school studies liked least _____
 Name high school or other organizations to which you belonged _____

 Name offices held in them _____
 Name specific school activities you engaged in during high school, such as athletics, dramatics, debating, music, and school publications _____

 Mention honors won in these activities _____
 Do you hold a scholarship? _____ What kind is it? _____
 Name any outstanding achievement of yours _____
 What are your special intellectual interests? _____
 List favorite recreations and hobbies _____
 Name the books which you read during the past year _____
 _____ Some of the magazines you read regularly _____

16. Vocational experience (jobs held)

Kind of Work	Just What Did You Do?	No. of Years	Months	Salary Earned	Hr. Per Day	Mo.

17. How have you spent your last two or three summer vacations _____

18. How do you expect to finance your college course? _____
 Are you wholly self-supporting? _____ Partially? _____ How many persons are dependent on you for support? _____
 _____ How many months have you lived away from home? _____

19. What do you prefer to do for your life work? _____
 What are you planning to do? _____
 Give reasons for your choice _____

20. Underline the Division in which you plan to register: Agriculture, Arts and Sciences, Education, Home Economics, Industrial Arts, Trade and Industrial Education.

21. If you have indicated the Division of Arts and Sciences, state whether you plan to take a general course or to prepare for one of the professions, such as law, medicine, dentistry, etc. _____

22. If you expect to teach, state the major subject or course you plan to pursue _____

23. Have your high school mail a copy of your high school transcript to the office of the Registrar.

24. If you have attended another college, have the registrar mail a copy of this transcript to the office of the Registrar.

25. Do you promise to abide by and observe all of the rules and regulations of the institution?

Signature

Figure 5b. Application for Admission Form (reverse side)

15. When do you expect to enroll? _____

16.

	Year of Birth	Place of Birth	Year of Death	Health	Highest gr. completed	Degree	Occupation
Father							
Mother							
Guardian							

17. Are parents separated? Yes No.

18. Give names and addresses of three (3) persons, other than relatives, with whom you are well acquainted, who can supply information about you.

Name _____ Address _____
 Name _____ Address _____
 Name _____ Address _____

19. BROTHERS

	Age	living at Home?	Highest Gr. Completed	Student or Kind of Occupation
1.				
2.				
3.				

SISTERS

1.				
2.				
3.				

20. Give the names of any members of your family who have attended this institution and the approximate dates of their attendance.

21. How have you spent your time since you last attended school? _____

22. Name the high school studies liked the best _____
 Name the high school studies liked least _____
 Name high school or other organizations to which you belonged _____
 Name offices held in them _____
 Name specific school activities you engaged in during high school, such as athletics, dramatics, music and etc. _____
 Mention honors won in these activities _____
 Do you hold a scholarship? What kind is it? _____
 Name any outstanding achievement of yours _____
 What are your special intellectual interest? _____
 List favorite recreations and hobbies _____
 Name the books which you read during the past year _____
 Name some of the magazines you read regularly _____

23. Vocational experience(jobs held)

Kind of work	Just what Did You Do?	No. of years	Months	Salary Earned	Per Hr. Day Mo.

24. How have you spent your last two or three summer vacations _____

25. How do you expect to finance your college course? _____
 Are you wholly self-supporting? partially? How many persons are dependent on you for support? _____ How many months have you lived away from home? _____

26. What do you prefer to do for your life work? _____
 What are you planning to do? _____
 Give reasons for your choice _____

26. Religious Preference (Optional) _____

27. Do you promise to abide by and observe all of the rules and regulations of this institution? _____

Signature _____

Figure 5b. Revised Application for Admission Form (reverse side)

LANGSTON UNIVERSITY
LANGSTON, OKLAHOMA

Mrs.
Mr.
Miss _____ has made application for admission to
Langston University. Please check the column which best characterizes the in-
dividual with respect to the following items:

<u>ITEM</u>	<u>VERY GOOD</u>	<u>GOOD</u>	<u>FAIR</u>	<u>POOR</u>
1. Out look upon life	()	()	()	()
2. Physical Health (General)	()	()	()	()
3. Cleanliness and General Appearance	()	()	()	()
4. Emotional Stability	()	()	()	()
5. Social Behavior	()	()	()	()
6. Ability to live with others	()	()	()	()
7. Mental Alertness	()	()	()	()
8. Academic Achievement	()	()	()	()
9. General Character Traits	()	()	()	()

COMMENTS:

NAME _____

Address _____

City and State _____

CHECK: Principal (); Alumnus (); Home

Room Teacher (); Counselor ();

Dean (); Registrar ()

OTHERS _____

THIS BLANK IS TO BE FILLED OUT BY THE PERSON SERVING AS A REFERENCE. SEND TO
THE OFFICE OF THE REGISTRAR, LANGSTON UNIVERSITY, LANGSTON, OKLAHOMA.

Figure 5c. Reference Form

Mr. _____ has made application for admission to Langston University. Please mark the column which best characterizes the individual with respect to the following items:		LANGSTON UNIVERSITY Langston, Okla. * * * * * Reference Card																																																	
"Please use a soft lead pencil!"																																																			
1. Outlook on life 2. Physical health (general) 3. Cleanliness and general appearance 4. Emotional stability 5. Social Behavior	<table border="1"> <tr> <th>Very Good</th> <th>Good</th> <th>Fair</th> <th>Poor</th> </tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> </table>	Very Good	Good	Fair	Poor																					6. Ability to live with others 7. Mental Alertness 8. Academic Achievement 9. General Character Traits	<table border="1"> <tr> <th>Very Good</th> <th>Good</th> <th>Fair</th> <th>Poor</th> </tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td></tr> </table>	Very Good	Good	Fair	Poor																				
Very Good	Good	Fair	Poor																																																
Very Good	Good	Fair	Poor																																																
This Blank Is To Be Filled Out By The Person Serving As A Reference, Send To The Office Of The Registrar, Langston University; Langston, Oklahoma; Zip Code: 73050		Name _____ Address _____ Street and Number City _____ State _____ Zip code _____																																																	
Please indicate relationship to student (Teacher & etc.) _____ Comments May Be Made On Reverse Side! _____																																																			

Figure 5c. Revised Reference Form

Langston University

Health Service

Student will please fill out the first three pages of this folder in ink.
Please Print

Name _____
 Last Name First Middle

Age _____ Date of Birth _____
 Month Day Year

Widowed _____ Divorced _____

Year: Fr. _____ Soph. _____ Jr. _____ Sr. _____

Special _____ Veteran _____ Major Dept. _____

Langston Address _____ Phone _____

Permanent Address _____
 Street City State

Parent, Guardian, Husband, Wife _____
 Check Which Name Phone

Address _____
 Street City State


Family Physician _____

Address _____

In case of serious illness notify: _____

(First page only!)

Figure 6. Health Service Form



CERTIFICATE OF ADMISSION
LANGSTON, UNIVERSITY
 LANGSTON, OKLAHOMA 73050

Office of the Registrar

This certificate admits you to Langston University for the _____ of _____ to enroll in _____ Semester Year

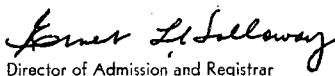
Class _____ with a major in _____ Major:

You should report for your first step in enrollment on _____

KEEP THIS CERTIFICATE AND PRESENT IT WHEN YOU REPORT.

Your admission is subject to the following conditions:

- _____ None.
- _____ Receipt of Supplementary Transcript of Grades.
- _____ Receipt of your ACT Scores.
- _____ Receipt of Health Record.
- _____ Admit on Probation.


 Director of Admission and Registrar

Date _____

By _____

Figure 7. Certificate of Admission Form

Office of

CERTIFICATE OF ADMISSION
LANGSTON UNIVERSITY
 Langston, Oklahoma 73050

the Registrar

This certificate admits you to Langston University for the _____ of _____ to enroll in _____ class with a major in _____ semester year. You should report for your first step in enrollment on _____ major. YOUR ADMISSION

STUDENT NUMBER _____

KEEP THIS CERTIFICATE AND PRESENT IT WHEN YOU REPORT.

IS SUBJECT TO THE FOLLOWING CONDITIONS:

1. None.
2. Receipt of Supplementary Transcript of Grades.
3. Receipt of your ACT scores.
4. Receipt of your Health Record.
5. Admit on Probation.

Date: | | | | |
 Director of Admissions and Registrar
 By _____


Figure 7. Revised

Figure 9 (continued)

Statistics Card Format

<u>Columns</u>	<u>Field Definition</u>
1 - 10	*Student Number
11 - 12	Age
13	Admission Status P-Poor or G-Good
14 - 15	*Academic Department (same as major)
16 - 18	*High School Code
19 - 20	Month of High School Graduation Code
	1 - January 7 - July
	2 - February 8 - August
	3 - March 9 - September
	4 - April 10 - October
	5 - May 11 - November
	6 - June 12 - December
21 - 22	Year of High School Graduation
23	*Sex
24	*Marital Status
25 - 27	High School Rank Percentage
28 - 30	*City Code or State Code
31	*Admission Basis
32 - 33	Father's School Background in Years
34 - 35	Mother's School Background in Years
36 - 37	Vocation or Profession of Parent
38 - 39	Number of Children in Family
40 - 42	College Grade Average (transfers only two decimal accuracy)
43 - 45	ACT English
45 - 46	ACT Math
47 - 48	ACT N. Science
49	Classification
50 - 65	*Name
66 - 67	Blank
68 - 69	ACT S. Science
70 - 71	ACT Comp.
72	*Veteran Status
73	*Curriculum
74	*Resident or Non-resident Status
75 - 80	Blank

*This information comes from the master card. The rest of the information must be obtained from the application for admission forms and the ACT college information cards.

STUDENT NUMBER										STUDENT NAME										VET. CURR. RES.		SEM. NO.	
TOWN		COUNTY OR STATE		ADM. BRANCH		HIGH SCHOOL		HS. GRAD. DATE		HIGH SCHOOL RANK (CLASS RANK/PLACES/TOTL)		SCHOLAR		ADVISER		SEM.							
DO NOT WRITE ABOVE THIS LINE! 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 ATTENTION: PLEASE MARK THE SQUARE TO THE RIGHT IF THERE IS AN ERROR IN THE INFORMATION ON THIS CARD. LIST THE CORRECTION(S) AND EXPLANATION(S) BELOW. (CHECK BACK OF CARD FOR INFORMATION ON CODING)														USE SOFT LEAD PENCIL TO MARK! 		LANGSTON UNIVERSITY STUDENT MASTER CARD OFFICE OF THE REGISTRAR							
1. _____ 2. _____ 3. _____																				DO NOT WRITE IN THIS AREA		FOR OFFICE USE ONLY!	
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 MC-112439-0																							

CLASSIFICATION		CURRICULUM		MARITAL STATUS	
(1) Freshman (0-30)	(5) Post-Graduate (have 4yr. Degree, taking Undergraduate Credit)	(1) B.A.	(2) B.S.	(1) Married	
(2) Sophomore (31-60)	(6) Special (Do not have 4yr. Degree, Not Working on a Degree.)	(3) B.S. (Elem Ed)	(4) B.S. (Sec Ed)	(2) Single	
(3) Junior (61-90)		(5) Pre-Professional	(6) Asso of Arts		
(4) Senior (91+Gr)		(7) Undecided, or not Working on a Degree.			
CODE NO.	CODE NO.	CODE NO.	CODE NO.	CODE NO.	CODE NO.
(1) Ag Econ	(10) Econ	(19) H Ec	(28) Phys	(36) Psych	
(2) Ag Eng	(11) Elect	(20) Hort	(29) P Sci	(37) Rel	
(3) Agro	(12) Elem	(21) I Arts	(30) Pol Sci	(38) Sci	
(4) An Prod	(13) Eng	(22) lib Sci	(31) Pre Den	(39) Soc	
(5) Art	(14) Fr	(23) Math	(32) Pre Eng	(40) Span	
(6) Bio	(15) Geo	(24) Mus	(33) Pre Law	(41) Spee	
(7) Bus Adm	(16) Ger	(25) Nurs	(34) Pre Med	(42) Tech	
(8) Bus Ed	(17) Hlth	(26) Phil	(35) Pre Prof	(43) Other	
(9) Chem	(18) Hist	(27) Phy Ed	Other	(44) Undec	

(Reverse side)

Figure 10. Student Master Card

Figure 10 (continued)

Master Card Format

<u>Columns</u>	<u>Field Definition</u>
1 - 10	Student ID Number
11 - 30	Student Name
31 - 33	City Code
34 - 36	County Code
37	Marital Status
38	Sex
39 - 42	Birth Date
43 - 45	High School Code
46	Admission Basis
47	Classification
48	Curriculum
49 - 50	First Major
51 - 52	Second Major
53 - 54	First Minor
55 - 56	Second Minor
57	Veteran Status
58	Resident or Non-resident
59 - 61	Class Rank (H.S.)
62 - 64	Class Total (H.S.)
65 - 66	Scholarship
67 - 69	Adviser
70	Health Form Completed (code 1)
71	ACT Scores Completed (code 1)
72	Clear to Enroll (code 1)
73 - 78	Blank
79	X Punch
80	Card Code (code 1)

The information for this card is keypunched from the Application for Admission form after it has been coded in the code strip.

FILE NO.		STUDENT NAME										ALPHA NO.		Sem	CLASS
CENTER	WING	ROOM		BUNG		TRK		OFF CAMPUS HOUSING		STUDENT NAME		Sem	CLASS		
0000	0000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000				
1234	5678	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000	00000000				
1111	1111	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111	11111111				
2222	2222	22222222	22222222	22222222	22222222	22222222	22222222	22222222	22222222	22222222	22222222				
3333	3333	33333333	33333333	33333333	33333333	33333333	33333333	33333333	33333333	33333333	33333333				
4444	4444	44444444	44444444	44444444	44444444	44444444	44444444	44444444	44444444	44444444	44444444				
5555	5555	55555555	55555555	55555555	55555555	55555555	55555555	55555555	55555555	55555555	55555555				
6666	6666	66666666	66666666	66666666	66666666	66666666	66666666	66666666	66666666	66666666	66666666				
7777	7777	77777777	77777777	77777777	77777777	77777777	77777777	77777777	77777777	77777777	77777777				
8888	8888	88888888	88888888	88888888	88888888	88888888	88888888	88888888	88888888	88888888	88888888				
9999	9999	99999999	99999999	99999999	99999999	99999999	99999999	99999999	99999999	99999999	99999999				
1	2	3	4	5	6	7	8	9	10	11	12	13	14		

LANGSTON UNIVERSITY

STUDENT HOUSING CARD

HOUSING OFFICE

FILE NO. _____ ALPHA NO. _____

1. NAME _____ LAST _____ FIRST _____ MIDDLE _____

2. PERMANENT HOME ADDRESS _____

3. OCCUPANCY _____ 4. QUARTER _____ YEAR _____

5. CLASSIFICATION _____ 6. SEX _____

7. OFF CAMPUS HOUSING _____

TTCC 675477

Housing Card Format

<u>Columns</u>	<u>Field Definition</u>
1 - 10	Student Number
11 - 15	Housing Fee for Semester
16 - 18	Blank
19	Sex
20	Blank
21	Center (Residence Hall Code)
22 - 49	Blank
50 - 68	Student Name
69 - 79	Blank
80	Card Code (8)

The information for this card is obtained from the Student Master Card and the Housing Office.

Figure 12. Housing Card

LANGSTON UNIVERSITY
Office of Registrar
LANGSTON, OKLAHOMA

HOUSING APPLICATION

Date _____

Name _____ Classification _____ Sex _____

Home Address _____ City _____ State _____

Parents or Guardian _____ Address _____

Home Telephone Number _____ Major Physical Handicaps _____

Remarks: _____

Note: In order to assure a room assignment this form should be returned immediately.
A \$12.00 property deposit should accompany this application.

REFUNDS FOR PROPERTY DEPOSIT WILL NOT BE MADE AFTER DECEMBER 15, 1966 FOR STUDENTS
WHO WILL NOT ENROLL IN JANUARY.

DO NOT WRITE BELOW THIS LINE

Date Application was received _____ Property Deposit _____

Dormitory _____ Room Number _____

Date Assignment card mailed to applicant _____

(Form H.A. No. 2, October, 1966)

KKP

Figure 13. Housing Application Form

Receipt No:	Center:	Room No:
LANCASTON UNIVERSITY RESIDENCE HALL AGREEMENT Housing Office, Lancaster, Oklahoma		
Student No. _____		
NAME (Print) _____	AGE _____	SEX _____
HOME ADDRESS _____ (Last) (Street) (City) (State)		
Occupancy to Begin Fall Semester _____ Spring _____ Summer _____		
Home Telephone No. _____	CLASSIFICATION: Fr. _____	Soph. _____ Jr. _____ Sr. _____
Last date in attendance at Lancaster University _____	Transfer Student: Yes _____ No _____	

Enclosed is the signed Agreement and a \$25.00 Check or money order payable to Lancaster University for a reservation in a University residence hall. Residence Hall reservations are made in order of receipt of Agreement and, if at all possible, in the order of student's choice. The University does not guarantee a specific reservation assignment if not claimed on the day classes begin in any semester.

(SEE REVERSE SIDE)

THE UNDERSIGNED UNDERSTANDS:

1. That this Agreement for board and room shall remain in effect for the entire college year (Fall and Spring Semesters) or for that portion of the college year during which the student is enrolled. Occupancy terminates annually at the end of the Spring Semester.
2. That he/she will be responsible for payment of room and board charges in advance each semester, or if necessary, four installments each semester. Failure to pay on or before the published deadline date in each case will require that the student be suspended from classes. A \$5.00 fee is required for reinstatement in college.
3. That the Residence Halls are officially closed during scheduled school vacations at Thanksgiving, Christmas, and in the Spring, and that payments do not cover these vacation periods.
4. That his/her signature on this Agreement constitutes acceptance of published policies and regulations of the University including the right to make periodic room inspections and to reassign individuals to different rooms or centers.
5. That this Agreement which is evidenced by the signature of the student and, if under 21 years of age, by his/her parent or guardian, is valid when accepted by the Housing Office. The student will be notified when he is accepted.
6. That, if approved by the Housing Office, this Agreement for the college year beginning with the Fall Semester may be cancelled by the student and his/her deposit and advance payments returned provided he/she requests cancellation in writing by August 15. Also, if approved by the Housing Office, Agreements becoming initially effective for the Spring Semester may be cancelled by notifying the Housing Office in writing two weeks prior to the published registration date for the semester for which the initial reservation is made. Failure to give such notice is cause for forfeiture of the reservation deposit.

I/WE HAVE READ AND UNDERSTAND THE ABOVE AGREEMENT AND ACCEPT ITS PROVISIONS.

Signature of Student _____ Date _____

Signature of Parents or Guardians _____ Date _____

(reverse side)

Figure 13. Revised Housing Application Form

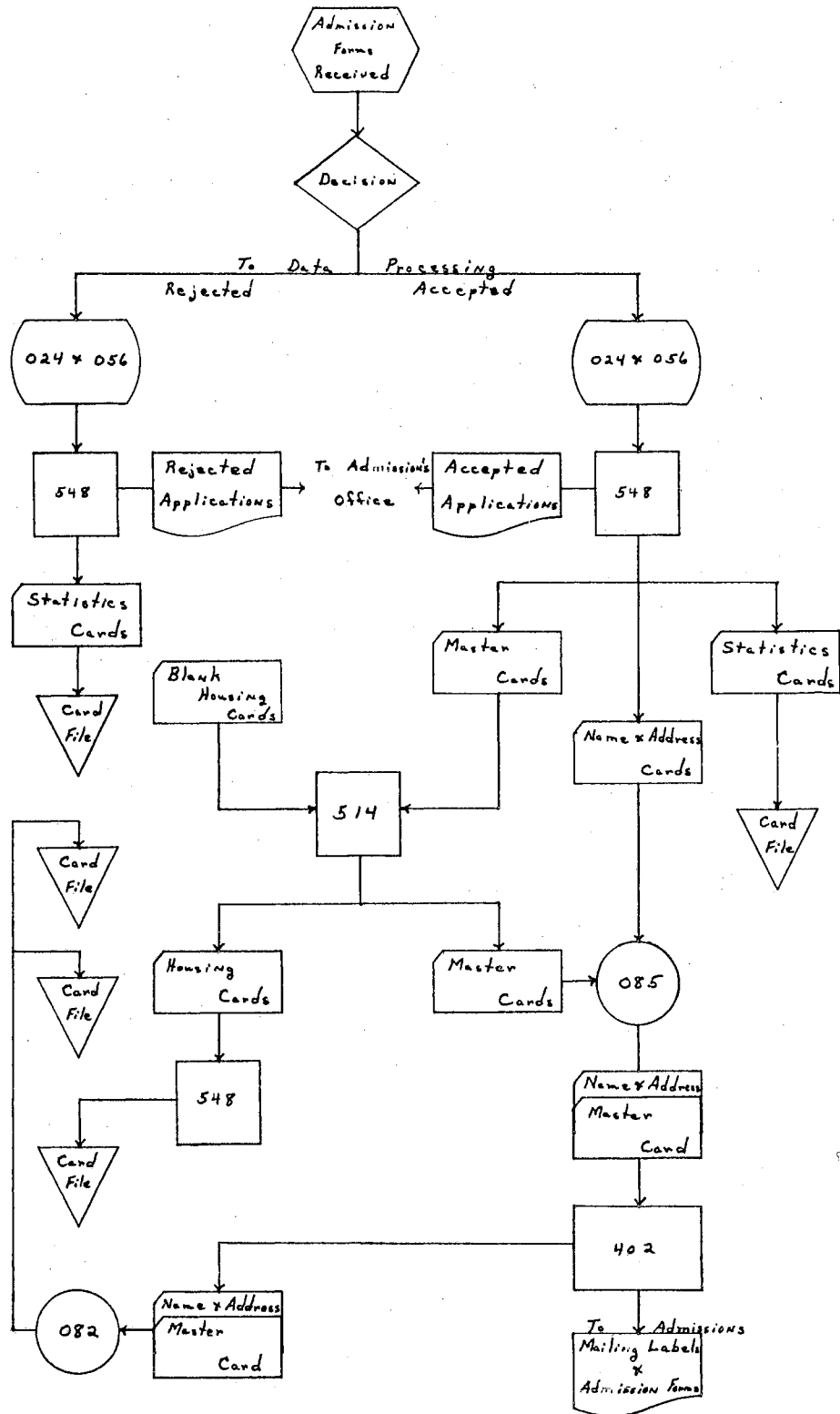


Figure 14. Admissions System Flow Chart

Preregistration and Registration Procedures

Preregistration procedures at Langston University involve several of the administrative offices and all of the academic departments of the University. The Academic Dean's Office and the Registrar's Office work with the academic departments to compile the semester course offerings and the numbers of students desired in each class. The request form used in this process is illustrated in Figure 15. The procedure is, the Academic Dean's Office requests the course offerings from the academic department heads, reviews these offerings and then has the university class schedule printed. Once the schedule is approved, the Registrar's Office receives a copy of the form specifying the maximum number of students desired in each class. A tally sheet is made from this form to use in registration at the scheduling station.

When the above procedures are completed, the University is ready to begin the preregistration of students for the next semester. The preregistration procedure involves new students and former students with the dates of preregistration making the main difference in the steps that are followed. The procedure is outlined in the following ten steps:

1. a. Present certificate of admission form to the registration desk in the registration area, complete housing application and deposit if student plans to live in residence halls and has not completed this step previously [new students only].
 - b. Report to the infirmary and pick up health clearance card.
2. a. Report to an adviser in the registration area [new students].
 - b. Pick up registration materials [includes trial study, master enrollment card, blank class cards and information sheet] in the

Registrar's Office, clear for housing and report to assigned adviser's office [former students].

3. Work out schedule on trial study program (Figure 16), complete class cards (Figure 17) and master enrollment cards (Figure 18) with adviser.

4. Teacher education students must secure the Division of Education's approval [former students only].

5. Report to sectioning station for class card approval [hand tally of class enrollments is kept at this station].

6. Report to the Academic Dean for his approval.

7. Report to the Business Office for approval.

8. Present health card, trial study, class cards and master card to the Registrar's Office [new students report to Registrar's station in registration area] for final approval.

9. Student presents class card to instructor for the first class meeting.

10. Student reports to the Business Office once during the first three weeks to arrange for payment of fees.

The regular days of registration include the same steps outlined for preregistration; except, all activities are conducted in the field house and student union with advisers and other registration personnel in the two registration areas. Thus, the registration of students at Langston University is completed by having the students follow the ten registration steps in preregistration or in regular registration on the first day or two of each new semester. The only difference between the two registrations is the location of advisers and other registration personnel.

The conversion of this manual system to a unit record system involves the design of several cards and forms, and the introduction of a two card registration system. The two card system involves having sets of cards made for each class opening; one card for student admission to class and for use in reporting mid-term grades to the Registrar's Office, and the second card for use in printing class rosters and final grades in the data processing center.

The unit record system follows the same pattern as the manual system with the course offerings requested by the Academic Dean's Office. However, in making this request the Academic Dean requests a complete course listing by department (Figure 20), from the data processing center. This listing is printed from the class master cards (Figure 19) and has all of the courses listed that are offered by each department. The listing has spaces provided where the department heads may fill in the time, instructor and number of class card sets desired for each class to be offered that semester. This listing is usually printed in four parts, one each for the Academic Dean, Registrar, Director of Data Processing and Department Head. As soon as the Academic Dean approves the schedule of course offerings, a copy is sent to the Director of Data Processing who has the class cards (Figure 21) and the class admission cards (Figure 22) made for the new semester.

These two decks of cards are collated together, such that, the class admission card follows the class card with the same end printed number. The courses are separated by the backing sheet (Figure 23) which has the course information printed on the top part of the sheet to identify each course. This information includes course name, number, description, instructor, meeting time and class size.

The preregistration and registration procedure will follow approximately the same steps as in the manual system with the exception that new students will present the revised certificate of admission (Figure 7 revised) which has the student ID number recorded and former students will receive a permit to register (Figure 24) in step 2b. Also, under this new system students will not receive blank class cards with their registration materials but will have class card sets pulled for them at the sectioning station, step 5. The class card sets are end printed from 01 to the desired enrollment for each class, thus a visual check can be made at any time to determine the enrollment in each class.

As soon as the class card sets are pulled, the student master card is also pulled and placed in front of the class card sets. The master cards are pulled by student number which is obtained from the certificate of admission or the permit to register.

Since the fees for each student will be computed by machine, there is no need for step 7. The fees are computed in the data processing center from the class cards and housing card, and a fee payment card (Figure 25) is punched. The fee payment card and a duplicate of this card (Figure 26) will then be sent to the Registrar's Office and the Business Office, respectively, for collection of fees.

The fee payment card is perforated down the middle to provide two records after it has been processed through the cash register. One copy is given to the student and the second copy is kept for the Business Office records.

The duplicate fee card is pulled from the file after the student completes payment and is used to complete the accounting for each day's receipts. In the case of partial payment, it provides a way of repro-

ducing a second fee payment card. It should be noted that the student account number is the same as the student ID number and thus, helps to develop the integrated system approach [see accounting procedures section].

In step 8, the student master cards and class card sets are picked up and taken to the data processing center where the desired information is reproduced from the master cards into the class card sets. The class admission cards are then returned to the Registrar's Office where they are mailed to the students with their fee payment cards. It may not be possible to punch the class admission cards if time is not available to guarantee the receipt of the cards by the students before classes begin for the new semester. In this case the class admission cards should be filled out and kept by the students. The unpunched cards will be punched when they are received at mid-term in the mid-term grading process [see post registration procedures].

The students complete the registration process by taking their fee payment cards to the Business Office and paying the required fees. Since the fee payment cards have the student ID numbers listed, it is very convenient to use this number as the student's account number in the Business Office, and as was stated before, this procedure will help in the overall development of an integrated system.

To further this development, it is necessary that the student have his ID number available whenever he has other transactions with the University. A workable procedure is to furnish each student with an ID card (Figure 27) which includes the student's name, ID number, birth date and picture. This ID card can be obtained for new students at registration time by using a dual purpose camera which photographs a

punched card (Figure 28) and the student at the same time. The film is then sent to a service company which makes the embossed student name and number are printed with raised print ID card or equipment can be purchased to make the card at the University. The card is used throughout the student's college career and is validated each semester by furnishing the student a validating card (Figure 29) when he pays his fees. The ID card and validating card furnish a very satisfactory identification system which can be used by all offices and organizations at the University. The purchase of imprinting machines provides a way of recording student names and numbers from the ID cards onto receipt forms, registration forms, library check out cards and so forth. This in turn provides a way of charging all student debts to one account number in the Business Office which is the student ID number.

The conversion of this application from the unit record system to an electronic data processing system has tremendous possibilities. The addition of a computer and high speed printer to the data processing system provides a way to develop a registration process that will save a tremendous amount of staff and student time in registration processes. The development of this system is presently in an experimental stage in several colleges and universities. The main problems involve the availability of computer storage for large amounts of registration data and the ability to define all of the decisions made in the registration process. The smaller colleges and universities have an advantage in this area if they have a reasonable size computer system available at the school. The advantage exists from having less information which must be stored in the computer storage area due to smaller course offerings and, in many cases, fewer decisions in the registration process.

The computer registration system would have the following steps:

1. Students would file an approved initial class schedule and permit to register with the Registrar's Office. This schedule would include a minimum of two alternate courses, [not alternate sections] in case of class closings.

2. These schedules and permits are brought to the data processing center where the student master cards and address cards are pulled from the files by using the permit cards. The courses listed on the initial class schedules are coded into course cards which are then collated behind the student master cards and address cards. The alternate course requests are coded to identify them as alternates. If a student has permission not to take classes certain class hours, a card is inserted at the end of the course cards providing this information.

3. The semester schedule of classes is stored in computer storage with all special instructions, such as students must not have more than three classes in a row, included in the scheduling computer program. This program should, within time limitations, automatically assign students to sections with the fewest students enrolled, to provide a level enrollment. If a desired course is closed, the program should then try to schedule one of the alternate courses to complete the student's schedule.

4. The output from this program should include a class card for each course and a printed combination, registration and fee payment form (Figure 30).³ The class cards are used to make the class admission cards and class rosters.

³This combination form could be used in place of the registration form and fee payment card in the unit record system.

5. The students complete the registration process, as in the unit record system, by reporting to the Business Office and paying their fees.

The main problem in this system is to develop a computer program that will fit the needs of the particular college or university structure. Several programs which may be of assistance in this area have been developed and are available through the various Machine Users Group Organizations. If these programs are not adaptable to the characteristics of the individual college or university, then a program must be written to include the special procedures desired and which can be processed on the available computer system. Some guidelines which should be observed in writing such a program are as follows:

1. Code the input data as compactly as possible to save storage area. The use of numerical codings for courses, times, student names and so forth, would be desired over alphabetic information. This may require writing the program to operate as several phases before the final output data is in the desired form. Example: Phase I: Schedule classes and punch numeric codes into cards. Phase II: Read cards from Phase I into storage with new program and punch course cards with alphabetic information. Phase III: Read student master card, address cards and cards from Phase II into storage with new program to compute fees and, print the combination registration and fee payment form.

2. Require alternate courses on the initial class schedule to help avoid incomplete schedules as a result of class closings.

3. Include a "no class time" procedure to allow for special students who must work certain hours of the day.

4. Provide a leveling procedure in class assignments to keep all sections at approximately the same enrollment.

5. Provide a way to call for the enrollment in any one class and be able to change the desired class size without disturbing the rest of the schedule.

6. When the computer is assigning classes the tentative class schedule should be developed in a computer storage area so the computer can juggle course sections to obtain the desired schedule before processing any output.

These are not all of the guidelines that could be listed but they do represent several important procedures which should be considered.

The electronic data processing system eliminates several of the registration steps required under the other systems. There is no need to make a set of class cards before registration since this step is a by-product of the computerized scheduling. The registration process would now involve getting approval of the initial class schedule and handing it into the Registrar, the computer scheduling of classes, student pickup of registration and fee payment form, payment of fees, and students reporting to class. The time consuming procedure of checking initial class schedules, tallying or pulling class cards and filling out registration forms and fee payment statements has been partially eliminated.

A registration systems flow chart using unit record equipment has been illustrated in Figure 31.

PROPOSED CLASS SCHEDULE						
FALL SEMESTER 1966						
COURSE NUMBER	DESCRIPTION	SECTION	TIME	DAYS	CLASS SIZE	INSTRUCTOR
1000	ELEM ALG	SEC 01	TIME	DAYS	A.S.	*
1012	COL ALG	SEC 01	TIME	DAYS	A.S.	*
1013	COL ALG	SEC 02	TIME	DAYS	A.S.	*
1042	SOL GEOM	SEC 01	TIME	DAYS	A.S.	*
1063	PL TRIG	SEC 01	TIME	DAYS	A.S.	*
1063	PL TRIG	SEC 02	TIME	DAYS	A.S.	*
1093	COL MATH	SEC 01	TIME	DAYS	A.S.	*
1093	COL MATH	SEC 02	TIME	DAYS	A.S.	*
1103	COL MATH	SEC 01	TIME	DAYS	A.S.	*
1103	COL MATH	SEC 02	TIME	DAYS	A.S.	*
2002	AD MATH	SEC 01	TIME	DAYS	A.S.	*
2044	PL A GEOM	SEC 01	TIME	DAYS	A.S.	*
2044	PL A GEOM	SEC 02	TIME	DAYS	A.S.	*
2213	BUS MATH	SEC 01	TIME	DAYS	A.S.	*
2213	BUS MATH	SEC 02	TIME	DAYS	A.S.	*
2303	FUD STAT	SEC 01	TIME	DAYS	A.S.	*
3043	FUD MATH	SEC 01	TIME	DAYS	A.S.	*
3054	DIFF CAL	SEC 01	TIME	DAYS	A.S.	*
3064	INT CAL 1	SEC 01	TIME	DAYS	A.S.	*
3073	INT CAL 2	SEC 01	TIME	DAYS	A.S.	*
3083	VECTOR AN	SEC 01	TIME	DAYS	A.S.	*
3103	HIGH ALG	SEC 01	TIME	DAYS	A.S.	*
3153	SOL A GEOM	SEC 01	TIME	DAYS	A.S.	*
4000	SE IAR	SEC 01	TIME	DAYS	A.S.	*
4013	MATH STAT	SEC 01	TIME	DAYS	A.S.	*
4033	CAL GEOM	SEC 01	TIME	DAYS	A.S.	*
4133	DIFF EQUA	SEC 01	TIME	DAYS	A.S.	*

Figure 20. Course Listing by Department

STUDENT NUMBER	DEPT	COURSE NO.	COURSE TITLE	SEC	STUDENT NAME	CL	CURR	EXPIRES
ADV. NO.	INSTRUCTOR	GRADE	MARK GRADE HERE	GRADE POINT				
DO NOT WRITE					ABOVE THIS LINE!			
NAME: _____ SIGNATURE _____ ADDRESS: _____ PERMANENT _____ MAILING _____ ADDRESS _____					CAD	OFFICIAL CLASS CARD		
					CBD			
					CCD			
					CCD			
	CWD							
	CFD							
	CPD							
	CWD							
	CWD							
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 MC-T11139								

Class Card (IBM) Format

ColumnsField Definition

1 - 10	Student Number
11	Marital Status
12 - 16	Department Name
17 - 20	Course Number
21 - 29	Course Title
30	M-Men W-Women (Also sub section)
31 - 32	Section
33 - 36	Blank
37	Grade
38 - 39	Blank
40 - 41	Lab Section
42 - 43	Honor Points
44	X or Eleven Punch for Part Time Students
45 - 48	Blank
49	Classification
50 - 68	Student Name
69 - 72	Instructor Code
73	Curriculum
74	Resident or Non-resident Status
75 - 76	Department Number
77	Sex
78	X or Eleven Punch into Striped Card Only
79	Admission Basis
80	Card Code (2)

The information on these cards is reproduced from the class Master Card and the Student Master Card.

Figure 21. Class Card (IBM)

STUDENT NUMBER		DEPT	COURSE TITLE	SEC	STUDENT NAME	
ADV. NO.	INSTRUCTOR		DATE	GRADE HERE		
<p align="center">CLASS ADMISSION CARD</p> <p>THIS IS YOUR ADMISSION CARD TO THE ABOVE COURSE. PLEASE FILL IN YOUR NAME, ADDRESS AND CLASSIFICATION, BELOW.</p> <p align="center">PRESENT TO INSTRUCTOR THE FIRST DAY OF CLASS</p> <p>NAME _____</p> <p>LANGSTON ADDRESS _____</p> <p>CLASSIFICATION _____</p>				<p align="center">MID-TERM UNSATISFACTORY GRADE REPORT</p> <p>REASONS FOR UNSATISFACTORY WORK:</p> <p>_____ THREE OR MORE CONSECUTIVE ABSENCES.</p> <p>_____ INSUFFICIENT DAILY PREPARATION.</p> <p>_____ POOR ATTITUDE.</p> <p>_____ INSUFFICIENT BACKGROUND.</p> <p>_____ INADEQUATE CLASS PARTICIPATION.</p> <p>_____ OTHER (SPECIFY) _____</p> <p>INSTRUCTOR'S SIGNATURE _____</p>		
<p align="center">LAWRENCE UNIVERSITY</p> <p align="center">MC-T 1130</p>						

Class Admission Card Format (Same as Class Card Format)

Figure 22. Class Admission Card

	GEGG 1014 SEC 1 ELE- GEGG JONES	
	ABS 040 1ST TIME 8 00A TO DAYS M,W,T,F	
	GEGG 1014 SEC 2 ELEM- GEGG SMITH	
	ABS 040 1ST TIME 9 00A TO DAYS M,W,T,F	

Figure 23. Backing Sheet

NAME-	STUDENT NUMBER-
REGISTRATION PERMIT	
LANGSTON UNIVERSITY Registrar's Office	
INSTRUCTIONS:	
After receiving this card the student should go to his adviser to complete the Trial Study Program. Students must have this card to enter the registration area!	
DO NOT FOLD →	PLEASE READ ABOVE INSTRUCTIONS!
<small>ISM H17076</small>	

Permit to Register Card Format

<u>Columns</u>	<u>Field Definition</u>
1 - 10	Student Number
11 - 19	Blank
20 - 23	Month Abbreviation
24 - 25	Day of Month
26 - 29	Time of Day
30 - 48	Name of Student
49	Resident or Non-resident Status
50 - 80	Blank

The information in this card is reproduced from the Student Master Card and from a registration appointment list received from the Registrar.

Figure 24. Permit to Register Card

STUDENT NAME					STUDENT NUMBER				
TUITION	ACT & UNION	SPECIAL FEES	RESIDENCE HALL	TOTAL	TUITION	ACT & UNION	SPECIAL FEES	RESIDENCE HALL	TOTAL
PLEASE DO NOT BEND, STAPLE OR MUTILATE THIS CARD RETURN THIS CARD WITH YOUR FEES TO THE BUSINESS OFFICE, LANGSTON UNIVERSITY									
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80									

Fee Payment Card Format

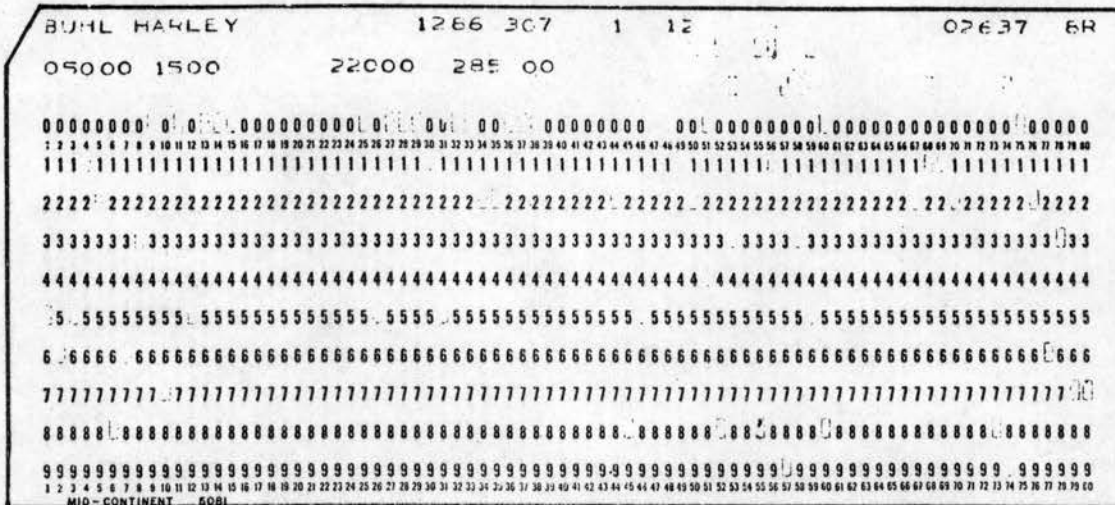
Columns

Field Definition

1 - 10	Student Number
11 - 27	Student Name
28 - 32	Tuition
33 - 36	Activity and Union Fee
42 - 46	Total
47 - 48	Credits
49	Classification
50	Residence or Non-residence Status
51	Full-time (coded 1) or Part-time (coded 2)
52 - 56	Receipt Number
57 - 79	Blank
80	Card Code (8)

This card is summary punched on the 514 reproducing punch by running the Student Master Card and Class Cards through the 402 accounting machine. The receipt number is key punched into the Duplicate Fee Card after the student pays his fees.

Figure 25. Fee Payment Card



Duplicate of Fee Payment Card Format (Same as Fee Payment Card Format)

Figure 26. Duplicate of Fee Payment Card

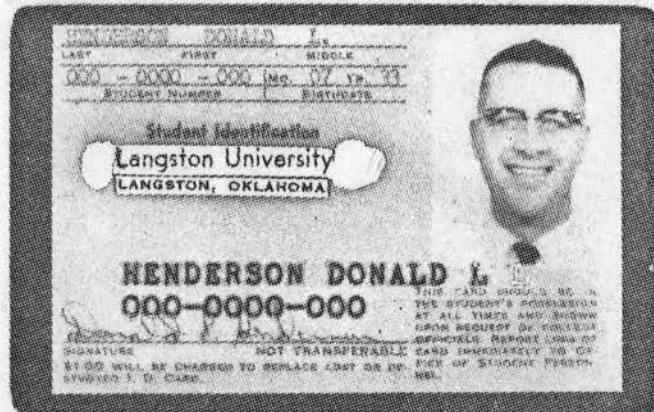


Figure 27. ID Card

LAST	FIRST	MIDDLE	LAST	FIRST	MIDDLE	THIS END → INTO CARD HOLDER
—	—	—	—	—	—	
STUDENT NUMBER			MO.		YR.	THIS CARD SHOULD BE IN THE STUDENT'S POSSESSION AT ALL TIMES AND SHOWN UPON REQUEST OF COLLEGE OFFICIALS. REPORT LOSS OF CARD IMMEDIATELY TO OF- FICE OF STUDENT PERSON- NEL.
Identification Card Receipt LANGSTON, UNIVERSITY Langston, Oklahoma.			STUDENT NUMBER		BIRTHDATE	
CASHIER'S STAMP HERE			Student Identification LANGSTON UNIVERSITY Langston, Oklahoma			SIGNATURE _____ NOT TRANSFERABLE \$1.00 WILL BE CHARGED TO REPLACE LOST OR DE- STROYED I. D. CARD.
Receipt only — Not to be used for identification. INSTRUCTIONS: 1. Do not detach this stub until your photograph has been taken. 2. Retain this receipt. 3. You must present this receipt when you pick up your student identifica- tion card.						

Identification Punched Card Format

<u>Columns</u>	<u>Field Definition</u>
1 - 10	Student Number
11 - 28	Student Name
29 - 32	Birth Date
33 - 80	Blank

The information for this card is reproduced from the Student Master Card.

Figure 28. ID Punched Card

LANGSTON UNIVERSITY ENROLLMENT FORM

Langston, Oklahoma

Name _____ Student Number _____

Is this your first college enrollment _____ Semester _____ Date _____, 19____
 Have you attended _____ Date of last _____
 Langston before? _____ Langston enrollment _____ Division _____ Do you Plan to teach? _____
 Do you plan to graduate this semester? _____ Have you been admitted to Teacher Education? _____
 Are you a legal resident of Oklahoma? _____ Classification: Fr. _____ Soph. _____ Jr. _____ Sr. _____ Spec. _____ Marital Status _____
 Are you attending on the GI Bill? _____ Departmental Major _____ Departmental Minor _____
 PL550 _____ PL634 _____ PL894 _____ Date of Birth _____
 Do you want a copy of "The Lion"? _____ Place of Birth _____ MONTH _____ DAY _____ YEAR
 _____ CITY _____ STATE _____

Local Address _____ Phone _____

From What High School Did You Graduate? _____
 NAME OF SCHOOL _____ CITY _____ STATE _____

School Last Attended before coming to Langston _____
 NAME OF SCHOOL _____ CITY _____ STATE _____

Your Legal Home Address _____
 STREET & NUMBER _____ CITY _____ COUNTY _____ STATE _____

Name of Parent or Guardian _____ Parent's Occupation _____

Address of Parent, guardian, wife or husband _____
 (INDICATE WHICH BY UNDERLINE) STREET & NUMBER _____ CITY _____ COUNTY _____ STATE _____ PHONE _____

Church Preference _____ Are you a Member? _____ Member of what campus organizations? _____

Dept.	Number	Sec.	Course Title	Hrs.	Time	Instructor	Room

* FEE *	Tuition = Total Credits _____ X Tuition \$ _____ Per Hour.				
STATEMENT	\$ _____	\$ _____	\$ _____	\$ _____	\$ _____
*****	Tuition	Stu. Center	Res. Hall	Spec. Fees	Total

Figure 30. Registration and Fee Payment Form

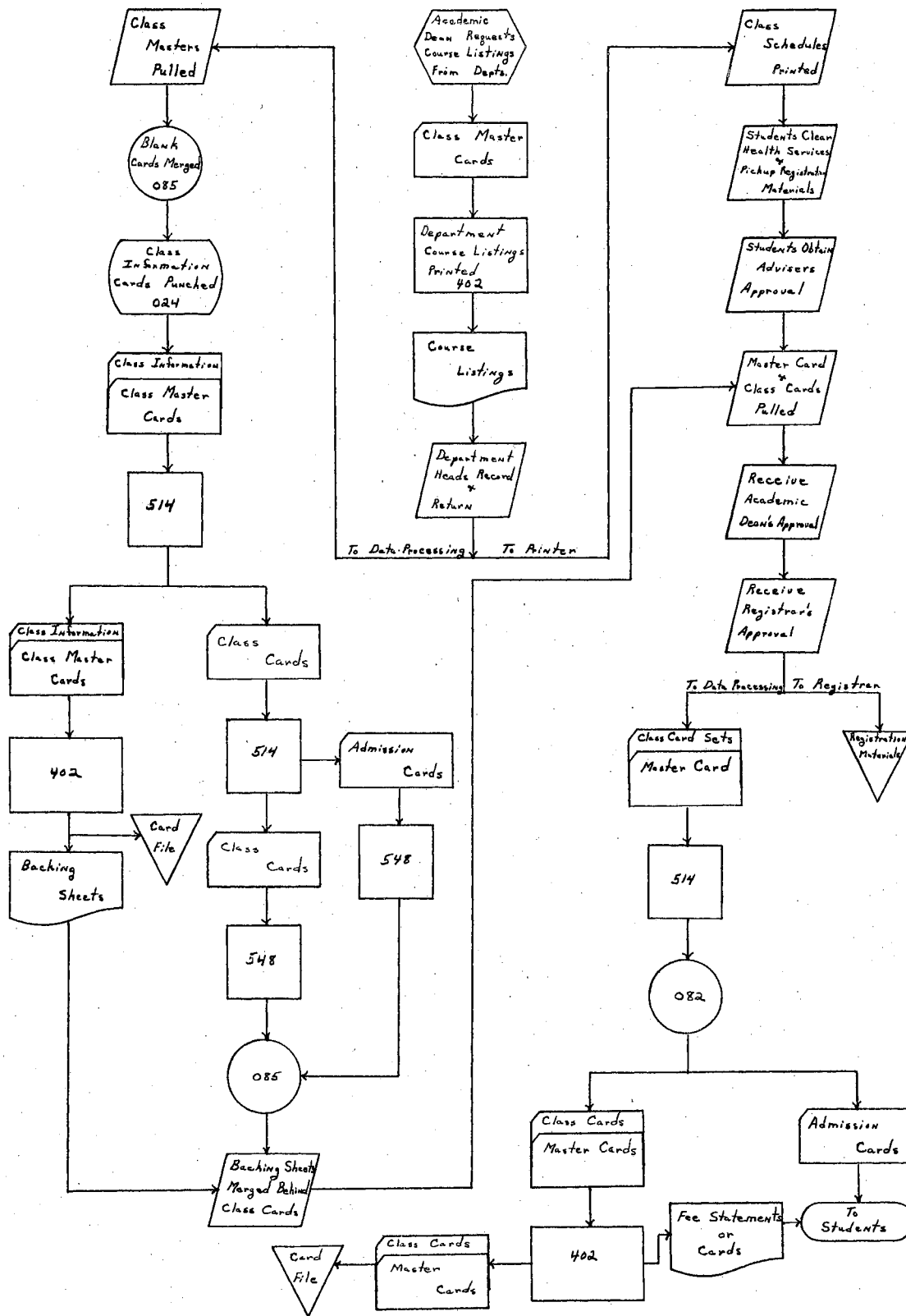


Figure 31. Registration Systems Flow Chart

Post Registration

The last day of registration signals the beginning of several post registration activities; such as, enrollment summaries and reports, class rosters, mid-term grades, final grades, academic standings reports and many other activities common to colleges and universities.

The compilation of enrollment summaries and reports under the manual system at Langston University is a time consuming process of tallying the information desired from the student enrollment forms and class cards. The enrollment breakdown includes dividing the student body into several divisions and obtaining a relationship between two or more of these divisions. Some of the division breakdowns are as follows:

- | | |
|---|--|
| 1. Student classification | 9. Full-time or part-time students |
| 2. Sex | 10. Probation enrollments |
| 3. Major and/or minor | 11. High school graduates |
| 4. New and transfer students | 12. Local residence |
| 5. Veteran status | 13. Adviser assignments |
| 6. Marital status | 14. Course enrollments by departments and divisions |
| 7. Residence by city, state and country | 15. Average student load by departments and divisions |
| 8. Enrollments by degree programs | 16. Faculty teaching loads by departments and divisions. |

The number of possible combinations from this enrollment division breakdown is tremendous when the processing must be completed under the manual system. As a result many of the statistical reports needed in the administration of the college are not available at the exact time when they would be of the greatest benefit.

The class rosters (Figure 32), which provide the faculty members with a complete alphabetic listing of students for each class they are teaching, are prepared by the Registrar's Office from the class cards turned in by the faculty for each of their classes. These rosters also act as the official grade rosters which are returned to the Registrar's Office at the close of the semester. The rosters are typed by hand and include all students who officially registered for each course. Students who changed courses by filing a change of schedule form (Figure 33) will only appear on the roster of the course added.

The mid-term grades are reported to the Registrar's Office by the faculty on the mid-semester progress report form (Figure 34). These forms are filled out by the faculty and distributed by the Registrar's Office. The clerical time involved is quite high since a copy is sent to the student's home address which requires the manual addressing of envelopes.

The final grades are reported to the Registrar's Office by the faculty on the class rosters discussed above and on the class cards. The grades are recorded by hand from the class cards to a summary sheet which lists the student body in alphabetic order and has each student's courses listed after his name. The class cards are then issued to the students and the permanent records (Figure 35) are posted by hand from the summary sheet. After the permanent records are posted, two xerox copies are made of this record and sent to the faculty adviser and parents, respectively.

The various academic standing reports are obtained by using an electric calculator and summarizing the credits, grade points and grade point averages on the summary sheets. These reports include honor

listings, probationary listings and so forth.

The development of a unit record system to replace the manual system in the post registration activities has many possibilities. Much of the information needed for the various reports is already coded into cards and ready for processing.

The enrollment summaries can be compiled by using combinations of the IBM student master cards, class cards and housing cards. These cards contain the necessary information in a coded form which can be sorted into the order desired and several copies printed on an accounting machine. For example, an alphabetic listing of students by county and by sex can be obtained by sorting the student master cards into alphabetic order [sequence number in card columns 4-10], then into county order [sequence number in card columns 34-36], and finally by sex [column 38]. The printed listing would be alphabetic by county and student with a separate listing for men and women. The flexibility of the system is readily apparent since the cards may be sorted into any desired order and printed with summaries obtained as a side benefit by connecting the accounting machine to the reproducing punch. In addition to the flexibility, the printing is obtained at a much greater speed while, at the same time, reducing the possibility of human error to a minimum.

The class rosters (Figure 32 revised) are easily obtained from the class cards by merging in a course header card (Figure 36) in front of the class cards for each course and printing the desired rosters. The up dating of the class card file, to take care of schedule changes, is done by using the request for change of records cards (Figure 37). These cards can be reproduced and copies sent to other offices or they

can be used with the regular change of schedule form. The main purpose, however, is to provide a way of machine merging class card adds and removing class card drops from the class card files.

The mid-term grades are sent to the Registrar's Office, by the Faculty, on the class admission cards which they received from their students at the first class meeting. The mid-term grade is coded on the card by using an electrographic pencil. If an instructor desires to give additional information, he may check reasons for unsatisfactory work and comment on the back of the card. Once the class admission cards are received by the Registrar's Office, they are sent to the Data Processing Center to be processed. At the center the class admission cards, which were not punched at registration time, are key punched with student number and collated behind the student's master card to provide a way of reproducing other coded information into the cards. After the blank cards are punched, all class admission cards are marked sensed on the reproducing punch, collated behind the student name and address cards, and the mid-term progress reports (Figure 34 revised) printed on the accounting machine. The class admission cards and reports are returned to the Registrar's Office where the cards are stuffed into window envelopes and mailed to the student's college address. The reports are separated and the copies distributed with the parents copy mailed by stuffing the report into a window envelope.

The final grades are obtained in the Registrar's Office by sending the faculty an official grade roster (Figure 38) and class cards for each course. The rosters are printed on the accounting machine from the class cards with a class summary card (Figure 39) punched on the reproducing punch for each class as a by-product. The class summary

cards contain the department and course codings, and the number of class cards issued for each course. This card is used to check the class cards as they are brought back to the center to make sure all class cards are returned.

The class cards are graded by using an electrographic pencil [the same process as used for mid-term grades] and returned to the Registrar's Office with the official grade rosters. The Registrar's Office returns the class cards to the Data Processing Center where the cards are mark sensed, checked for errors, and a machine check made to determine if all cards have been returned.

The class cards are collated together with the summary cards (Figure 40) and student name and address cards to run the student grade report (Figure 41). The card order should be (1) summary card, (2) student name and address cards and (3) class cards. As a by-product of the student grade reports a new summary card is summary punched on the reproducing punch as the reports are printed on the accounting machine. This summary card contains the number of credits attempted and earned, honor points, semester grade average, and overall grade average as well as other information about the student. The complete summary card format is outlined in Figure 40. As soon as the grade reports are processed, the class cards are separated from the other cards and collated behind the new summary cards to print the grade labels (Figure 42).

The grade reports and grade labels are returned to the Registrar's Office where the reports are distributed and the labels are used to post the permanent records (Figure 35 revised). The copy of the grade report sent to the student's home address is stuffed in a window envelope to avoid addressing an envelope for each student.

The academic standing reports are immediately available by sorting and printing the new summary cards in any order desired. As the various lists are printed, a summary may be obtained by summary punching on the reproducing punch, obtaining overall men's grade point average, semester grade point averages of all students living in residence hall B, and so forth.

The adaptation of the post registration applications to an electronic data processing system is a very progressive step which adds speed, flexibility, and precision to the system. The personal information about each student and the course enrollments are all stored on random access storage in the data processing area. The various enrollment reports and class rosters can be obtained by placing the computer under the correct program control and placing the stored information into the machine system.

The mid-term grades can be processed by reading the mark sensed class admission cards, from the unit record system, into the computer system and calling the student name and address information from random access storage to print the mid-semester progress reports.

Since the summary of previous college work is a part of the personal information file kept in random access storage, the procedure for final grades is the same as that used for mid-term grades. The class cards from the unit record system are mark sensed and read into the computer system. The student grade reports and grade labels are printed at several hundred lines a minute and the summary of college work is updated as the class cards are read by the card reader.

The academic reports on grade point averages are available immediately after the grade reports since the summary of college work has been

up-dated in the grade report process. Thus, by proper computer programming any report on academic standing can be generated.

The main problem associated with the computer system in this application is the same as the one found in the computer registration system, computer storage capacity. To solve this problem it may be necessary to program the system by phases as was suggested in the last section. The solution of this problem, however, provides a very fast and efficient system to handle college or university post registration procedures.

The post registration procedures using a unit record system have been illustrated by a systems flow chart in Figure 43.

REPORT OF GRADES

LANGSTON UNIVERSITY

INFORMATION

Office of the Registrar

1. Report all students who have been in your course any time during the term.
 The marking system is as follows: A-90-100; B-80-89; C-70-79; D-60-69; F-Failure; W-Withdrawn; I-Incomplete; W is reported by an instructor only upon notice by the office.

A grade of "I" must be explained upon reverse side of this report. Notes should correspond with numerical notation. Make entries in "Sem. Hrs." column ONLY when student receives irregular credit.
 The summary at the bottom of this page is part of the report.

Do not write in column marked CKD

Semester ending 196

Department Course No. Section

Descriptive Title of Course Credit Sem. Hrs.

Signature of Instructor Approval of Dean

Name of Student	Mark	Sem. Hours	Ckd	Name of Student	Mark	Sem. Hours	Ckd
1			32	.....		
2			33	.....		
3			34	.....		
4			35	.....		
5			36	.....		
6			37	.....		
7			38	.....		
8			39	.....		
9			40	.....		
10			41	.....		
11			42	.....		
12			43	.....		
13			44	.....		
14			45	.....		
15			46	.....		
16			47	.....		
17			48	.....		
18			49	.....		
19			50	.....		
20			51	.....		
21			52	.....		
22			53	.....		
23			54	.....		
24			55	.....		
25			56	.....		
26			57	.....		
27			58	.....		
28			59	.....		
29			60	.....		
30			61	.....		
31			62	.....		

SUMMARY OF GRADES IN THIS REPORT

The total of all grades must equal the number reported on this sheet

A B C Number in Class

D F I Number Passed

Figure 32. Class Roster

										CLASS ROSTER	
										LANGSTON UNIVERSITY	
Dept.	Course	Section	Course Title	Instructor	Date	Page				Mid-Semester	Final Grade
NO.	Student Number	Student's Name		Cl.	Cr.						
1.											
2.											
3.											
4.											
5.											
6.											
7.											
8.											
9.											
10.											
11.											
12.											
13.											
14.											
15.											
16.											
17.											
18.											
19.											
20.											
21.											
22.											
23.											
24.											
25.											

TO THE INSTRUCTOR:
According to our records this is a correct roll of the students registered in this course and section as of the above date.
1. If any of the students listed are not attending, please report their names to this office immediately.
2. If there are students attending who are not listed and who have a class admission card for them, please enter their name on the roster.
3. Those students attending who are not listed and for whom you do not have a class admission card, please request them to check with this office at once.
STUDENTS SHOULD NOT BE PERMITTED TO CONTINUE IN ATTENDANCE UNLESS THEY ARE LISTED, OR UNLESS YOU HAVE RECEIVED A CLASS ADMISSION CARD FROM THEM! FOR THIS SECTION, YOUR COOPERATION IN REPORTING SUCH CREDENTIALS AND IN REPORTING EXCESSIVE ABSENCES TO THE Student Personnel OFFICE will be greatly appreciated. Conditional and Drop Notices will be sent you as they occur.
IT IS NECESSARY FOR A STUDENT TO PROCESS AN OFFICIAL DROP WHEN CHANGING SECTIONS WITHIN THE SAME CLASS (EXCEPT FOR SECTIONS EXCLUDED)
A class dropped after the 15th instructional day of a regular session or the 7th instructional day of a summer session is normally recorded as "W." If the drop is due to circumstances beyond the student's control and responsibility, the student may petition to have the grade recorded as "N."
IF THIS SECTION IS CANCELLED please make the appropriate notation by each student's name, return this original class roster to the Registrar's Office and inform the students that the section has been cancelled and that each should report immediately to the department/office of the course cancelled for counseling and change of schedule procedures. IT IS NECESSARY FOR A STUDENT TO FILE A DROP EVEN WHEN THE COURSE HAS BEEN OFFICIALLY CANCELLED BY THE COLLEGE TO ALLOW REFUND OF TUITION OR ADJUSTMENT OF THE STUDENT'S SCHEDULE!
It will be appreciated if the instructor will return this original class roster to the Registrar's Office with a note that the above action has been taken.

Figure 32. Class Roster (revised)

CHANGE OF SCHEDULE						REGISTRAR
Name of Student					Date	
has been granted the following changes in registration:						
	Course and No.	Credit	Time	Days	Place	Instructor
Drop						
Add						
Advisor			Dean			
CHANGE OF SCHEDULE						DEAN OF INSTRUCTIONS
Name of Student					Date	
has been granted the following changes in registration:						
	Course and No.	Credit	Time	Days	Place	Instructor
Drop						
Add						
Advisor			Dean			

Figure 33. Change of Schedule Form

LANGSTON UNIVERSITY			GRADING SYSTEM	
MID-SEMESTER PROGRESS REPORT			A 93-100	Four grade points
The grade entered below indicates the student's class standing at the end of nine weeks of the current semester and is not to be considered his final grade.			B 85- 92	Three grade points
			C 77- 84	Two grade points
			D 70- 76	One grade point
			F Failure	No grade points
			W Withdrew	No grade points
			WP Withdrew Passing	No grade points
			WF Withdrew Failing	No grade points
I Incomplete	No grade points			
LAST NAME	FIRST NAME	MIDDLE NAME		
COURSE NUMBER AND TITLE			DATE	
GRADE	SEMESTER	1 2	INSTRUCTOR'S SIGNATURE	

Figure 34. Mid-Semester Progress Report Form

LANGSTON UNIVERSITY						
Langston			Oklahoma			
Student Name				Student Number		
				MID - SEMESTER GRADE REPORT		
Dept.	Course No.	Course Title	Sec.	Grade	Cr Hrs.	Grading System
						A 93-100 B 85-92 C 77-84 D 70-76 F Failure W With- drew WP " Pass- ing WF " Fail- ing I Incom- plete
The grades entered above indicate the Student's class standing at the end of nine weeks of the current semester and is not to be considered his final grade.						
ADVISER CODE			Date _____, 19__			

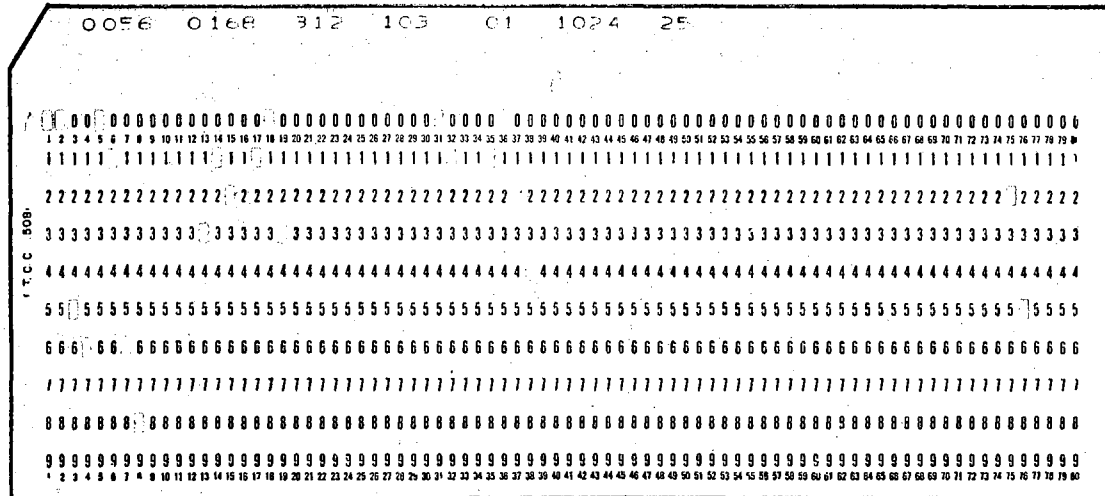
Figure 34. Mid-Semester Progress Report Form (revised)

LANGSTON UNIVERSITY PERMANENT RECORD																													
NAME--LAST				FIRST		MIDDLE		PLACE AND DATE OF BIRTH						GRADUATED		DEGREE													
HOME ADDRESS								MAJOR				MINOR (S)																	
NAME AND ADDRESS OF PARENT OR GUARDIAN								DEGREE REQUIREMENTS				SEM. HRS.																	
MATRICULATION DATE				DEPT.		NO.		DESCRIPTIVE TITLE				WRK SEM GRD HRS HRS PTS		DEPT.		NO.		DESCRIPTIVE TITLE				WRK SEM GRD HRS HRS PTS							
HIGH SCHOOL																													
GRADUATED																													
ENTRANCE CREDITS		UNITS																											
ENGLISH																													
ALGEBRA																													
GEOMETRY																													
PHYSICS																													
CHEMISTRY																													
PHYSIOLOGY																													
BOTANY																													
ZOOLOGY																													
BIOLOGY																													
GEN. SCI.																													
GEOGRAPHY																													
U. S. HISTORY																													
OKLA. HISTORY																													
SOC. STUDIES																													
LATIN																													
FRENCH																													
SPANISH																													
MANUAL ARTS																													
AGRICULTURE																													
HOME ECON.																													
MUSIC																													
OTHER SUBJECTS																													
TOTAL																													
ONE TRANSCRIPT OF RECORD SURVIVES THE STUDENT FEE OF CHARGE.				EXPLANATION										ENTITLED TO HONORABLE DISMISSAL															
ADDITIONAL TRANSCRIPTS ONE DOLLAR EACH.				<p>UNIT-- THE COLLEGE UNIT IS THE STANDARD SEMESTER UNIT, THE NORMAL SEMESTER PROGRAM BEING FROM 12 TO 16, EXCLUSIVE OF REQUIRED PHYSICAL EDUCATION.</p> <p>MARKING SYSTEM-- A-EXCELLENT, B-GOOD, C-FAIR, D-POOR, F-FAILURE, INC-INCOMPLETE, W-WITHDRAWAL, WF-WITHDRAWAL FAILING, WF-WITHDRAWAL FAILING, AN INCOMPLETE BECOMES F IF NOT REMOVED DURING NEXT SEMESTER OF REGISTRATION.</p> <p>A MINIMUM GRADE POINT RATIO OF 2.00 IS REQUIRED FOR GRADUATION.</p> <p>GRADE POINTS--FOUR POINTS ARE GIVEN FOR EACH UNIT MARK OF A, 3 FOR B, 2 FOR C, 1 FOR D, 0 FOR F AND WF.</p>										<p>I CERTIFY THAT THE ABOVE INFORMATION IS CORRECT.</p> <p>NOT AN OFFICIAL TRANSCRIPT WITHOUT SIGNATURE AND COLLEGE SEAL.</p> <p>LANGSTON, OKLAHOMA</p> <p style="text-align: right;">REGISTRAR.</p>															

Figure 35. Permanent Record

LANGSTON UNIVERSITY PERMANENT RECORD												
NAME--LAST				FIRST		MIDDLE		PLACE AND DATE OF BIRTH				
HOME ADDRESS						GRADUATED						DEGREE
NAME AND ADDRESS OF PARENT OR GUARDIAN						MAJOR			MINOR (S)			
						DEGREE REQUIREMENTS			SEM. HRS.			
						TOTAL SEM. HRS.			TOTAL GRADE POINTS			
MATRICULATION DATE	DEPT.	NO.	DESCRIPTIVE TITLE	Gr	Sem. Hrs.	GRD PTS	DEPT.	NO.	DESCRIPTIVE TITLE	Gr	Sem. Hrs.	GRD PTS
HIGH SCHOOL												
GRADUATED												
ENTRANCE CREDITS	UNITS											
ENGLISH												
ALGEBRA												
GEOMETRY												
PHYSICS												
CHEMISTRY												
PHYSIOLOGY												
BOTANY												
ZOOLOGY												
BIOLOGY												
GEN. SCI.												
GEOGRAPHY												
U. S. HISTORY												
OKLA. HISTORY												
SOC. STUDIES												
LATIN												
FRENCH												
SPANISH												
MANUAL ARTS												
AGRICULTURE												
HOME ECON.												
MUSIC												
OTHER SUBJECTS												
TOTAL												
ONE TRANSCRIPT OF RECORD FURNISHED THE STUDENT FREE OF CHARGE.	EXPLANATION						ENTITLED TO HONORABLE DISMISSAL					
ADDITIONAL TRANSCRIPTS ONE DOLLAR EACH.	UNIT-- THE COLLEGE UNIT IS THE STANDARD SEMESTER UNIT, THE NORMAL SEMESTER PROGRAM BEING FROM 12 TO 14, EXCLUSIVE OF REQUIRED PHYSICAL EDUCATION. MARKING SYSTEM-- A-EXCELLENT, B-GOOD, C-FAIR, D-POOR, F-FAILURE, INC-INCOMPLETE, W-WITHDRAWAL, WP-WITHDRAWAL PASSING, WF-WITHDRAWAL FAILING. AN INCOMPLETE BECOMES F IF NOT REMOVED DURING NEXT SEMESTER OF REGISTRATION. A MINIMUM GRADE POINT RATIO OF 2.00 IS REQUIRED FOR GRADUATION. GRADE POINTS--FOUR POINTS ARE GIVEN FOR EACH UNIT MARK OF A, 3 FOR B, 2 FOR C, 1 FOR D, 0 FOR F AND WF.						I CERTIFY THAT THE ABOVE INFORMATION IS CORRECT. NOT AN OFFICIAL TRANSCRIPT WITHOUT SIGNATURE AND COLLEGE SEAL. LANGSTON, OKLAHOMA REGISTRAR.					

Figure 35. Permanent Record (revised)



Class Summary Card Format

<u>Columns</u>	<u>Field Definition</u>
1 - 4	Number of Students
5 - 8	Credit Hours for Class
9 - 12	Blank
13 - 15	Date
16	Blank
17 - 20	Course Number
21 - 30	Blank
31 - 32	Section
33 - 34	Blank
35 - 38	Instructor Code
39	Blank
40	Card Code (X or Eleven Punch)
41 - 74	Blank
75 - 76	Department Code
77 - 80	Blank

This information is summary punched at the same time the Official Class Rosters are printed.

Figure 39. Class Summary Card

STUDENT NUMBER	NAME OR ADDRESS	ADVISER	SEM. CREDIT HRS.	SEM. GRADE POINTS	SEM. CREDIT HRS. AT
SUMMARY CARD OR ADDRESS CARD					
C0	C0	C0	C0	C0	C0
C1	C1	C1	C1	C1	C1
C2	C2	C2	C2	C2	C2
C3	C3	C3	C3	C3	C3
C4	C4	C4	C4	C4	C4
C5	C5	C5	C5	C5	C5
C6	C6	C6	C6	C6	C6
C7	C7	C7	C7	C7	C7
C8	C8	C8	C8	C8	C8
C9	C9	C9	C9	C9	C9
1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30
31	32	33	34	35	36
37	38	39	40	41	42
43	44	45	46	47	48
49	50	51	52	53	54
55	56	57	58	59	60
61	62	63	64	65	66
67	68	69	70	71	72
73	74	75	76	77	78
79	80				

Summary Card Format

Columns

Field Definition

1 - 10	Student Number
11 - 30	Student Name
31 - 32	Credits earned for the semester
33 - 34	Grade points earned for the semester
35 - 36	Credits attempted for the semester
37 - 39	Credits earned overall
40 - 43	Grade points earned overall
44 - 46	Credits attempted overall
47 - 50	Adviser
51 - 57	Blank
58 - 62	Overall grade point average
63 - 67	Semester grade point average
68 - 69	Blank
70	1--Above a 2. Average (Overall Grade Point Average)
	2--Below a 2. Average
71	Blank
72	1--Above a 2. Average (Semester Grade Point Average)
	2--Below a 2. Average
73 - 75	High School Code
76 - 79	Blank
80	Card Code (3)

This card is summary punched at the same time the Student Grade Reports are printed.

Figure 40. Summary Card

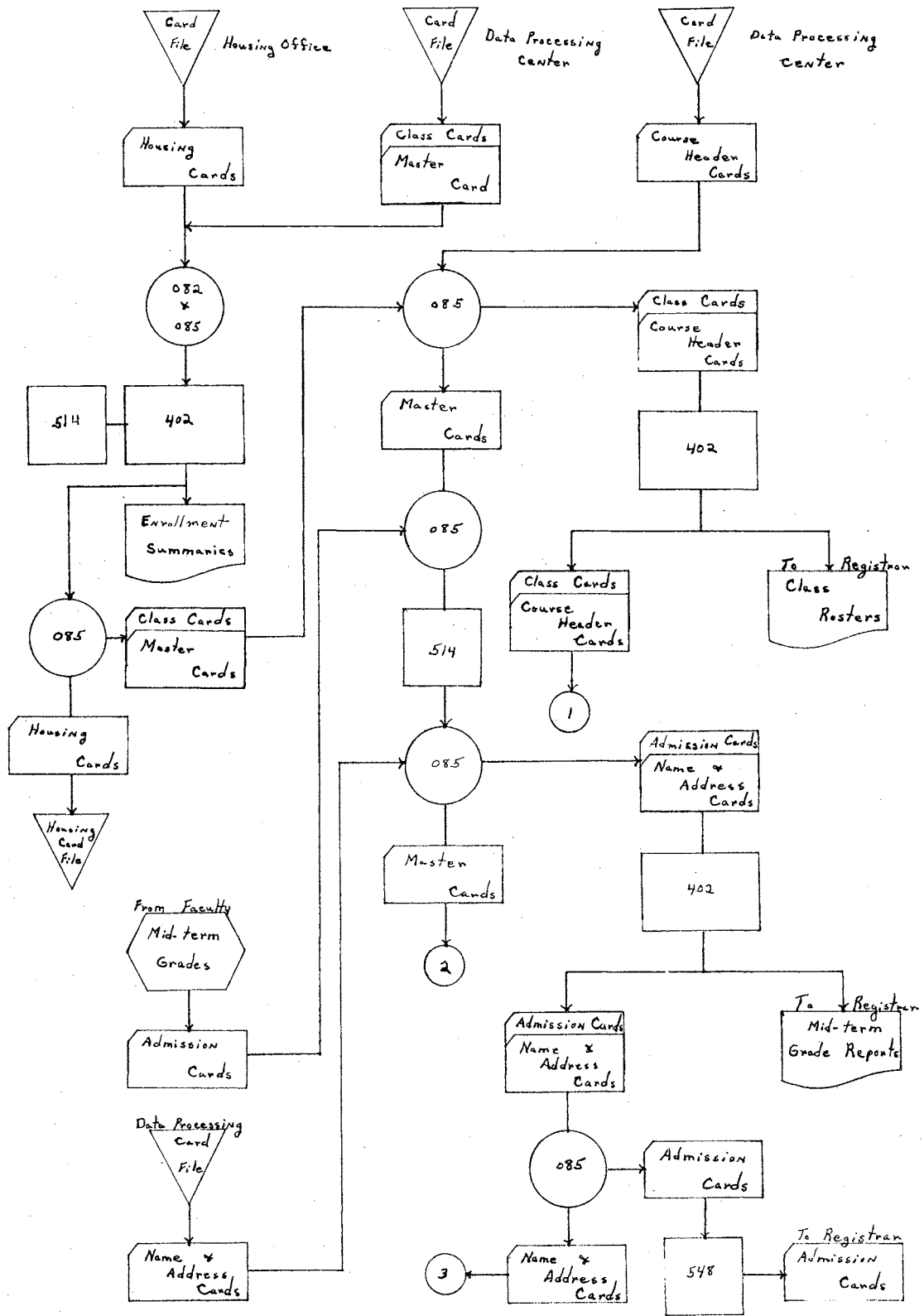
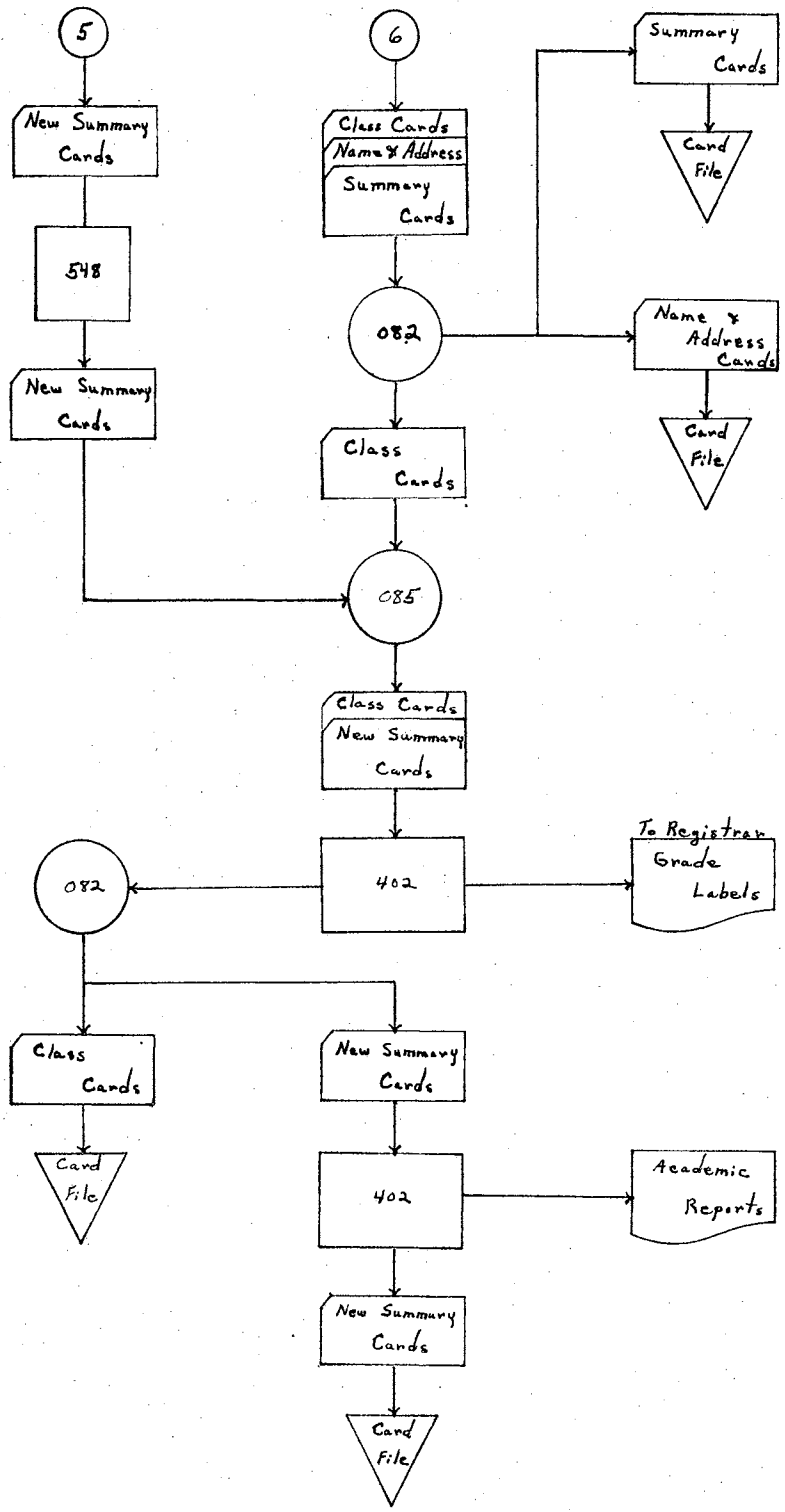


Figure 43. Post Registration Systems Flow Chart

Figure 43. (continued)



Accounting Procedures

The accounting operations and business activities at Langston University include keeping records of all monies due and paid to the University by students, organizations, faculty and staff. The transactions are recorded on ledger cards (Figure 44) by manually posting each record as the transaction occurs. The Business Office is presently using a cash register machine which posts the ledger cards at the same time the receipt forms (Figure 45) are generated. The ledgers used for claims and orders are posted on a manually operated accounting machine.

The accounting operations of the Business Office involve contact with every individual on campus and with many off-campus businesses. The major operations include procedures for accounts receivable, accounts payable and disbursements, and payrolls.

Accounts receivable includes all of the accounts listed on the bottom of the receipt form in Figure 45. The procedure used in this operation is a balance-forward type of procedure where the debits and credits appear as individual items on the ledger cards. The ledger cards are presently filed in alphabetic order and are referenced to the receipt by the student account number. The account number is not an alpha-number and thus referencing to the alphabetic ledger file is a time consuming procedure whenever a reference must be made.

The receipt form has a reference number which provides a way of checking the student's copy of a transaction with the Business Office copy. This number is used in place of recording the student's name on the receipt form.

The accounts receivable operation officially has its beginning when students report to the Business Office in step 7 of the registration process. At this time the total fees for the semester are determined and posted on the ledger cards as the receipt form is generated. The student may make full or partial payment at this time, or he may wait until a later date. Once the students process through this registration step they have a copy of the receipt which lists their total fees and the Business Office has a ledger card with an identical listing. If a student has additional charges at the University, such as medical charges, they are posted under his name on the ledger card. As payments are received, they are also posted on the ledger card with a balance brought forward after each transaction. The process of finding delinquent accounts is a time consuming operation which involves checking each ledger card and then contacting the students who are delinquent in their payments. ✓

The accounting procedures include making a summary at the end of each day, on a daily allocation sheet (Figure 46), and depositing the receipts in the bank with a deposit card (Figure 47). At the end of each month the daily allocation sheets are summarized and a monthly report is compiled on the same type of form. The deposit cards are sent to the State Budget Office where a monthly summary and breakdown by accounts is generated. A copy of this summary is sent to the Business Office by the State Budget Office.

The conversion of this manual system to a unit record system places a very heavy demand on the development of a permanent student number which is also the student's account number and on a workable student ID card system. The use of the student number as an account number pro-

vides a definite identification system which helps develop an integrated systems approach between all offices of the university. This integrated system is further developed by having a student ID card system which includes embossed ID cards. The cards may be used in every college activity where students are checking out materials or opening charge accounts. The embossed ID cards provide an easy way to record student name and number on receipt forms. In the case of charge accounts or fines, these receipt forms can be sent to the Business Office where the amount charged can be posted to the student's account.

The accounts receivable procedures, under the unit record system, start when the fee payment cards and duplicate fee cards are generated, as outlined in the previous section on preregistration and registration procedures.

The fee payment card is processed through the cash register and then separated into two parts, one for the Business Office and one for the student. This card takes the place of the receipt form and since the student name and number is printed on each half of the card, there is no need to have the receipt reference numbers. The Business Office copy of this card is used to pull the duplicate fee card from the card files. The two decks of cards are then taken to the data processing center at the close of each day.

At the data processing center the amount of payment, date and account code are key punched, from the cash register printing on the fee payment card, into the duplicate fee card. This card is then used to generate a summary report and listing of the day's receipts by account number. A daily summary card (Figure 48) is generated as a by-product of the summary report and a new fee payment card is also gener-

ated, if the student has not completed payment in full. The new fee payment cards are used to generate new duplicate fee cards; and then, the summary report and listing, new fee payment cards, old fee payment cards [Business Office copy], new duplicate fee cards, old duplicate fee cards, the daily summary card, and mailing labels are returned to the Business Office. The new fee payment cards are mailed to the students before the next pay period; the new duplicate fee cards represent the outstanding accounts receivable ledger, and the old duplicate fee cards with the new cards represent the total ledger. The daily summary card is filed until the end of the month and then used to compile the monthly summary report. The procedure outlined above would eliminate the old ledger cards since the duplicate fee cards would, in effect, be the accounts receivable ledgers. If additional charges are received on an account, they are processed in the same way as the credits explained above. Thus, the unit record duplicate fee cards provide the same information as the ledger which is presently in use. However, if the ledger cards are required, they can be obtained by printing gum labels (Figure 49) from the duplicate fee cards and posting them on the ledger cards.

The daily allocation sheet is completed from the summary report and the total receipts for the day are checked against the cash register total. The deposit card would remain the same as the one used under the manual system.

One variation in the unit record system, which may be needed to meet requirements in some colleges, is the use of a multi-copy fee statement form (Figure 50) rather than the fee statement card. This form would allow a better detailed description of charges and credits than possible on the fee payment card. The only disadvantage is the cost of

the form and extra time involved in processing.

The accounts receivable operation can be transferred to an electronic data processing system with few changes in the unit record system. The students would receive their first fee statement on the registration and fee payment form (Figure 30). The following fee statements would either be the fee payment card or statement. The duplicate fee card would be used to transmit the daily transactions to computer storage where all transactions for each student are stored by student account number. If a summary or report is desired, the computer operator need only place the correct computer program in the computer system and the desired report can be printed at several hundred lines per minute.

The need for a common student number and account number is readily apparent since the storage of the accounting ledger for each student should be stored under the same code number as the registration data to provide a way to generate addresses and other information for fee statement mailing purposes.

The main disadvantage to the computer system is the same as stated in previous sections; a large storage capacity must be available in the computer system. The storage of the information presently found on the ledger card will require a large amount of storage space which is not really needed if the accounts receivable are kept on duplicate fee cards. Thus, a possible solution to the storage problem is to store the ledger card information on unit record cards and then read the information from the cards to generate the desired reports.

The accounts receivable procedure for a unit record system has been outlined by a systems flow chart in Figure 51.

The Accounts Payable and Disbursements operations at Langston

University are handled in two major accounts; (1) the trust fund account which includes all the auxiliary functions of the University, and (2) the general appropriation account. The accounting procedures used under each account are very similar, with the main difference occurring when the disbursements are processed.

The requisition of supplies and other materials by departments, other offices and by faculty are obtained by filing a purchase requisition (Figure 52) in the Business Office. The approved purchase requisition form is used to type the requisition to the Board of Regents (Figure 53) for the general account items and to type a purchase order (Figure 54) for the trust fund account items. The requisition to the Board of Regents is used in that office to type a purchase order, with three copies of the order returned to the Business Office at Langston University. Thus, at this point the Business Office has a minimum of three copies of the purchase orders under both accounts. These three copies are distributed as follows: one copy is sent to the department making the request, a second copy is sent to the receiving room and the third copy is filed in the Business Office. The other copies of the purchase orders are mailed to the vendors by the Business Office, for trust fund purchases, and by the Director of Purchases, Board of Regents Office, for general account purchases.

When an invoice is received from a vendor, the Business Office sends it to the appropriate department head or office manager, who approves the form and returns it to the Business Office. The invoice is then used to prepare a control form (Figure 55) and assign a claim number. This control form is stapled to the invoice and forwarded to

the accounts payable clerk who prepares checks (Figure 56) for the trust fund purchases and prepares claim forms (Figure 57) for purchases on the general account. The checks are signed and mailed to the vendor and the claim forms are sent to the Board of Regents Office for payment.

The control form, invoice and check or claim form copies are stapled together [called a control form packet] and used to post the major fund account [cash account], sub-account [accounts], department control and department ledgers. The major fund account is recorded on the same type ledger card as the department control ledger card, called the register of claims ledger (Figure 58). The sub-accounts ledger and department ledger cards are identical, called the register of purchase order and claims (Figure 59), and are used to record a complete breakdown by sub-accounts under the main accounts. The posting of these records is completed manually on an accounting machine in the Business Office.

The control form packet is also used to complete a monthly summary report of expenditures (Figure 60) under each major fund. This summary report must check with the totals obtained from the department ledger cards. Once this cross check is made each month, a monthly report of expenditures (Figure 61) is made by object code. These monthly reports are accumulative and thus provide a yearly report at the end of December.

The conversion of this system to a unit record approach has many interesting possibilities. The introduction of punch cards into the previously described system would occur when the purchase orders are available. The purchase orders are used to keypunch a master control card (Figure 62) which is used later to create various reports.

When the invoice is received and approved by the appropriate department head, the control form (Figure 55 revised) is completed and, a vendor number and claim number assigned. The invoice, control form and master control card are sent to data processing where the following unit record cards are punched: (1) Vendor name and address cards if the vendor is new or has changed addresses and (2) a payment card (Figure 62).

The master control cards are used to print an invoice register (Figure 63) and the other two sets of cards are used to print the accounts payable checks (Figure 56 revised) or the claim forms (Figure 57 revised) for the general account. At the same time the checks are being printed a ledger account card (Figure 62) is punched. These cards are used with the master control cards to complete the monthly reports at the end of each month. The payment cards are used to print a daily check register (Figure 64).

The only adjustment between the trust fund account and the general fund account is the printing of claim forms rather than checks. The other cards and reports would be handled identically under each account.

The necessity for flexibility would require that some checks be generated by hand. This presents no great problem, since all other steps can be completed, except for check generation on the printer. Thus the accounts payable and disbursements operation, under the unit record system, is a complete procedure.

The development of the unit record system has required the numerical coding of the control forms, fund, account and objects by number. Since these are already in a numerical coded form at Langston University there is no need to make a change in procedures. This is a major

consideration that should be followed throughout the complete development of a new system. As Wagner pointed out in his study, to avoid confusion and revolt by the working staff, "the new method of operation must be wrapped up in as much of the old as is possible" (56:111).

One numerical coding which was not mentioned above, but could provide an excellent reference file, is a vendor code. This code could be assigned as an alpha-number and used in the vendor name and address cards, thus eliminating the need to keypunch new cards for repeated vendor invoices. Also, a vendor summary card (Figure 65) could be generated for each invoice which would be used to summarize the amount of business, type of service, quality of merchandise and so forth, by vendor.

The conversion of this system to an electronic data processing system does not require many adjustments. The cards and forms can remain relatively stable with the cards used as visual references and the reports being produced from computer storage. The major advantages between the two systems is the greater speed and less possibility of error associated with the computer system and the elimination of some of the card files, such as the vendor file. The information in these files can be stored on computer disk files or tapes.

Another advantage, however, that should not be overlooked in this computer application as well as the others mentioned in this chapter, is the analysis possibilities of a computer system. The ability to analyze data is an inherent part of the stored program concept of computers. The normal processing of data under the accounts payable application or any other application can be handled very much the same as the unit record system but in addition several programmed checks and balances

can be built into the system. This advantage is probably the main attraction computer systems have over the other systems.

A systems flow chart of the unit record system is illustrated in Figure 66.

The payroll function of a college or university consists of operations which involve the working heart of the institution, the employees. This area is very important to employee morale and is also very important because it accounts for a large portion of an institution's expenditures. The payment of all employees and a complete analysis of the payroll must be made accurately and promptly for each payroll period.

The payroll at Langston University is presently completed partially in the Business Office and partially at the State Budget Office.

The Business Office compiles the payroll register (Figure 67) and maintains individual employee earnings records (Figure 68) on each employee. Due to the size of the University, no time cards are used for staff or faculty. The approval of absences and deductions for absence without pay are handled individually through the Academic Dean and Business Offices. The student assistants fill out a time sheet (Figure 69) which is approved by their supervisor and turned into the Business Office.

The State Budget Office uses the payroll register to generate the checks (Figure 70) which are returned to the Business Office with a copy of the payroll register. The checks are issued by the Business Office along with earnings statements (Figure 71) which are generated when the employee earnings records are posted manually on the accounting machine. The analysis of payroll expenditures by accounts and departments is completed from the payroll registers and the individual

earnings records.

The conversion of the payroll application to a unit record system is a natural step since the unit record system was developed for exactly this type of application. The first step in this development should be the assignment of employee numbers which are actually alpha-numbers. This assignment could be completed in the same way as the student numbers were assigned in Chapter III. The employee number would be used to identify the employee earnings record in the Business Office as well as in the control and processing of the payroll cards. The number would also be used to process class rosters, grade rosters, adviser copies of the student grade reports and any other reports involving the college staff or faculty.

The second step is to generate an employee master data card set (Figure 72) for each employee. This set would include a master card, deduction card, year-to-date earnings card and employee address cards. The master cards will include detailed data on each employee; such as, highest degree obtained and college at which it was obtained, major speciality, research area, special talents, original home area and other qualifications which can be used in news releases, faculty recruitment, and public service functions. The deduction cards contain information on authorized payroll deductions; such as, health insurance, savings, income tax deductions, and so forth. The year-to-date earnings cards contain a summary of the accumulative earnings and deductions which are made for each pay period. The name and address cards are self explanatory and are used for any mailings that are made to the faculty or staff.

A third step in the preparation of materials for this application could include the development and use of a time card or record (Figure 73). This card would have the dual purpose of notifying the employee and his supervisor about accumulated leaves and overtime, and represents the time card for the next pay period. A similar card (Figure 69 revised) could be used to replace the student assistant time sheets and provide the same service for these employees and their supervisors.

At the end of each pay period the master cards and time cards are used to generate a current earnings card (Figure 74) with all corrections and changes made in the master cards before the current earnings cards are generated. The current earnings, deductions and year-to-date cards are merged together to print the payroll register (Figure 67 revised). As the payroll register is printed a summary of all columns is accumulated in the accounting machine and a new year-to-date card is punched for each employee. The column summaries are printed at the end of the run to provide the totals required on the reverse side of the payroll register (Figure 67 reverse side).

The new year-to-date, current earnings, and deduction cards are merged together to print the check and earning statements (Figure 75), and a deduction register (Figure 76). The earnings statements are the only records generated if this part of the payroll is handled by a central office. These cards are separated at the end of this run and filed for the next payroll period. The year-to-date cards are merged with the employee name and address cards at the end of the year to prepare the W-2 statements. Also, the year-to-date cards are used to prepare the quarterly 941 social security forms.

The accumulative year-to-date card file represents the employee earnings record and thus the manual record could be eliminated. However, if the need for this record is present, they may be posted at the end of each pay period by using the same gum labels (Figure 49) used for posting the accounts receivable ledger cards.

This completes the unit record system for payroll with all previous records preserved, and many additional records and reports available which were not possible before.

The development of this system into an electronic system requires very few changes unless computer storage is available for the information in the various card files. If this is the case, the files are eliminated and a current earnings card is the only card needed to start the payroll procedure described above.

If storage is not available, the card files would remain the same with the computer system furnishing added speed and checking possibilities. The additional checking would occur from programming the computer to cross check for discrepancies in the payroll procedure as it is processed. This is a very important and worth while addition to the system which is not possible under the other systems.

A systems flow chart for the unit record payroll system is illustrated in Figure 77.

LANGSTON UNIVERSITY

BUSINESS OFFICE
LANGSTON, OKLAHOMA

STUDENT LEDGER

ACCT. NUMBER _____

NAME _____ PARENTS _____


ADDRESS _____

DATE	SYMBOLS	CHARGES	CREDITS	BALANCE	PREVIOUS BALANCE
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

EXPLANATION OF CODES

- 10 STUDENT I.D. CARD
- 11 DORMITORY
- 12 BOARD
- 13 REGISTRATION
- 14 OUT OF STATE FEE
- 15 STUDENT CENTER FEE
- 16 PARKING PERMIT
- 17 MEDICAL CHARGES
- 18 PROPERTY DEPOSIT
- 19 YEAR BOOK
- 20 LIBRARY FINES
- 21 STUDENT LOANS
- 22 COTTAGE RENT
- 23 FACULTY HOUSING
- 24 CURRENT
- 25 GAS
- 26 WATER
- 27 NDSL
- 28 ND SL INTEREST
- 29 T & C
- 30 DEGREE
- 31 CHANGE OF ENROLLMENT
- 32 LATE ENROLLMENT
- 33 MUSIC FEE
- 34 CORRESPONDENCE STUDY
- 35 STUDENT WORK AID
- 36 STUDENT CREDIT
- 37 MISCELLANEOUS
- 38 LAUNDRY FEE
- 39 SCHOLARSHIP
- 40 PARKING FINE

PAY THIS AMOUNT



T-537H

Figure 44. Ledger Card

Figure 48 (continued)

Daily Summary Card Format (first card)

<u>Columns</u>	<u>Field Definition</u>
1 - 4	Date
5 - 10	Resident Halls Receipts
11 - 16	Board Receipts
17 - 21	Student Union Receipts
22 - 27	Faculty Housing Receipts
28 - 33	Total 47A
34 - 39	Acct. Number 200 Payments
40 - 45	Registration Receipts
46 - 51	Out of State Fees
52 - 56	Transcript and Certificate Receipts
57 - 62	Theater Receipts
63 - 68	Number 47 Payments
69 - 74	Cottage Rent
75 - 78	Blank
79	Card Sequence Number
80	Card Code (8)

Daily Summary Card Format (second card)

<u>Columns</u>	<u>Field Definition</u>
1 - 4	Date
5 - 9	Property Deposits
10 - 15	Student Activity Receipts
16 - 20	Laundry Receipts
21 - 26	NSL Payments
27 - 31	Misc. Credit
32 - 37	Total 47
38 - 44	Total 47A and 47
45 - 51	Student Charges
52 - 48	NSL Loans
59 - 64	NSL Interest
65 - 70	Misc. Debit
71 - 77	Total Debits
78	Blank
79	Card Sequence Number
80	Card Code (8)

These cards are generated on the 514 reproducing punch when the daily summary report is printed on the 402 accounting machine.

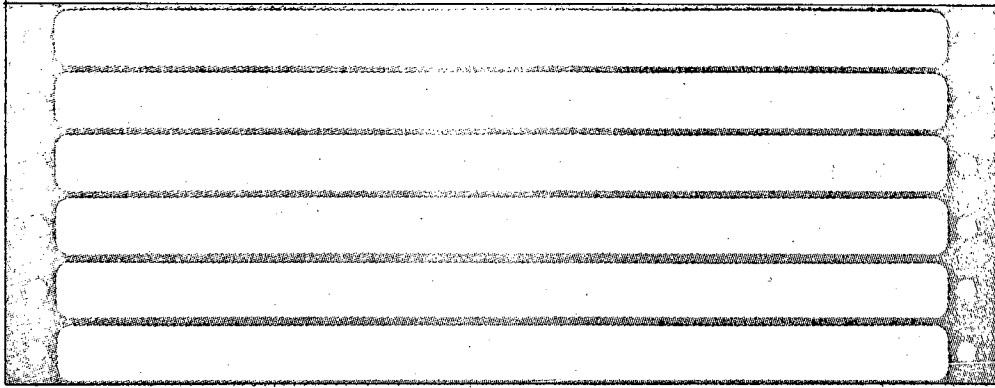


Figure 49. Gum Labels (ledger card)

LANGSTON UNIVERSITY Business Office		
Langston _____		Oklahoma _____
Student Name	Student Number	
	* * STATEMENT * *	
	Date: _____, 19__	
Date Charged	Description	Amount
Please make checks payable to LANGSTON UNIVERSITY. Mail check and original copy of this statement to Business Office. Your canceled check is your receipt.		Current Balance \$

Figure 50. Fee Statement Form

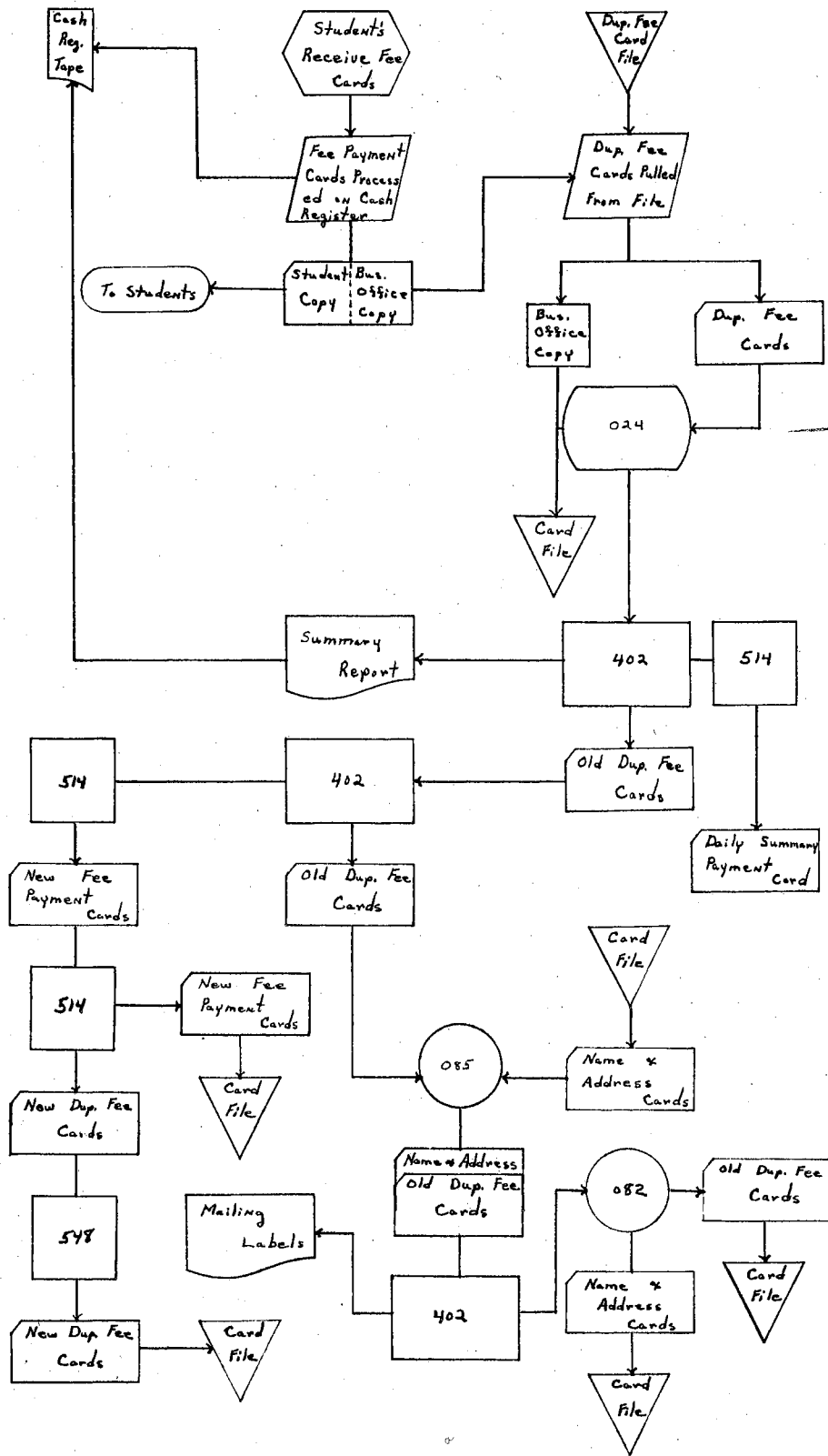


Figure 51. Accounts Receivable Systems Flow Chart

PURCHASE REQUISITION

DATE _____

PLEASE FURNISH FOR OFFICIAL USE OF _____ DEPARTMENT

SUGGESTED SOURCE OF SUPPLY

Quantity	Items	Unit Price		Total Price	

Price Quotation Dated _____ By _____

Requested By _____

Approved _____
Head of Department

Approved _____ Business Manager Approved _____ President of University

Figure 52. Purchase Requisition

BOARD OF REGENTS FOR OKLAHOMA STATE UNIVERSITY AND A. & M. COLLEGES		No.	PURCHASE ORDER NO.																					
REQUISITION		Fill in below this line																						
Date _____		INSTITUTION TITLE _____																						
TO THE DIRECTOR OF PURCHASES		BUDGET CLASS _____ PROJECT _____																						
Please order materials listed below or disburse to payee named for wages, travel or other non-material purposes.		ACCOUNT NO. AND APPROPRIATION TITLE _____																						
		FISCAL YEAR _____																						
QUANTITY	FOR	Materials—Specify clearly and completely all items requested Wages—Designate "Labor Payroll" and dates covered Travel—Designate payee, title, dates and purposes of travel Other Non-Material Items—Designate payee and basis for payment	PRICE IF ESTIMATED	PRICE IF QUOTED																				
		AS PER QUOTATION DATED _____ F. O. B. _____																						
		EXTENSIONS AND CALCULATIONS CHECKED BY _____																						
TO BE COMPLETED BY DEPARTMENT		FOR BUSINESS OFFICE USE																						
USE OR PURPOSE		DATE APPROVED BY BOARD _____																						
INQUIRIES FROM PURCHASING OFFICER TO BE DIRECTED TO		AUTHORIZED TRAVEL																						
WANTED NOT LATER THAN		<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">DATE</th> <th style="width: 15%;">CLAIM NO.</th> <th style="width: 15%;">P. O. NO.</th> <th style="width: 15%;">AMOUNT</th> <th style="width: 15%;">BALANCE</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table>			DATE	CLAIM NO.	P. O. NO.	AMOUNT	BALANCE															
DATE	CLAIM NO.	P. O. NO.	AMOUNT	BALANCE																				
VENDOR PREFERRED		VENDOR DESIGNATED BY DIRECTOR OF PURCHASES _____																						
OTHER POSSIBLE SOURCES OF SUPPLY		APPROVED _____ BUSINESS MANAGER/PRESIDENT																						
REQUESTED BY—ADM. OFFICER		REQ. ENTERED _____ ORDERED _____																						
		FOR DIRECTOR OF PURCHASES _____																						

Figure 53. Requisition to Board of Regents

STATE OF OKLAHOMA BOARD OF REGENTS for OKLAHOMA A. & M. COLLEGES		PURCHASE ORDER INSTITUTION'S COPY			REQUISITION No. 02204 <small>The Above Number Must Show On All Packing Lists, Invoices And Communications. EW</small>
REGISTRATION FOR TAX FREE TRANSACTIONS UNDER CHAPTER 32 OF THE INTERNAL REVENUE CODE NO. A - 145787					
DATE	FUND	FUNCTION	AGENCY	ACCOUNT	PURCHASE ORDER NUMBER
Oct. 13, 1966	200	1	420	2107	804395
To:			Ship To:		
Mescaliter Scientific Corporation 60 Arsenal St. Watertown, Massachusetts			Langston University Langston, Oklahoma Oc-225 203H-2 Attn: Mr. J.A. Simpson		
ADDRESS ALL COMMUNICATIONS AND INVOICES TO THE COLLEGE FOR WHICH ORDER IS PLACED AND NOT TO THE BOARD OF REGENTS.				WANTED ON OR BEFORE Immediately	
ITEM NO.	QUANTITY	DESCRIPTION	UNIT PRICE	AMOUNT	
		Items as per attached;			\$176.40
		FOR: Physic Supplies			
AS PER QUOTATION BY		DATED 9-22-66	TERMS	FOR Langston, Oklahoma	
VENDORS READ AND FOLLOW CLOSELY					
An invoice in quadruplicate is required on each Purchase Order, same to be mailed promptly to the Institution or Department receiving supplies or services. Purchase order number must appear on each invoice, package, delivery ticket, and all correspondence pertaining to this order. Not valid until encumbered on the records in the Budget Office. This order void one year from date of issuance, capital outlay purchases excepted. The above purchase order is issued in conformity with your quotation and constitutes a contract. Address communications to the College for which order is placed and not to the Board of Regents.					
				STATE OF OKLAHOMA Board of Regents for Oklahoma A. & M. Colleges BY: <i>Jack Elker</i> DIRECTOR OF PURCHASING	

Figure 54. Purchase Order

LANGSTON UNIVERSITY

Langston, Oklahoma
Logan County

CLAIM NO.

In Account With _____ Date: _____

Institution 420

	Quantity	Article	Unit Price	Total Price

15378

I, The Undersigned, Upon Oath do depose and say, That I am
the above named claimant; that I have full knowledge of the above
and foregoing account; that said account is just, correct, due and according to law; that the
amount claimed, after allowing all just credits, is now due and wholly unpaid; and that I am
duly authorized to make this affidavit, so help me God: Claimant.
Subscribed and sworn to before me this day of, 19.....
My Commission Expires, 19..... Notary Public
Signed by the President of Langston University

Figure 55. Control Form

INVOICE CONTROL

LANGSTON UNIVERSITY
 Langston, Oklahoma
 Logan County

CLAIM NO.

In Account With _____

Date _____

Due Date _____

Vendor No. _____

New Vendor _____

Institution 420

	Quantity	Article	Unit Price	Total Price

13379

I, The Undersigned, Upon Oath do depose and say, That I am the above named claimant; that I have full knowledge of the above and foregoing account; that said account is just, correct, due and according to law; that the amount claimed, after allowing all just credits, is now due and wholly unpaid; and that I am duly authorized to make this affidavit, so help me God. Claimant.


Subscribed and sworn to before me this day of, 19.....

My Commission Expires, 19..... Notary Public

Signed by the President of Langston University

Figure 55. Control Form (revised)

1884
 CO-OPERATIVE PUBLISHING CO., SPRINGFIELD, OHL.



STATE OF OKLAHOMA
 OFFICIAL DEPOSITORY
 OKLAHOMA CITY, OKLAHOMA

VOUCHER NO. 39-89
 1030

FUND	F	AGENCY	ACCT.
810	1	420	47 A

VOID ONE YEAR FROM DATE OF ISSUE

LANGSTON UNIVERSITY LANGSTON, OKLA., _____, 19__

PAY TO THE ORDER OF _____ \$ _____

ISSUED FOR _____

CLAIM NO. _____

THIS SPACE FOR TRANSFER OF FUNDS TO

FUND	F	AGENCY	SOURCE
		420	


PAYABLE AT THE OFFICE OF
THE STATE TREASURER
 STATE CAPITOL
 OKLAHOMA CITY, OKLAHOMA

ORIGINAL

BY: _____ PRESIDENT
 BY: *Void* BUSINESS MANAGER

⑆1030⑉0085⑆ 002 047 00⑈

Figure 56. Check Blank



STATE OF OKLAHOMA
 OFFICIAL DEPOSITORY
 OKLAHOMA CITY, OKLAHOMA

VOUCHER NO. 39-89
 1030

FUND	F	AGENCY	ACCT.
810	1	420	47 A

VOID ONE YEAR FROM DATE OF ISSUE

LANGSTON UNIVERSITY LANGSTON, OKLA., _____, 19__

PAY TO THE ORDER OF _____ \$ _____

ISSUED FOR _____

CLAIM NO. _____

THIS SPACE FOR TRANSFER OF FUNDS TO

FUND	F	AGENCY	SOURCE
		420	

PAYABLE AT THE OFFICE OF
THE STATE TREASURER
 STATE CAPITOL
 OKLAHOMA CITY, OKLAHOMA

ORIGINAL

BY: _____ PRESIDENT
 BY: _____ BUSINESS MANAGER

⑆1030⑉0085⑆ 002 047 00⑈

Figure 56. Check Blank (revised)

STATE OF OKLAHOMA

Agency _____ Date _____, 19____

IN ACCOUNT WITH _____

PURCHASE ORDER

P. O. ADDRESS _____

No. _____

For The Following Items:

DATE	Quantity	ARTICLE	Unit Price	Amount Claimed	Object	Disallowed By Approv. Officer	Disallowed By Budget Div.

The State Auditor is hereby authorized to deliver warrant issued in payment of this claim to the Approving Officer in charge of Department or Institution above named, and such officer is authorized to mail said warrant to claimant at address herein above named.

I, _____ the undersigned, upon oath, do depose and say that I have full knowledge of the above and forgoing account; that said account is just, correct, due and according to law; and that the amount claimed after allowing all just credits, is now due and wholly unpaid, and that I am duly authorized to make this affidavit, so help me God.

Subscribed and sworn to before me _____, 19____

Claimant

My Commission expires _____, 19____

Notary Public

OFFICER'S APPROVAL

APPROVED BY OFFICIAL BOARD

Received and checked by _____

Chairman _____

Approved on Fund _____ Function _____ Agency _____ Account _____

Member _____

For \$ _____ Dated this _____ day of _____, 19____

Member _____

Approving Officer

Amount _____

BUDGET OFFICE COPY

Figure 57. Claim Form

LANGSTON UNIVERSITY												
REGISTER OF PURCHASE ORDERS AND CLAIMS												
FUND YEAR												PAGE NO.
DATE	REFERENCE			TRANSACTIONS			TOTALS TO DATE			PURCHASE ORDERS OUTSTANDING	UNENCUMBERED BALANCE TO DATE	
	P. O. NO.	CLAIM NO.	CODE	P. O. CHARGED OR LIQUIDATED	EXPENDITURES	BUDGET INC. OR DECREASE	EXPENDITURES	BUDGET	UNEXPENDED BALANCE			

Figure 59. Register of Purchase Orders and Claims

LANGSTON UNIVERSITY
OFFICE OF THE BUSINESS MANAGER
EXPENDITURES BY OBJECT

Fund _____

	Current Month	19____ Year to Date
0 PERSONAL SERVICES		
01 Salaries		
02 Fees and Wages		
03 Professional Services		
*04 Professional Salaries		
*05 Non-Professional Salaries		
1 CONTRACTUAL SERVICES		
10 Travel		
11 Freight, Express and Parcel Post		
12 Postage		
13 Telephone, Telegraph and Radio		
14 Utilities		
15 Rents (Space, Land, Machines, etc.)		
16 Printing and Binding		
17 Repairs, Alt. & Maint. of Bldgs., Eqmt. & Non-St. Imp.		
18 Construction, Highway and Bridge Repairs, etc.		
19 Other Contractual Services		
2 SUPPLIES AND MATERIALS		
20 Food		
21 Wearing Apparel		
22 Office Supplies		
23 Forage, Vet. Agr. & Botanical Supplies		
24 Laundry, Household & Refrigeration Supplies		
25 Educational and Recreational Supplies		
26 Medical and Laboratory Supplies		
27 Motor Vehicle Supplies and Fuels		
28 Supplies & Mat. used in Const. Rep. or Alt. of Bldg. Eqmt. & Non-Structural Imprv. Not Done Under Contract		
29 Other Supplies and Materials		
3 EQUIPMENT		
30 Office Equipment		
31 Household Equipment		
32 Medical and Laboratory Equipment		
33 Motor Vehicles (Truck and Passenger)		
34 Educational and Recreational Equipment		
35 Machinery and Tools		
36 Books and Periodicals		
37 Specimens and Collections		
38 Livestock and Poultry (Foundation)		
39 Other Equipment		
4 PENSIONS AND ASSISTANCE		
40 Pensions and Assistance Payments		
41 Bonuses and Payments to Inmates		
5 CURRENT CHARGES AND OBLIGATIONS		
50 Payment of Principal or Interest on Debt		
51 Premiums on Bonds or Insurance		
52 Grants and Memberships in Organizations		
53 Fees for Licenses, Permits and Privileges		
54 Refunds		
55 Withholdings Payable		
56 Imprest Cash		
57 Purchase of Merchandise for Resale		
58 Payments to Local Subdivisions		
59 Other Current Charges and Obligations		
60 Payment to Personnel Board		
64 Payment of Deferred Annuities		
65 Insurance Benefits		
67 O. A. S. I.		
9 LAND AND STRUCTURES		
96 Land (Purchase)		
97 Land (Non-Structural Improvements)		
98 Buildings (Capital Improvements; including purchase and erecting and fixed equipment)		
99 Other Structures (Purchase, Construction and Repair)		

Figure 61. Report of Expenditures by Object Code

Vendor No.	Name	Inv. No.	Cont. No.	Date Due	Acct. No.	Invoice Amt.	Disc.	Net Amt.	Check No.
000000	MASTER CONTROL	000000	000000	000000	000000	000000	000000	000000	0000
000000	PAYMENT CARD	000000	000000	000000	000000	000000	000000	000000	0000
Name	Date	Action	Ref.	Acct. No.	Annual Budget	%X if Negative			
LEDGER ACCT. CARD									
000000	000000	000000	000000	000000	000000	0000000000			
111111	111111	111111	111111	111111	111111	1111111111			
222222	222222	222222	222222	222222	222222	2222222222			
333333	333333	333333	333333	333333	333333	3333333333			
444444	444444	444444	444444	444444	444444	4444444444			
555555	555555	555555	555555	555555	555555	5555555555			
666666	666666	666666	666666	666666	666666	6666666666			
777777	777777	777777	777777	777777	777777	7777777777			
888888	888888	888888	888888	888888	888888	8888888888			
999999	999999	999999	999999	999999	999999	9999999999			

Figure 62. Master Control Card, Payment Card, Ledger Account Card

INVOICE REGISTER						
LARGSTON UNIVERSITY						
LARGSTON OKLAHOMA						
11/30/66						
VENDOR NUMBER	NAME	CONTROL NUMBER	INVOICE AMOUNT	DISTRIBUTION ACCOUNT NUMBER		AMOUNT
075641	MOORE BOS FOR.S	06 2247 06 2247	182 68	195	01211	182 68
082479	MIDWEST TYPEWRIT	06 2250 06 2250	6 50	195	48011	6 50
089307	OKLAHOMA NEWS	06 2251 06 2251	66 12	195	33111	66 12
TOTAL			7206 70			

Figure 63. Invoice Register

CHECK REGISTER					
LANGSTON UNIVERSITY					
LANGSTON OKLAHOMA					
11/30/66					
VENDOR NUMBER	VENDOR NAME	CHECK NUMBER	CHECK AMOUNT	INVOICE NUMBER	INVOICE AMOUNT
075641	MOORE BUS FORMS	52849	182 68	062160	182 68
075641		52849	182 68		
TOTAL 7206 70					

Figure 64. Check Register

Vendor No.	Name	Inv. No.	Control No.	DATE Pd.	ACCNT. No.	Inv. Amt.	Disc.	Net. Amt.	Cash Act. No.
000000	000000000000000000000000	000000	000000	000000	00000000	00000000	00000000	00000000	0000
111111	111111111111111111111111	111111	111111	111111	11111111	11111111	11111111	11111111	1111
222222	222222222222222222222222	222222	222222	222222	22222222	22222222	22222222	22222222	2222
333333	333333333333333333333333	333333	333333	333333	33333333	33333333	33333333	33333333	3333
444444	444444444444444444444444	444444	444444	444444	44444444	44444444	44444444	44444444	4444
555555	555555555555555555555555	555555	555555	555555	55555555	55555555	55555555	55555555	5555
666666	666666666666666666666666	666666	666666	666666	66666666	66666666	66666666	66666666	6666
777777	777777777777777777777777	777777	777777	777777	77777777	77777777	77777777	77777777	7777
888888	888888888888888888888888	888888	888888	888888	88888888	88888888	88888888	88888888	8888
999999	999999999999999999999999	999999	999999	999999	99999999	99999999	99999999	99999999	9999

Figure 65. Vendor Summary Card

STATE BUDGET DIRECTOR
STATE OF OKLAHOMA - AGENCY PAYROLL

PAYROLL ABSTRACT AND WARRANT REGISTER

TO THE COMMISSIONER OF ADMINISTRATION, DIRECTOR CIVIL SERVICE, STATE AUDITOR AND STATE TREASURER:
 I HEREBY CERTIFY that the claims herein approved have been reviewed pursuant to law, including laws 1979, Chapter 45, as amended, if applicable, and no proper charges against the appropriation and allotment indicated herein and that the goods have been received or the services rendered, all as set forth herein, further that all necessary Secretary and Civil Service forms in connection with this payroll have been submitted and have been approved.

By _____ Department Authorized Signature
 Date _____ DATE PAID

DEPT. ACCT. FUND	NO. ENTRY	INDEX	ITEM	ALLOT. CLARK	OTR.	FUND	DOCUMENT	PAY PERIOD ENDING			ABSTRACT NO.	AUDITOR'S WARRANT NUMBER			
								CLASS CODE	COST CODE	DATE					
SOCIAL SECURITY NUMBER	EMPLOYEE NAME	CLASS CODE	COST CODE	HOURS	HRLY RATE	GROSS EARNINGS	RETIREMENT	SOCIAL SECURITY	FEDERAL WITH-HOLDING	STATE WITH-HOLDING	CREDIT UNION	GROUP INSURANCE	UNION DUES	MISC. DEDUCTIONS	NET AMOUNT

Figure 67. Payroll Register (revised)

**LANGSTON UNIVERSITY
EMPLOYEE EARNINGS RECORD**

S. S. NUMBER _____

NAME _____

CO-OPERATIVE PUBLISHING CO., ESTABL. DELA. 17247

AD PROOF	TO DATE		BALANCES		MONTH	GROSS PAY	DEDUCTIONS						NET PAY		
	EARNINGS	W-TAX	O.A.S.I.	PROOF			MAINT.	W-TAX	RETIRE.	INS.	BOND	O.A.S.I.		MISCL.	

Figure 68. Employee Earnings Record

LANGSTON UNIVERSITY
MONTHLY STUDENT WORK RECORD
October 1966

Name of Student _____

Job _____

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Date							1
Time							
							Total hours for week _____

Date	2	3	4	5	6	7	8
Time							
							Total hours for week _____

Date	9	10	11	12	13	14	15
Time							
							Total hours for week _____

Date	16	17	18	19	20	21	22
Time							
							Total hours for week _____

	23	24	25	26	27	28	29
							Total hours for week _____

Total Hours for Month _____

Student's Signature _____ Date _____

I hereby certify that the above is a true statement of the hours worked by the student listed and that (he or she) has performed (his or her) assigned job in a satisfactory manner.


Supervisor's Signature _____ Date _____

COMMENTS:

Figure 69. Student Assistant Time Sheet

SOCIAL SECURITY NUMBER	STUDENT NAME										ACC. NO. CODE	NO. DEP.	OVER HOURS	PAY PERIOD	HOURS EARNED THIS P.P.	ACCUM. HOURS	PAY RATE	FUNCT. CODE	
STUDENT ASSISTANT TIME CARD																			
DATE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16			
HOURS WORKED																			
DATE	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	TOTAL HOURS			
HOURS WORKED																			
PLEASE EXPRESS FRACTIONAL HOURS IN TENTHS																			
SIGNATURE OF STUDENT										SIGNATURE OF SUPERVISOR									

Figure 69. Student Assistant Time Sheet (revised)



STATE OF OKLAHOMA
OFFICE OF THE STATE AUDITOR
OKLAHOMA CITY, OKLAHOMA
PAYROLL WARRANT

236125

MA 9-66
1-630

TO THE STATE TREASURER
PAY TO THE ORDER OF

AGENCY	SOCIAL SECURITY NUMBER	NAME	
420	260 58 0819	K H RC	

PAY

\$ *****95⁸/₁₀₀00
DOLLARS CENTS

GROSS AMOUNT	MAINTENANCE	FED. W. TAX	STATE TAX	MISC.
10000				

DO NOT FOLD OR STAPLE

NETAL	ACCT. NO.	TRK.	ROUTE	AMOUNT	DATE OF ISSUE
				420	10 31 66

VOID ONE YEAR FROM DATE OF ISSUE

Courby Vincent Williams

STATE TREASURER

T. H. Brown

STATE AUDITOR

⑆ 03000085⑆ 001000001⑆

Figure 70. Payroll Check

LANGSTON UNIVERSITY ----- Langston, Oklahoma ----- STATEMENT OF EARNINGS									
Period End.	F.F. Soc. Sec. No.	Gross Earn.	Deductions	T.P. ID No.	Date				
		Deductions			Amount				
Year To Date									
Total Earn.	Withhold.	Hlth Ins.	FICA	Fed. Inc.	St. Inc.	Other	Net Amt.		
LANGSTON UNIVERSITY Langston, Oklahoma									
PAY TO THE ORDER OF						Check No.			
						Date			
						Net Amt.			
Date	Dept.	Acct.							
Payable at the Office of THE STATE TREASURER State Capital OKLAHOMA CITY, OKLAHOMA						Langston University Salary Account			
						_____ President _____ Business Manager			

Figure 75. Check and Current Earnings Statement

D E D U C T I O N S R E G I S T E R						
LANGSTON UNIVERSITY LANGSTON OKLAHOMA						
EMPLOYEE NUMBER	EMPLOYEE NAME	HEALTH INS	FICA	FED INC	STATE INC	OTHER
0001	JONES DICK	23 00	13 33	14 22	3 09	
0002	LEE W J	18 66	13 33	12 00	7 43	12 00
0233	SMITH EK	23 00	13 33	13 06	7 68	
0234	WHITE RONALD	23 00	13 33	15 10	8 34	25 00
TOTALS		3789 16	2656 18	4133 69	1617 52	1479 00

Figure 76. Deduction Register

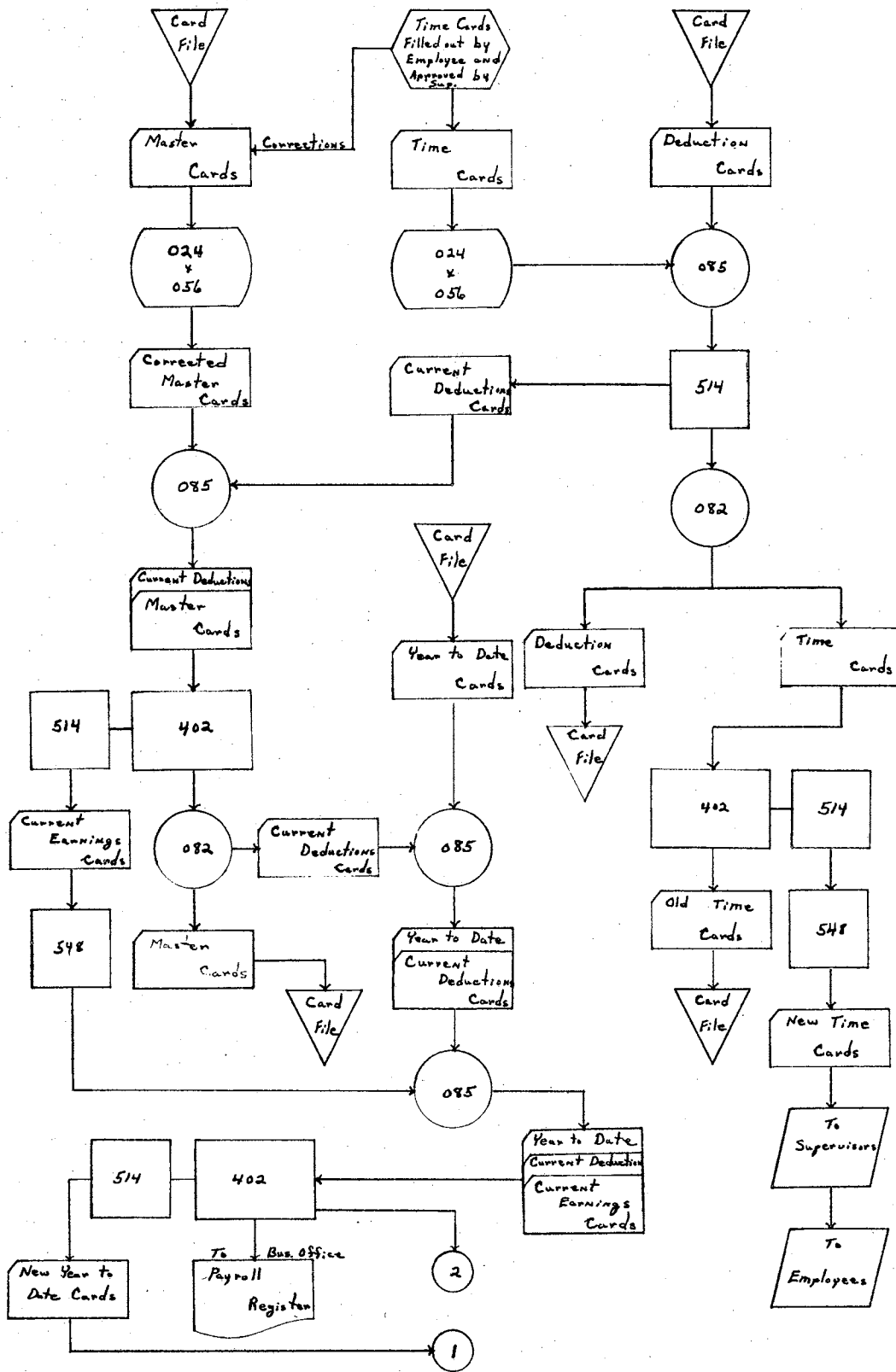
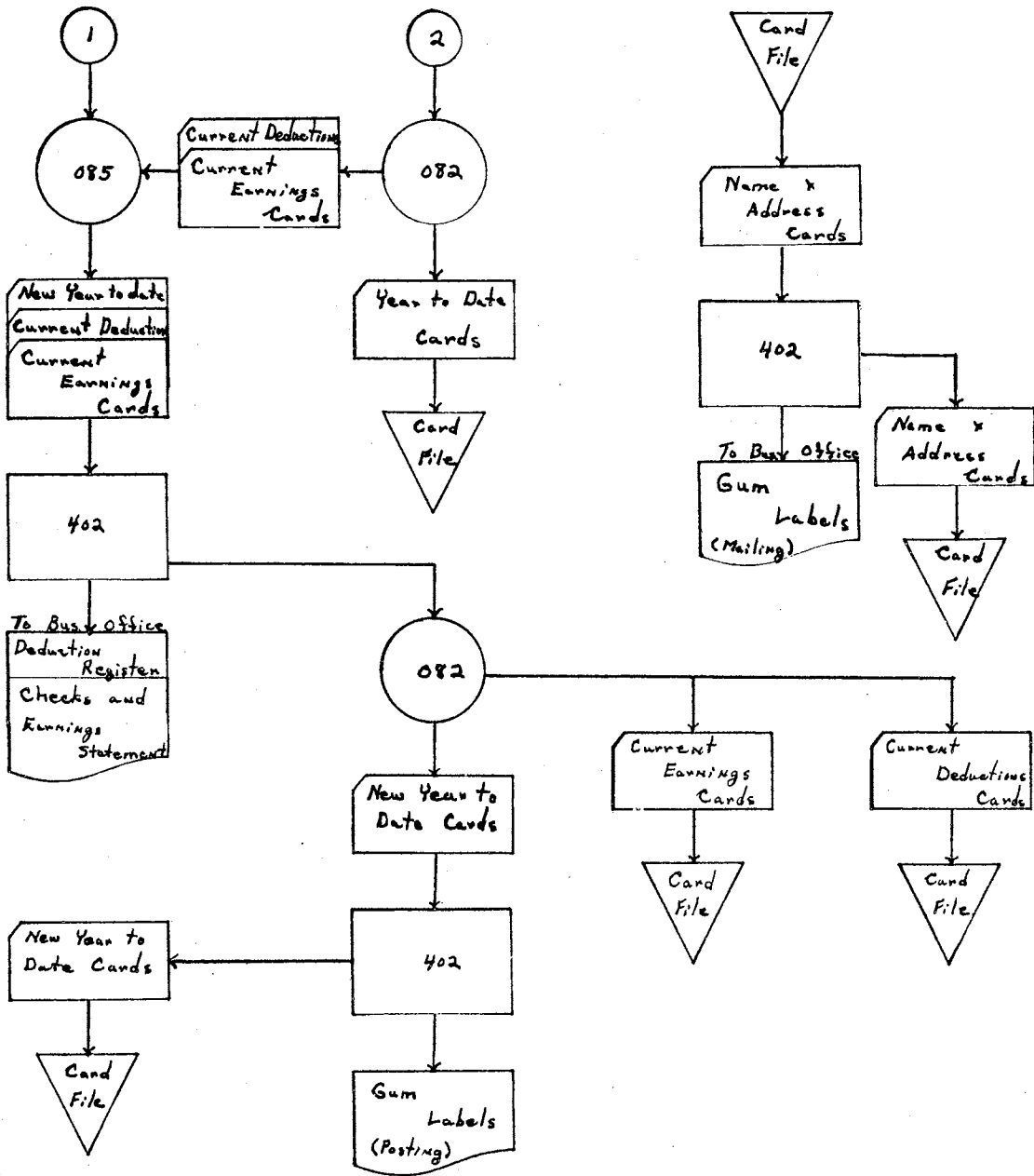


Figure 77. Payroll Systems Flow Chart

Figure 77 (continued)



Miscellaneous Applications

The previous sections outline procedures to be used in the major administrative applications of electronic data processing equipment. These applications are the ones which should be initiated first in the conversion from a manual system to a unit record or electronic system. As Wagner suggested in his report, "segments of a complete operation must be installed as circumstances permit or indicate rather than have a complete operation installed at one time" (56:111). Any attempt to go too far in too short a time fails to take into account human factors that tend to resist technological innovations unless handled correctly. Many of the college or university employees must be trained and given time to absorb the many changes introduced by a machine system.

After the initial phase has been introduced and is working smoothly, many other machine applications are possible and desirable. Several of the administrative applications are identified by Hamblen in his 1964 research project [see Chapter II; pp. 20-22]. Some of the sub-major applications which should be considered are listed below with card illustrations designed by the author for Mankato State College, Mankato, Minnesota.

1. Dining Hall Application: Dining hall lists and cards (Figure 78) can be obtained from the housing cards. The dining hall cards are the same size as the student ID card and should be carried in the same folder. The card has the student's name, number, residence hall and dining hall number printed on the card with the dining hall number being printed by the special end-printing feature of the 519 reproducing punch. The cards are issued in different colors for each dining hall.

2. Informational Services Record: The collection of student data for publicity purposes can be streamlined by using a punched card (Figure 79) which can be punched with coded information that can be processed and printed at machine speeds. The establishment of a code number, and a name and address card set for each student's home town newspaper provides a way to process and mail various news releases.

These cards can also be used to obtain a student directory by merging them with student name and address card sets.

3. Laboratory Cards: Colleges or universities which have separate lab sections from the lecture sections of a course need some way to control lab admissions and report lab grades to lecture instructors. The laboratory card (Figure 80) provides a workable system to satisfy both of these needs. These cards are made up by section and issued at the class-card issue station, in the registration process. They are given to the students with their class admission cards and are turned into the lab instructors as their lab admission card.

4. Mark-Sensing: The 514 or 519 reproducing punch with a special mark-sensing device can read and punch mark-sense cards (Figure 81) which have been marked with an electrographic pencil. These cards can be used as answer cards to tests, inventory cards, or in any other project which involves recording numerical numbers.

The use of the mark-sense cards as answer cards would require reserving two or three mark-sense columns as student class number columns and having different colored cards for tests involving more than 24 or 25 questions. Also, a computer or an accounting machine with a calculating device must be available to read and score the test results.

The mark-sense cards may be used for inventory control by pre-punching equipment or supply detail information into the cards and then mark-sensing with an electrographic pencil, at location, the quantity, location and so forth.

5. Religious Census Cards: The problem of acquainting students with their campus religious organization is simplified by using the religious census cards (Figure 82) which can be punched, sorted, and sent to the various campus ministers. The cards are normally distributed with the registration materials at registration time and gang-punched with the class cards on the 514 reproducing punch.

6. Selective Service Reports: The selective service reports on male students must be processed as soon after registration as possible. An excellent procedure is to use a selective service card (Figure 83) which is gang-punched with the class cards on the 514 reproducing punch, key punched with the board number, interpreted on the 548 interpreter, sorted into board order and mailed without additional hand processing.

7. Student Programs: The development of a system for the student loan and scholarship programs is a natural extension of the accounting systems. The development of this system should use the student number as a control number and account number, thus integrating the system with the accounts receivable system in the Business Office.

8. Development and Gift Program: This application could include name and address, and gift card files. The name and address file would include all pertinent information about alumni and other donors to the college or university funds. The gift card file would include a summary of each alumnus or donor's gifts. These files are used to complete

mailings, gift accounting and any other project or projects involving the personnel concerned.

The sub-major applications listed above do not include all of the possibilities in the administrative functions of a college or university, but together with the previously outlined major applications they do represent most of the practical applications in a small educational institution. Further development in this area must be determined by the local situations with the understanding that some things are necessarily better done manually than by machine.

STUDENT NAME										CLASS	CURR	FILE NO.	
COUNTY OR STATE	TOWN	HIGH SCHOOL	H'S CRSD DATE	SEX	MAR	ALPHA NO.	NEWSPAPER QUARTER						
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 DO NOT WRITE ABOVE THIS LINE 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80													
1. (160-71) PRINT NAME FIRST MIDDLE AND MAIDEN LAST LOCAL TEL NO										MANKATO STATE COLLEGE INFORMATIONAL SERVICES CARD OFFICE OF THE DIRECTOR			
2. (164-19) PRINT ADDRESS AT COLLEGE-RESIDENT HALL OR OFF CAMPUS HOUSING													
3. (164-19) PRINT PERMANENT HOME ADDRESS STREET CITY STATE COUNTY													
4. (143-63) PRINT NAME OF PARENT OR GUARDIAN NAME OCCUPATION										10. (128) SEX	11. (133) MARITAL	12. (175) VET. STATUS	13. (148) CLASSIFICATION
5. (132-143) PRINT NAME OF HOMETOWN NEWSPAPER BIRTH DATE MAJOR AND MINOR										1. MALE	1. MARRIED	1. VETERAN	(1) FRESHMAN (10-47 CR)
6. (1307) PRINT QUARTER AND YEAR OF FIRST ADMISSION										2. FEMALE	2. SINGLE	2. NON-VETERAN	(2) SOPHOMORE (48-86 CR)
7. (1307) ADMISSION BASIS AT TIME OF MATRICULATION										4. (174) CURRICULUM			(3) JUNIOR (86-143 CR)
8. (1) NON-HIGH SCHOOL GRADUATE.										(1) B.S. (PHYSICAL THERAPY)			(4) SENIOR (144+ CR)
9. (2) HIGH SCHOOL GRADUATE. (130-422) CITY HIGH SCHOOL CLASS OF										(2) P.N.E.-PROFESSIONAL			(5) GRADUATE STUDENT
10. (3) TRANSFER STUDENT FROM UNIVERSITY OF MINNESOTA.										(3) B.A.			(6) HAVE 4 YR. DEGREE, TAKING GRADUATE CREDIT
11. (4) TRANSFER STUDENT FROM MINNESOTA JUNIOR COLLEGE.										(4) B.S. (ELEMENTARY ED.)			(7) POST-GRADUATE
12. (5) TRANSFER STUDENT FROM MINNESOTA PRIVATE COLLEGE.										(5) B.S. (SECONDARY ED.)			(8) HAVE 4 YR. DEGREE, TAKING UNDERGRADUATE CREDIT
13. (6) TRANSFER STUDENT FROM OUT-OF-STATE COLLEGE.										(6) B.A. (HUMANIS)			(9) SPECIAL (DO NOT HAVE DEGREE, NOT WORKING ON A DEGREE PROGRAM)
14. (7) TRANSFER STUDENT FROM MINNESOTA STATE COLLEGE.										(7) MASTER OF SCIENCE			(10) HAVE DEGREE, NOT WORKING ON A DEGREE PROGRAM
15. (8) TRANSFER STUDENT FROM MINNESOTA STATE COLLEGE.										(8) UNDEGREE, OR NOT WORKING ON A DEGREE.			(11) SPECIAL (DO NOT HAVE DEGREE, NOT WORKING ON A DEGREE PROGRAM)
16. (9) TRANSFER STUDENT FROM MINNESOTA STATE COLLEGE.										(9) B.S. (MED. TECHNOLOGY)			(12) SPECIAL (DO NOT HAVE DEGREE, NOT WORKING ON A DEGREE PROGRAM)
17. (10) TRANSFER STUDENT FROM MINNESOTA STATE COLLEGE.										(10)			(13) SPECIAL (DO NOT HAVE DEGREE, NOT WORKING ON A DEGREE PROGRAM)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80													
TTCC - G7529B													

Figure 79. Informational Services Card

STUDENT NUMBER	DEPT	COURSE NO.	LABORATORY	SEC.	STUDENT NAME	CURR	PERIOD
DO NOT WRITE ABOVE THIS LINE!							
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80							
SCIENCE LABORATORY ADMISSION CARD (PRESENT TO LAB INSTRUCTOR THE FIRST DAY OF CLASS)				CAD	SCIENCE LABORATORY CARD (FOR INSTRUCTOR'S USE ONLY)		
INSTRUCTIONS: THIS IS YOUR ADMISSION CARD TO THE LABORATORY CLASS IDENTIFIED AT THE TOP OF THIS CARD. YOU MUST ALSO HAVE AN ADMISSION CARD FOR THE LECTURE PART OF THIS CLASS WHICH WILL ALLOW YOU ADMISSION TO THE LECTURE SESSIONS. PLEASE FILL OUT THE BLANKS BELOW AS COMPLETELY AS POSSIBLE. SINCE YOUR LAB INSTRUCTOR WILL USE THIS CARD TO SUBMIT YOUR FINAL LAB. GRADE TO YOUR LECTURE INSTRUCTOR, THE GRADES FROM YOUR LAB. AND YOUR LECTURE SESSIONS WILL BE COMBINED TO DETERMINE YOUR FINAL COURSE GRADE.				CB	TO: LECTURE INSTRUCTOR		
				CC	COMMENTS:		
				CD			
				CW			
				CF			
				CP			
				CND			
				CND			
NAME LAST FIRST MIDDLE OR MAIDEN					LAB. INSTRUCTOR'S SIGNATURE		
CLASSIFICATION INSTRUCTOR LECTURE INSTRUCTOR							
LECTURE SESSION							
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80							

Figure 80. Laboratory Card

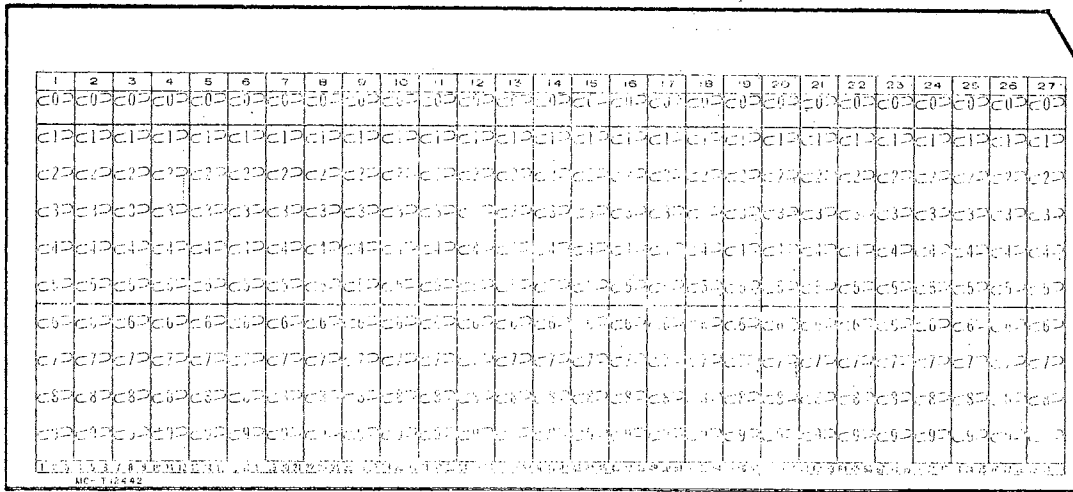


Figure 81. Mark Sense Card

STUDENT NAME															SEX CLASS MAR.			STUDENT NUMBER																																																													
MANKATO ADDRESS															HOME ADDRESS										DIV. REL.																																																						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
PRINT NAME FIRST MIDDLE LAST															MANKATO STATE COLLEGE																																																																
PRINT ADDRESS AT COLLEGE STREET TELEPHONE															RELIGIOUS CENSUS CARD																																																																
PRINT NAME OF PARENT OR GUARDIAN															SEX			MARITAL			CLASSIFICATION																																																										
PRINT ADDRESS OF PARENT OR GUARDIAN STREET CITY STATE															1. MALE 2. FEMALE			1. MARRIED 2. SINGLE			1. FRESHMAN 2. SOPHOMORE 3. JUNIOR 4. SENIOR 5. GRADUATE 6. POST-GRAD 7. SPECIAL																																																										
PRINT NAME OF HOME CLERGY															MANKATO CHURCH ATTENDING																																																																
CHECK DENOMINATION															SCHOOL OR DIVISION																																																																
1. ASSEMBLIES OF GOD 2. BAPTIST (AMERICAN) 3. BAPTIST (CONFERENCE) 4. BAPTIST (CONSERVATIVE) 5. BAPTIST (OTHER) 6. CHRISTIAN SCIENCE 7. CHURCH OF CHRIST 8. CHURCH OF GOD															9. DISCIPLES OF CHRIST 10. EASTERN ORTHODOX 11. EPISCOPAL (ANGLICAN) 12. EVANGELICAL COVENANT 13. EVANGELICAL L. BRETHREN 14. FOUR SQUARE GOSPEL 15. HINDU 16. JEHOVAH'S WITNESSES 17. JEWISH															18. LATTER DAY SAINTS (MORMON) 19. LUTHERAN (AMERICAN-ALC) 20. LUTHERAN (AMERICAN-LCA) 21. LUTHERAN (MISSOURI) 22. LUTHERAN (WISCONSIN) 23. LUTHERAN (OTHER) 24. METHODIST 25. MOSLEM															26. PRESBYTERIAN 27. ROMAN CATHOLIC 28. SALVATION ARMY 29. 7TH DAY ADVENTIST 30. UNITARIAN (UNIVERSALIST) 31. UNITED CHURCH OF CHRIST 32. UNDECIDED 33. OTHER (WRITE IN)																																		
															(PLEASE PRINT)																																																																
															MAJOR AREA																																																																
															(PLEASE PRINT)																																																																

MC-21 12672

COMPLETION OF THIS CARD IS VOLUNTARY - MINISTERIAL ASSOC. DISTRIBUTES THESE CARDS TO CAMPUS RELIGIOUS ORGANIZATIONS.

Figure 82. Religious Census Card

Summary

The administrative procedures of a college or university involve many offices and employees. An attempt has been made in this chapter to outline the basic administrative operations where electronic data processing equipment is most beneficial; namely, admissions, preregistration and registration procedures, post-registration procedures, and accounting applications. The recommended procedures were developed by reviewing the manual system at Langston University, Langston, Oklahoma, and reviewing data processing procedures used at Barrington College (Rhode Island), Hamline University (Minnesota), University of Illinois, Mankato State College (Minnesota), Miami University (Ohio), Oklahoma State University, University of Utah, and Wittenberg University (Ohio).

The administrative activities were divided into specific sections in an attempt to move away from the traditional specific office approach and establish a data processing system free from office boundaries. This provides a way to foster an integrated system which will help the college or university administration provide better guidance, coordination and support to its faculty and students.

There are many other applications which were not covered in this chapter that should be reviewed as soon as the need for these applications develop [see Chapter II; pp. 20 - 22]. However, the applications presented are the basic ones which should be developed first. After these applications are well developed and are functioning efficiently, the exploration of other areas may be started and developed. A basic rule should be followed, however; never try to expand too fast or beyond the capabilities of the equipment and staff.

Each administrative section was developed by analyzing the present manual system, developing a unit record system, and extending the unit record system to a computer oriented system. The unit record system recommendations were made after taking into consideration the type of equipment Langston University currently has on order. Since the present order does not include a computer, the cards, forms, and flow charts represent a unit record approach. The card illustrations in most of the figures include the card format and where the format information should be obtained.

The form illustrations are designed for 402 - 403 printing with the proper line and character spacing allowed before they were photographically reduced. However, careful planning at the time the forms are designed will result in few changes when a different printer is installed.

The cards, forms, flow charts and explanations should provide a complete unit record system for each section. The flow charts give a detailed description for each system, including the data flow through the Data Processing Center. In addition to this information, two alphabetic listings of recommended punch cards and data processing forms are summarized for the reader's benefit in appendices A and B, respectively. The appendices include a short summary on each card and form that is considered as a final record generated by the unit record system. All cards and forms used to obtain these final records are considered as intermediate records and for this reason are not summarized.

At the end of each section, a recommendation is made on converting the unit record system to a computer oriented approach. In all cases an approach has been recommended which provides an easy conversion

without totally changing the system. This allows a gradual retraining of the employees and staff without a major disruption of office and staff procedures. The employees will have time to absorb the changes and thus help in the establishment of the new system.

CHAPTER V

EDP IN ACADEMIC DEVELOPMENT AND CURRICULUM

Introduction

The rapid development of computing machines and related automata has brought about an increased growth in new areas of research and a need for considerable modification in the educational offerings of colleges and universities. This modification must provide an educational program which will develop the personnel needed in the data processing industry. For example, "in the software area alone, requirements for manpower in 1970 are estimated to be three times the 150,000 analysts, programmers and operating personnel in data processing today" (44). In addition to this huge demand, there are the increasing needs in the areas of sales, maintenance, research and development, design engineering and the many related areas.

The implications to higher education are even more apparent when the various curriculum areas are reviewed. A recent CUPM [Committee on the Undergraduate Program in Mathematics] study indicated that considerably more than a quarter of the students graduating with a major in mathematics are working in the computing field (38). Many other college graduates from engineering, business, and the sciences are also entering this new field. These are very remarkable figures when it is considered that few small colleges and universities offer course work in

this area; a fact which was emphasized in Chapter I by an official of one of the leading computer corporations.

One of the assistant commissioners in the United States Office of Education, Walter M. Arnold, recently stated; "nowhere has electronic equipment created changes more apparent than in the occupations associated with the handling of business information" (53). The routine tiresome work of obtaining, compiling and reporting information necessary for business operation is now readily adaptable to machine processing. The consequences of this adaptation imply considerable changes in the fields of accounting, business administration, statistics and other associated areas.

The need for curriculum changes in post-high school and higher education programs is reinforced by the industrial demands for qualified people. As more and more government agencies, universities, and industrial organizations order computing equipment, the shortage of trained people will become critical. Also, as the shortage of qualified personnel becomes critical, the non-qualified workers are fast becoming unemployed. A 1963 Senate Subcommittee on Employment and Manpower reported an estimated loss of 4000 jobs per week was due to automation (27). Buckingham (8), in a recent report, estimated that each electronic computer manufactured puts an average of 35 non-qualified workers out of work and changes the job descriptions of an additional 105 workers.

The consequences of these influences on higher education were outlined by Davis (19) in his article, "The Computer is Neutral." He suggested the following points:

1. It is obvious that more students will have to be trained to understand the ways in which the society is using computers, to appreciate their strengths and weaknesses, and to evaluate the appropriateness of delegating specific decisions to them.

2. The pace of change has completely upset our established notions about education. Learning has now become a life-long process.

3. Many universities tend to be highly compartmentalized. Yet outside the university, it is rapidly becoming apparent that nothing succeeds like cooperation between disciplines, that the world is too complicated and the problems too vast to be solved by isolating skilled people from one another.

4. The new developing society will provide the potential for increased leisure. This implies an educational responsibility to train people in art, music, drama, and other impractical subjects that will enable them to find a place in the larger society and to better understand themselves and the world they live in, and ensure that students possess the emotional resources, the habits and skills to find happiness and contentment.

The role small colleges and universities can play in developing educational programs which will help fulfill these new educational needs of the American Society are suggested in the following three sections: Academic Development, Curriculum, and Computerized Instruction.

Academic Development

The academic development of a college or university is defined for this report as the total academic preparation of the educational institution. The educational improvement and development of faculty and

staff and encouragement of research projects, are topics which are important in this academic development. The use of electronic data processing equipment by Langston University and other small colleges and universities can provide information, previously not available, which will help improve and develop the academic program of the institution.

The educational improvement and development of the faculty and staff should be one of the first considerations of a college administration. As Commissioner Flynt (22:7) pointed out in his review of the role of data processing in education; "the understanding, acceptance and cooperation from all people associated with the phenomena of data processing is a basic factor." There are very few academic areas and administrative offices which are not associated with data processing in some way. The use of data processing equipment in administrative offices has been explored in the previous chapter. The association of academic areas varies; from faculty or student research projects to training students in mathematics, business and science to meet modern-day employment requirements. Academic departments which offer a major in one of the changing fields are not providing an adequate education for their students if they fail to provide qualified faculty and up-to-date course offerings.

The amount of research carried on at a small college or university is generally limited due to the emphasis on teaching rather than research. However, the introduction of electronic data processing equipment to a campus provides the opportunity to process large amounts of data from research projects without interfering with the teaching program. Many individual and institutional research projects are

possible since the data processing equipment eliminates the time consuming tasks of data summarization. The completion of these research projects will help provide, in many cases, answers to administrative problems and also help faculty stay on the forefront of their academic fields.

Some of the institutional research projects which should be made are as follows (15):

1. Student dropouts
2. Faculty load studies
3. Space studies
4. Administrative and instructional costs
5. Enrollment projections and trends
6. Trends in courses taken
7. Advanced placement course quality
8. Complete class scheduling
9. Maintenance efficiency and effectiveness
10. College norms.

The results of these projects will allow colleges and universities to make plans which are developed from a greater number of available facts.

In an integrated system, like the one defined in Chapter IV, most of these facts or data are available for immediate processing from the information card files developed on each student and for each enrollment period. As these studies are made and data is collected from one year to the next, an institution has the beginnings of simulation projects in which more complex plans and patterns can be tested and results assessed without actually carrying out the plans and suffering

the trial and error method. This provides a way of making sure all planning activities are adapted to fit the objectives and policies of the institution.

Curriculum

The development of an educational program in small colleges and universities, which will help provide students with the required background for the data processing industry, is a difficult project. The shortage of qualified personnel to teach is a major problem which schools must contend with, as well as the rising salaries resulting from this shortage.

Keenan (35) reported in a recent article:

We must anticipate the day when an introductory computer science course will be as natural in science education as is a basic course in calculus or a foreign language, and as many as 100,000 college students will be annually enrolled in introductory computer science courses.

The Associate Commissioner for Research, Dr. R. Louis Bright, of the United States Department of Health, Education, and Welfare in comments before a meeting of the Association for Educational Data Systems stated the impact of the computer on the American Society has been "vastly underrated" (44). He urged that all high school and college students be given a course in the social implications of computers and what they can do and what they can not do. Dr. Bright further stated, "any person who graduates today from a four-year liberal arts college without being instructed in the use of computers has been severely cheated."

The two references mentioned above indicate there will be a continuing shortage of qualified personnel until higher education is able

to educate enough instructors to teach the required courses. Due to this shortage, smaller schools must identify and analyze the objectives they wish to obtain from a data processing system. The objectives may range from a simple introductory approach to a program which terminates with a degree in computer science. Harsh (30) suggested several philosophical positions in approaching data processing education. They are as follows:

1. The schools might be seen as construing as their main role the development of intellect. Data processing information, of necessity, then, would be directed mainly toward identifying those elements which are most useful in developing the intellect and identifying, retrieving, and presenting content--content that has been established as useful in developing the intellect.

2. Some schools have been defined as existing mainly to pass on the tested heritage from man's historical development. In such schools, data retrieval, data information, and teaching systems undoubtedly would be concerned primarily with accumulating from man's historical development those items perceived as most useful in the current social order.

3. The schools' role might be to assist individuals in adjusting to their present society. This is the philosophical position commonly referred to as social realism.

4. The schools might be intended to develop individuals with the ability to refine the social heritage critically and to improve society. This is frequently referred to as an educational philosophy reflecting experimentalism.

5. A fifth position would suggest that schools are to develop individuals for a new society based upon best solutions to present conditions and trends. This position has sometimes been referred to as reconstructionism.

6. Still another position is found with the schools that are currently giving high emphasis to self-creativity and the development of the individual. Some would say that this is a type of educational laissez-faire philosophy. In such a philosophy the content which becomes so important in humanism or social evolutionism is of little or no significance.

Once the objectives and philosophical view points have been determined and a workable plan outlined, a curriculum must be developed to augment the program. The development of a course of studies in the electronic data processing field is a project which many colleges and universities are presently attempting. The present status of the electronic data processing curricula development [or as it is now called, computer science curricula] in most colleges and universities can be described as in a transitional state. Many schools have realized the need for education in this area and are thus developing programs. A recent study on courses and curricula aimed at the education of computer users showed the main trends include (52):

Undergraduate:

1. The use of informal noncredit programming instruction followed by use of the computer for solving problems assigned in regular engineering courses.
2. The presentation of isolated credit courses in computer programming to students in a particular discipline such as civil engineer-

ing, electrical engineering, statistics, or business administration, by the particular department; usually in the junior or senior year.

3. The offering of a general introductory programming course to a wider audience by the mathematics department or computer center staff, followed by optional advanced courses in numerical methods and advanced programming (compiler languages, etc.).

4. The offering only of mixed graduate-undergraduate computer courses in computers that include some programming, and some logic and systems design.

5. The presentation of full curricula with a major in computer science, engineering mathematics, applied mathematics, or some such title.

Graduate:

1. Scattered courses in different departments, such as Numerical Analysis in Mathematics, Symbolic Logic either in Mathematics or Philosophy, EDP Methods in Business Administration, Switching Theory, Digital Computer Logic Design, and Analog Computation in Electrical Engineering, with no special degree programs in computing offered.

2. Full graduate majors leading to Master's or Doctoral degrees in Computer and Information Sciences, or Communications Science, or some such title, with a choice of subspecialties within the field. Such programs are usually supervised by some established department, or by an interdepartmental committee.

3. Specialized graduate degree programs aimed at a relatively narrow segment of the field, such as Information Storage and Retrieval.

These trends are starting to remove some misconceptions of the purpose of computer science. As a distinctive subject it involves more

than design of computers and learning how to program their operation.

The area of computer science was defined in a recent report as (2:544):

concerned with information in much the same sense that physics is concerned with energy; it is devoted to the representation, storage, manipulation and presentation of information in an environment permitting automatic information systems. As physics uses energy transforming devices, computer science uses information transforming devices. Some forms of information have been more thoroughly studied and are better understood than others; nevertheless, all forms of information, numeric, alphabetic, pictorial, verbal, tactile, olfactory, results of experimental measurement, etc. are of interest in computer science.

This definition of computer science points out the many specialized areas which do not fit adequately into any other academic subject. Certainly, computer science is a distinct discipline which needs to be organized into a rational academic curriculum.

The curriculum should be flexible enough to allow students from the various academic areas to follow one of several programs. Among these programs, there should be an opportunity to:

1. Complete an undergraduate and/or graduate major in computer science. From this area the future computer science specialists and scientists will be developed.
2. Obtain training and educational background for students who wish to work in the applied area of computers.
3. Supplement the educational background of students majoring in other academic fields.
4. Obtain a general education background about computers for all students.

These purposes can be attained by offering computer science courses which cover the specialized areas of computer science and developing or modifying courses in the various academic fields. The

leading computer association, the Association For Computing Machinery [better known as ACM] formed a committee approximately three years ago to suggest a program of study which would satisfy these purposes. This committee received recommendations from a large number of computer scientists in developing a curriculum which was intended to be flexible enough that students receiving the baccalaureate could follow one of several paths. These paths are suggested as follows (2):

1. Undertake graduate work in computer science. It is hoped that many of the best students will follow this path since the future leadership of the computer science community depends on it.

2. Contribute to the rapidly growing profession of systems programming.

3. Work on applications programming. It is felt that an undergraduate program would provide a stronger background in numerical analysis, logic, statistics, and formal languages than that available to many of those now engaged in applications programming.

4. Undertake graduate work in a field other than computer science. It is expected that students following this path would help introduce the methodology and discipline of computer science into other fields.

The program suggested by this committee is outlined in Table V (2:546).

The courses which are numbered in Table V are listed below with the catalogue descriptions and prerequisites. The first number in the description gives the number of lectures, the second the number of laboratory hours, and the third the number of hours of credit.

1. Introduction to Algorithmic Processes (2-2-3). Prerequisite: Concurrent registration in Beginning Analysis. Concept and Properties

TABLE V

PRELIMINARY RECOMMENDATIONS OF THE CURRICULUM COMMITTEE OF ACM
FOR MAJORS IN COMPUTER SCIENCE

Courses Recommendations	Computer Science				Supporting
	Basic Courses	Theory Courses	Numerical Algorithms	Computer Models & Application	
Required	1. Introduction to Algorithmic Processes	5. Algorithmic Languages and Compilers	3. Numerical Calculus (or Course 7)		Beginning Analysis (12 cr.) Linear Algebra (3)
	2. Computer Organization and Programming				
	4. Information Structures				
Highly Recommended Electives	6. Logic Design and Switching Theory		7. Numerical Analysis I		Algebraic Structures
	9. Computer and Programming Systems		8. Numerical Analysis II		Statistical Methods Differential Equations Advanced Calculus Physics (6cr.)
Other Electives	10. Combinatorics and Graph Theory	13. Constructive Logic		11. Systems Simulations	Analog Computers Electronics
		14. Introduction to Automata Theory		12. Mathematical Optimization Techniques	Probability and Statistics Theory
		15. Formal Languages		16. Heuristic Programming	Linguistics Logic Philosophy and Philosophy of Science

of an algorithm, language and notation for describing algorithms, analysis of computational problems and development of algorithms for their solution, application of a specific procedure-oriented language to solve simple numerical problems using a computer.

2. Computer Organization and Programming (2-2-3). Prerequisite: Course 1 above. Logical basis of computer structure, machine representation of numbers and characters, flow of control, instruction codes, arithmetic and logical operations, indexing and indirect addressing, input-output, subroutines, linkages, macros, interpretive, and assembly systems, pushdown stacks, and recent advances in computer organization.

3. Numerical Calculus (2-2-3). Prerequisites: Course 1 above and Beginning Analysis 3. An introduction to numerical methods. Includes elementary discussion of errors, polynomial interpolation, quadrature, linear systems of equations, solution of nonlinear equations and numerical solution of ordinary differential equations.

4. Information Structures (2-2-3). Prerequisite: Course 2. Study of information representations and relationships between the form of representation and processing techniques. Transformations between storage media. Referencing of information as related to the structure of its representation and implications for the design of the referencing language.

5. Algorithmic Languages and Compilers (3-0-3). Prerequisites: Course 2 above and possibly Course 4. Formal description of algorithmic languages, e.g., Algol, and the techniques used in their compilation. Study of syntax, semantics, ambiguities, procedures, replication, iteration and recursion in these languages. Syntactic decomposition and the theory of compilers which are syntax directed or recursively controlled.

6. Logic Design and Switching Theory (3-0-3) or (2-2-3). Prerequisites: Courses 1, 2. Symbolic logic and Boolean algebra for description and analysis of switching circuits; simplification of switching circuits; error detecting and correcting codes; storage elements defined logically; basic sequential circuits; digital systems design principles.

7. Numerical Analysis I (3-0-3). Prerequisites: Course 1 above and Advanced Calculus. A thorough treatment of solutions of equations, interpolation and approximations, numerical differentiation and integration, numerical solution of initial value problems in the solutions of ordinary differential equations. Selected algorithms will be programmed for solution on computers.

8. Numerical Analysis II (3-0-3). Prerequisites: Course 1 above, Advanced Calculus and Linear Algebra. The solution of linear systems by direct and iterative methods, matrix inversion, the evaluation of determinants, eigenvalues and eigenvectors of matrices. Applications to boundary value problems in ordinary differential equations. Selected algorithms will be programmed for solution on computers. NOTE: While other arrangements of the material in Courses 7 and 8 are possible, the arrangements suggested here allow the two courses to be taught independently. It may also be considered desirable to require Numerical Calculus as a prerequisite for these courses.

9. Computer and Programming Systems (3-0-3). Prerequisite: Course 4. Input-output and storage systems, structures and transformations of data bases, assembly and executive systems.

10. Combinatorics and Graph Theory (3-0-3). Prerequisites: Course 1 and Beginning Analysis. An introduction to set theory, graph

theory, and combinatorial analysis. Includes such topics as set algebra, recurrence relations and Polya's Theorem.

11. Systems Simulations (2-2-3). Prerequisites: Course 1, possibly Course 4, and Probability and Statistics. Computer simulation utilizing logical, numerical and Monte Carlo modeling to represent systems. The description of the status of systems by the use of sets of entities and the modification of this status by events. The generation, termination, and flow of entities possessing prescribed attributes through storage and processing facilities. Balancing systems, sharing facilities, and using priorities to modify performance. Collection and evaluation of statistics on passage times, flow volumes, queue lengths, manpower and equipment utilization. Use of special simulation languages to simulate actual systems.

12. Mathematical Optimization Techniques (3-0-3). Prerequisite: Course 8. Extremal properties of multivariate functions with and without constraints, convex sets and convex functions, linear programming, dynamic programming.

13. Constructive Logic (3-0-3). Prerequisites: Course 1 and Beginning Analysis. An introduction to logic and Boolean algebra. Set algebra, product sets, relations and functions, propositional calculus, algorithms and quantification theory.

14. Introduction to Automata Theory (3-0-3). Prerequisites: Course 13, and Algebraic Structures. A discussion of various types of automata, such as finite, probabilistic, growing, and reproducing automata. Representation of automata by regular expressions, state graphs, logical nets, recursive functions, and Turing machines.

15. Formal Languages (3-0-3). Prerequisites: Course 5 and possibly 13. This course is a study of certain languages and grammars which can be specified in precise mathematical terms. These formal languages are closely related to computer languages and can serve as primitive models of natural languages. Various types of formal languages are defined and their properties derived. The ideas have been applied in computer programs for syntactic analysis and machine compilation.

16. Heuristic Programming (3-0-3). Prerequisites: Courses 4 and 11. Distinction between heuristic and algorithmic methods. Polya's and Hadamard's role in mathematical intuition. Justification of the need for heuristic approach. The objectives of work in Artificial Intelligence and in Simulation of Cognitive Behavior. Discussion of research projects using heuristic programming techniques. Brief description and related research areas, such as Self-Organizing Systems, Neural Cybernetics, Automata Theory, Machine Translation of Languages, Information Retrieval, Automatic Medical Diagnosis, Machine Composition of Music, Automatic Engineering Design, etc.

This curriculum provides a strong computer science program for colleges and universities which have the faculty resources to provide the necessary instruction. Since many smaller colleges and universities do not have the staff or facilities for this type of program, another approach is recommended by the author. This approach includes two possible programs; (1) a two-year terminal program for data processing positions which do not generally require a college degree, and (2) an applied mathematics major on a four-year degree program.

The two-year terminal program is designed to prepare programmers, applications analysts and for other data processing positions which do not generally require a college degree. This program may be developed with a business or science concentration; it is outlined in Table VI with a business concentration. The course recommendations were made for the program after reviewing the course offerings for four operational programs [see Table VII], Langston University's program and analyzing the recommendations of the United States Office of Education which were published in 1963 (53).

The courses recommended by the author in Table VI, for the two-year terminal program, are listed below with the catalogue descriptions and prerequisites. The first number in the description gives the number of lectures, the second the number of laboratory hours, and the third the number of hours of credit.

1. American Government (3-0-3). Prerequisite: None. Standard American Government Course.
2. Business Organization and Management (3-0-3). Prerequisite: Course 5. A course to familiarize the student with the concepts and structure of American Business, including functions, financing, internal structure, and methods of control.
3. Computer Programming I (2-2-3). Prerequisite: Course 13 or consent. Programming a computer with an algorithmic-oriented language, with emphasis on the machine, its components and logical function. Introduction to algorithmic processes and problem flow charting.
4. Computer Programming II (2-2-3). Prerequisite: Course 3. A continuation of computer programming I with emphasis placed on tape and disk random access storage capabilities, input-output, subroutines,

TABLE VI

TWO-YEAR TERMINAL DEGREE IN DATA PROCESSING
(BUSINESS CONCENTRATION)

Courses	Schools				USOE	Langston	Recom.	Pro.
	A	B	C	D		Sum- mary	Pro- gram	Course Credit Number
Acc't Machine Wiring		x			x	2	x	
Admin. Systems & Manag.	x		x			2		
American Government	x	x				2		3 1
American History			x			1		
Business Math				x		1		
Business Organ. & Manag.			x	x	x	3	x	3 2
Computer Concepts		x				1		
Computer Math				x		1		
Computer Programming I	x	x	x	x	x	5	x	3 3
Computer Programming II	x			x	x	3	x	3 4
Cost Accounting	x	x			x	3	x	3 5
Data Processing Appl.		x	x	x	x	4	x	2 6
Data Processing Math I			x	x	x	3		3 7
Data Processing Math II					x	1		3 8
Data Processing Practice		x	x			2		
Economics	x					1	x	
Elective (General)	x	x	xxx			3		
Elective (Science)			x			1		
Elective (Soc. Sci., Lit- erature or Philosophy)	x	x			x	3		3 9
Electromechanical Equip.	x		x			2		
English Comp. or Writ. I	x	x	x	x	x	5	x	3 10
English Comp. or Writ. II			x	x	x	3	x	3 11
Field Project			x	x	x	3	x	
Fine Arts Elective	x	x				2		3 12
Gen. Math or Algebra	x	x	x			3	xx	
Health	x	x				2		2 13
Introduction to College	x	x				2		
Intro. to Data Process.	x	x	x	x	x	5	x	2 14
Intro. to Wiring I		x	x	x		3		3 15
Intro. to Wiring II				x		1		
Payroll Accounting	x	x				2		
Physical Education	4 cr.	4 cr.	1 cr.	4 cr.		4		4 16
Principles of Acc't I	x	x	x	x	x	5	x	3 17
Principles of Acc't II	x	x	x	x	x	5	x	3 18
Programming Systems I			x	x	x	3	x	3 19
Programming Systems II					x	1	x	3 20
Physics	x					1		
Speech	x	x				2		2 21
Statistics	x		x	x	x	4	x	3 22
Systems Design & Pract.		x	x	x	x	4	x	3 23
Tech. Writing				x		1		
Total Credits:	64	66	64	64	63		65	66

and macro-programming.

5. Cost Accounting (3-0-3). Prerequisite: Course 17. Cost concepts, cost accounting cycle. Elements of manufacturing cost: materials, labor and overhead. Job-order cost and process cost.

6. Data Processing Applications (1-2-2). Prerequisite: To be taken concurrently with Course 2. Practical case studies are used to illustrate the use of data processing equipment in various types and sizes of representative companies.

7. Data Processing Mathematics I (3-0-3). Prerequisite: Two years of high school algebra. Numerical concepts for the study of accounting and machine processes are covered. Topics considered include concepts of notation, algebra, number systems, basis, fixed and floating point numbers, precision and significance, and linear equations.

8. Data Processing Mathematics II (3-0-3). Prerequisite: Course 7. A continuation of data processing mathematics I with additional concepts considered in the area of the iterative process, solution of simultaneous linear equations, logic, Boolean algebra, numerical solutions to physical problems, and the study of errors involved with numerical solutions.

9. Elective (Social Science, Literature or Philosophy) (3-0-3). Prerequisite: None. Standard general education course in one of these areas.

10. English Composition I (3-0-3). Prerequisite: None. Standard composition course.

11. English Composition II (3-0-3). Prerequisite: Course 10. Standard composition course with some emphasis given to business writing.

12. Fine Arts Elective (3-0-3) or (2-2-3). Prerequisite: None. The student may choose an elective course from the art, music, or humanities areas.
13. Personal Health (2-0-2) Prerequisite: None. Development of knowledge, attitudes, and habits necessary for healthful living.
14. Introduction to Data Processing (2-0-2). Prerequisite: None. The influence of electronic data processing on our way of life. How man communicates with a machine and the work a machine can do for man. Computers in business, industry, and education.
15. Introduction to Wiring (2-2-3). Prerequisite: None. A thorough study of card layout, flow charting, and machine wiring of unit-record equipment for business applications.
16. Physical Education (0-2-1). Prerequisite: None. It is recommended that students take one physical education course each semester to keep their bodies in good physical condition.
17. Principles of Accounting I (3-0-3). Prerequisite: None. Standard accounting course.
18. Principles of Accounting II (3-0-3). Prerequisite: Course 17. A continuation of course 17 with emphasis placed on the concept of performing accounting services on data processing machines.
19. Programming Systems I (2-2-3). Prerequisite: To be taken concurrently with Course 4. Introduction to programming systems to familiarize the student with the purpose and functions of the various types of systems. The course consists of concepts covering assembly programs and compilers, macro generators, report generators, utility programs, data scheduling systems, sort-merge, monitors, and high-level languages.

20. Programming Systems II (2-2-3). Prerequisite: Course 19.

A continuation of course 19 with additional emphasis placed on higher level language processors, monitor and supervisory systems, simulation, and tele-processing.

21. Fundamentals of Speech (2-0-2). Prerequisite: None. Learning how to speak before groups.

22. Elementary Statistics (2-2-3). Prerequisite: Course 8.

An introduction to the theory of statistics and its applications in business today. Methods of organizing and presenting data for processing on data processing machines will be emphasized.

23. Systems Design and Practice (2-2-3). Prerequisite: To be taken concurrently with Course 20. Analysis of information flow, system specifications and equipment selections, and implementation of the system in a business will be emphasized.

This program was developed with the small college or university in mind, as well as, the general education of the enrolling students. The general education section of the program consists of 23 semester hours or approximately one-third of the program. The major emphasis of the program is not impaired by this requirement since it still consists of over 40 semester hours which is a strong major.

The recommended program varies from the Langston University program in nine places. The recommended program includes additional course work in physical education and health, speech, fine arts elective, American government, and social science, literature, or philosophy elective. It does not include course work in economics and science elective. The only other difference in the two programs is the introduction of two data processing mathematics courses in place of the

Langston University mathematics requirement and the introduction to wiring I course instead of a field project course.

It is beneficial to add the additional general education courses; and thus, provide the students with a fully rounded program of study which will tend to satisfy the fourth need of the new developing society, outlined by Davis [see page 177]. The economics and science elective courses may be used in the general education course listing to provide flexibility for student choice. The addition of the two data processing mathematics courses could provide some difficulty since they do not fit the course descriptions of standard mathematics courses. The course content of data processing mathematics I and II includes sections on algebra, real numbers, logic, Boolean algebra, numerical methods and error analysis, all of which encompass topics from several standard mathematics courses. The additional topics of fixed and floating point numbers and the iterative process are not normally covered in the standard mathematics courses. Since these are the concepts needed by people working in the data processing areas, it is desirable to develop the two courses as new courses with the course content cutting across the several mathematical areas. Hence, it is recommended that the additional general education courses be added to the Langston program and the mathematics requirement be changed.

The change of the mathematics requirement entails developing the two new mathematics courses. Possible texts for these courses could be chosen from the following list:

1. Courant: What is Mathematics?
2. Crowder: The Arithmetic of Computers
3. Hohn: Applied Boolean Algebra

4. Moore: Fundamental Principles of Mathematics
5. Richardson: Fundamentals of Mathematics
6. Titchmarsh: Mathematics for the General Reader
7. Wade and Taylor: Fundamental Mathematics

TABLE VII

FOUR COLLEGES HAVING TWO-YEAR TERMINAL
DATA PROCESSING PROGRAMS

College	Type of College	Enrollment	Degree
Foothill College (California)	2-year	11,000	AA
Otero College (Colorado)	2-year	548	AA
Southeast Mo. (Missouri)	4-year	5,200	AA
Trinidad College (Colorado)	2-year	1,200	AA

The importance of the two-year terminal program, defined above, can best be determined by considering the number of people working in data processing jobs. These jobs range from keypunch operators and systems analysis to programming and machine operations which are conservatively estimated at ten positions for each system. A survey of data processing salaries in June, 1965, by the "Business Automation" magazine (3) gives a representative sample of the salaries being paid in the data processing area (Table VIII).

The four-year degree program in applied mathematics is a program to educate students majoring in mathematics and expecting to work or to study further in the computer science area. This program is a natural for those schools which do not have the faculty or facilities for a baccalaureate degree program in computer science, as outlined by the ACM curriculum committee.

TABLE VIII
SALARIES PAID FOR DATA PROCESSING POSITIONS

Job Title	Actual Weekly Salaries		
	Low	Average	High
Manager of Data Processing	105	280	600
Asst. Manager of Data Processing	98	234	400
Tech. Assistant to Manager	96	207	370
Coordinator of Data Processing	88	190	290
Work Processing Scheduler	80	142	230
Manager of Systems Analysis	116	232	418
Lead Systems Analyst	107	216	346
Senior Systems Analyst	105	193	322
System Analyst A	95	168	281
System Analyst B	90	152	226
System Analyst C	86	136	192
Manager of Programming	109	204	351
Lead Programmer	92	185	323
Senior Programmer	81	161	292
Programmer A	72	140	240
Programmer B	65	124	219
Programmer C	63	110	187
Manager of Computer Operations	82	184	316
Lead Computer Operator	80	139	276
Senior Computer Operator	75	128	217
Computer Operator A	66	106	174
Computer Operator B	60	96	160
Computer Operator C	57	88	147
Supervisor Auxiliary Equipment	78	131	226
High Speed Printer Operator	64	108	165
Magnetic Tape Librarian	61	101	158
Coder	50	93	128
Data Examination Clerk	52	95	152
Machine Accounting Manager	101	225	349
Assistant Machine Accounting Manager	85	168	270
Tech. Assistant to Machine Accounting Manager	84	162	225
Tabulating Supervisor	82	146	281
Tabulating Machine Operator, Group Leader	75	121	207
Tabulating Machine Operator A	65	102	170
Tabulating Machine Operator B	56	94	160
Key Punch Supervisor	67	123	214
Key Punch Operator, Group Leader	60	95	156
Key Punch Operator A	56	84	143
Key Punch Operator B	50	82	128
Tabulating Record Control Supervisor	77	132	210
Tabulating Record Control, Leader	64	106	174
Tabulating Record Control A	53	97	144
Tabulating Record Control B	51	92	127
Coder	48	85	129
Teletype Operator	53	88	131
Data Converting Operator	57	77	136

Computer science is closely associated with mathematics; an example, numerical analysis is a branch of mathematics which developed rapidly after computers were developed. Also, many of the problems arising from computers are intimately associated with questions in combinatorial mathematics, abstract algebra, logic, etc. Fundamentally, the inherent structure of a computer requires the associated disciplines to strive for the type of generality, abstraction, and logical detail that is characteristic of mathematical arguments. Thus, the development of an applied mathematics degree program will provide interested students with a background which will allow them to enter the computer science field at graduation. In addition most colleges and universities will be able to establish this program within their existing curriculum by the addition and revision of a small number of courses.

The recommended program is outlined in Table IX. This recommendation was made after reviewing the course requirements in computer science programs of 17 colleges and universities, the recommendations received from 15 colleges and universities on the "Seventy College Survey" [schools are listed in Table X], and analyzing the recommendations of CUPM for "An Undergraduate Mathematics Program for Work in Computing" (38) and the ACM Computer Science Curriculum Recommendations.

The courses recommended by the author in Table IX, for the four-year degree program in applied mathematics, are listed below with the catalogue descriptions and prerequisites. The first number in the description gives the number of lectures, the second the number of laboratory hours, and the third the number of hours of credit.

TABLE IX
FOUR-YEAR BACCALAUREATE DEGREE PROGRAM IN APPLIED MATHEMATICS

Course Listings	Number of Colleges and Universities Offering Courses		Recommended Credits		Summary	Recommended Program		
	Seventeen Inst. Study	Fifteen Inst. Study	CUFK	ACM		Credits	Course Number	Langston Univ.***
Accounting		1			1			
Admin. Systems & Procedures	3	1			4			
Adv. Applied Mathematics		1			1			
Advanced Calculus		1	6	6	3*	6**	1	revise
Advanced programming	2	6	3	3	10	3**	2	New
Adv. Reading & Research	4				4			
Algebraic Structure			3	3	2			
Analog Computation	4	1		3	6	3	3	New
Artificial Intelligence	4				4			
Automatic programming	3				3			
Beginning Analysis			9	9	2*	9		required
Intermediate Analysis			3	3	2*	9(3**)	4	Present
Boolean Algebra		3			3			
Combinatorics			3	3	2	3	5	New
Computer Methods & Lab.	17	7			24	3**	6	New
Computer programming	17	14		3	32	3**	7	New
Computer Science Seminar	7				7			
Cybernetics	2				2			
Electronics				3	1			
Heuristics	2			3	3			
Intro. to Algorithmic Proc.	8			3	9			
Intro. to Computer Science	17	4	3		22	2**	8	New
Intro. to Information Struct. or Processing	5	1	3	3	8	3	9	New
linear Algebra		1	3	3	3*	3**	10	Present
Linear programming		2		3	3			
linguistics				3	1			
Logic	9	2	3	3	13	3**	11	revise
Logic Design & Switch.Theory				3	1			
Machine Language Programming	3	3			6			
Math. Theory of Computers	2	2			4			
Numerical Analysis I	17	10	3	3	29	3**	12	New
Numerical Analysis II	13	9	3	3	24	3	13	New
Numerical Calculus	3			3	4			
Numerical linear Algebra	4				4			
Num. Solution Diff. Equations	6			3	7			
Philosophy				3	1			
Physics				6	1			
Probability & Statistics		5	3	6	7*	3**	14	Present
Programming Systems	14	6		3	21	3	15	New
Real time - Process Control	4				4			
Simulation Processes	6	1	3	3	9	3	16	New
Structure of Digital Computers	13	5	3	3	20	3	17	New
Theory of Automata	3	1	3	3	6	3	18	New

*These courses are normally offered in the standard mathematics curriculum and thus were not listed by the colleges and universities as special requirements.

**These courses are required (totaling 32 cr. above elementary calculus) with an additional two courses recommended as electives to be chosen from remainder of the listing.

***A review of Langston University's curriculum, indicating which courses are new, present, or need revising.

1. Advanced Calculus (3-0-3). Prerequisite: Elementary Calculus. Recommend an applied approach with emphasis on applications rather than the normal introduction to real variable theory.
2. Advanced Programming (2-2-3). Prerequisite: Course 7. A study of the structure of languages, the theory of compilers, and monitor and executive systems.
3. Analog Computation (2-2-3). Prerequisites: Course 4 and 7. Programming and scaling of analog computers for the solution of differential equations. A study of the methods and techniques of solving simultaneous linear and non-linear differential equations.
4. Intermediate Analysis (3-0-3). Prerequisite: Elementary Calculus. The recommended requirement would include differential equations and an introduction to numerical techniques, with the second and third courses covering complex variables and vector analysis, respectively.
5. Combinatorics (3-0-3). Prerequisite: Elementary Calculus. A study of combinatorics in a way which exemplifies the use of groups and algebraic structures, permutations and combinations, generating functions and cycles of permutations.
6. Computer Methods (2-2-3). Prerequisite: Course 2. Special timely topics such as input/output and storage control systems, program supervision and intercommunication, multiprocessor control, interrupt and program protection, multi-computer communications, multi-access and time-share operations and other topics which will provide the advanced student with the capability of formulating problems.
7. Computer Programming (2-2-3). Prerequisite: College Algebra. Programming a computer with an algorithmic-oriented language (Fortran).

Introduction to algorithmic processes and problem flow charting.

8. Introduction to Computer Science (2-0-2). Prerequisite:

None. The Influence of computers on our way of life. How man communicates with a machine and the work a machine can do for man. Computers in business, industry, and education.

9. Introduction to Information Structures (2-2-3). Prerequisite:

Course 2. Description of a data base and its structure; the basic concepts of functions, arrays, records, files, lists, linkages and transformation vectors and matrices, serial and parallel files and hierarchies of storage. Sorting and searching of information from files; referencing and processing techniques based on structure list processing, content addressing, and cross referencing of files.

10. Linear Algebra (3-0-3). Prerequisite: College Algebra.

Standard linear algebra course which develops the algebra and geometry of finite-dimensional linear vector spaces, the algebra of matrices and the theory of eigenvalues and eigenvectors.

11. Constructive Logic (3-0-3). Prerequisite: College Algebra.

An introduction to logic and Boolean algebra. Set algebra, product sets, relations and functions, propositional calculus, algorithms and quantification theory.

12-13. Numerical Analysis (2-2-3). Prerequisites: Courses 1 and

10. Standard numerical analysis sequence, using the computer as an operational tool in solving problems; such as, the digital solutions of differential equations, the study of eigenvalue and transform methods, quadrature techniques for numerical integration, Runge-Kutta and predictor-corrector methods in digital computer solutions.

14. Probability and Statistics (3-0-3). Prerequisite: College Algebra. General mathematical introduction to probability and statistics.

15. Programming Systems (2-2-3). Prerequisite: Course 2. Input-output and storage systems, structures and transformations of data bases, assembly and executive systems.

16. Simulation Processes (2-2-3). Prerequisites: Courses 14 and 15. Study of programming languages designed for simulation use, technical problems of simulation, statistical problems and applications.

17. Structure of Digital Computers (2-2-3). Prerequisite: Course 2. An introduction to the concepts involved in the logical design of computers and computer systems.

18. Theory of Automata (3-0-3). Prerequisites: Courses 5 and 11. Definition of the notion of finite automata, what finite automation can do, sequential machines, algebraic description, and theory of computability.

The program represents a strong major area in mathematics and computer science education with many of the recommended courses corresponding to those suggested in colleges and universities having computer science programs. Also, the program includes several courses recommended by the computer science curriculum committee of ACM and the CUPM curriculum committee. Since these three groups represent the foremost thoughts and ideas of the computer science and mathematics fields, the recommended program gathers its strength from all three groups. The emphasis is placed on core courses required courses which were recommended by two or more of the expert groups.

TABLE X

COLLEGES AND UNIVERSITIES WHICH WERE REVIEWED FOR
COMPUTER SCIENCE REQUIREMENTS

School	17 Schools	15 Schools	Approximate Enrollment	Dr. in Comp. Sci. Area
U. of Arkansas	X		9,672	M.S.
Auburn University		X	12,000	
Brigham Young Univ.	X		17,631	A.A.
Brown University	X		4,530	B.S.
U. of Colorado	X		21,934	
U. of Connecticut		X	13,000	M.S.
Eastern New Mexico		X	4,350	B.A.
Georgetown University		X	8,000	
State College of Iowa		X	6,450	
Kansas State Teachers University of Maine		X	6,500	B.A., M.A.
Mankato State College	X		5,500	
U. of Maryland	X		10,300	
U. of Massachusetts		X	25,880	M.A.
U. of Michigan	X		10,000	B.A., M.A., Ph.D.
U. of Minnesota		X	30,000	Ph.D.
U. of Missouri (Rolla)	X		53,794	B.A., M.A.
U. of Missouri	X		4,460	B.A.
Oklahoma State Univ.	X		27,730	
U. of Nevada		X	17,000	
U. of North Carolina	X		4,200	M.S., Ph.D.
North Dakota State U.		X	12,250	
Purdue University	X		5,000	B.S., M.A., Ph.D.
Riverside City College		X	20,000	A.A.
St. Louis University		X	7,500	
Stanford University	X		11,000	B.S., M.S., Ph.D.
Texas A & M Univ.	X		10,735	M.S.
U. of Texas	X		9,510	M.S., Ph.D.
U. S. Naval Academy		X	26,853	
Washington State U.	X		4,046	M.S.
West Virginia U.		X	9,498	
U. of Wisconsin	X		11,500	B.A., M.S., Ph.D.
			42,381	

The development of this program at Langston University requires the addition of several courses to the curriculum and the revision of four others. The new courses which should be introduced immediately are as follows: (1) Advanced Programming, (2) Computer Methods, (3) Computer Programming, (4) Introduction to Computer Science, (5) Numerical Analysis, and (6) Programming Systems. The other new courses

listed in Table IX should be introduced into the curriculum as soon as demand warrants and instructors are available.

The courses which need revision are the four semester courses in analytical geometry, differential and integral calculus, differential equations, and logic. The revision of these courses will provide three of the courses in the recommended program and also strengthen the departmental offerings in mathematics. A possible revision would include the analytical geometry and elementary calculus in two semesters, an intermediate analysis course the third semester, and an applied advanced calculus sequence the fourth and fifth semesters, satisfying the intermediate analysis and the advanced calculus requirements. The intermediate analysis course would consist of differential equations and an introduction to numerical techniques. The present logic course could be revised to include the topics of binary arithmetic, Boolean algebra, numeral systems, and logic functions as they apply to the understanding of digital computers.

The recommended course revisions and additions will provide Langston University with a strong program for those students who desire to enter the computer science field. The program consists of enough computer science course work to allow a student to go on to graduate school in mathematics or computer science, or go directly into a computer science position.

The two programs outlined in this section represent approaches to solving the problem; shortages of qualified personnel in data processing. The computer science curriculum outlined by the ACM curriculum committee is a very strong program; however as pointed out previously, it requires more faculty and equipment than normally found on a small

college or university campus. Therefore, it is the author's recommendation that one or both of the recommended programs represent a more realistic approach for smaller schools. The number of new courses required is less, especially if the following courses are designed and used in both programs [DP defines those courses recommended in the two-year program and Com Sci defines the courses recommended on the four-year program]:

1. DP 3, 4 and Com Sci 2, 7
2. DP 23 and Com Sci 6
3. DP 14 and Com Sci 8
4. DP 19,20 and Com Sci 15, 16

In addition the recommended programs may be developed with only unit record equipment on campus and a working agreement with another computer installation to process computer programs. Langston University has an excellent opportunity to make this type of arrangement with Oklahoma State University which is only 24 miles away and has an IBM 7040 computer system.

The recommended programs not only represent a realistic approach for smaller schools, but also provide course work which can be used to supplement other academic areas and provide a general education background about computers for all students. Hence, the programs satisfy three of the four purposes of a computer science curriculum [see page 185].

Computerized Instruction

One of the newest developments in the computer science field is the idea of an automated classroom. This possibility was suggested by

Bushnell [see page 31] in his 1963 studies. During the past year International Business Machines announced the new IBM 1500 communications system which made this suggestion a reality. The computer-assisted instruction is obtained by placing a programmed set of instructions in computer storage at a central processing center and connecting the 1500 terminal stations to the central unit. The terminal stations consist of a typewriter, random access slide projector, visual character display and a random access tape recorder. Information is displayed on a screen, the typewriter, or played on the tape recorder upon direction from the computer. The student then responds by typing his answer.

The system has the advantage of allowing each student to proceed at his own pace, and to receive assistance and study at times when his instructor is not available. Through the visual display systems, students are able to understand the results of experiments or calculations better by actually seeing the data transformed into pictorial representations. In this way the system provides expert help for both ends of the ability scale. Special materials can be available for the very advanced or the particularly slow. These materials can be developed by experts in the particular fields and thus provide a program of instruction which would not be possible if the instructors had to be present.

An important development of the program is the individualized education which reaches some of the students who are now at the low end of the scale but do have the intellectual potential to succeed. The classroom teacher is released from routine chores and thus can provide additional guidance and individualized student attention. Hence, such an approach fundamentally changes the entire teaching process.

A vision of this new potential educational technology was reviewed in a recent article by Oettinger (41). He foresaw the student as having access to library information and instruction via the above system. He stated, the

key idea is that, by pushing buttons or otherwise signaling from a suitable terminal, a student has access to:

1. The catalogs of great libraries, hence access to their collections.
2. The catalogs of new video tape or film libraries, hence access to the collections which include recorded lessons on specialized topics (possibly in the manner of an illustrated encyclopedia) and also source materials such as records of significant contemporary events, of outstanding dramatic productions, of clinical recordings (perhaps of a difficult operation particularly well performed in a leading hospital) and so on.
3. Teaching programs of the kind already in widespread experimental use.
4. Tools to aid symbol manipulation and concept formation such as numerical and algebraic manipulators, dictionaries, thesauri, editing programs, etc. (41:487-488).

Dr. Harold Mitzel, Assistant Dean of Research in the College of Education, Pennsylvania State University, recently reported their experiments in computer-assisted instruction have shown "most students are enthusiastic about their experience" with the system (12:8). The experiments involve three courses where some students took part of their course by computer. He further stated there was no indication these students fell behind or went ahead of their classmates who were receiving most of the material by conventional lecture.

The University of Oklahoma Medical School (54) recently announced the computerized instruction of a graduate level course, Medical Backgrounds; a survey course in medical terms and procedure. They claim to be the first graduate school in the nation to use this approach. Dr. Edward Brandt, Jr., Director of the University's Medical Center Computer Facility, and Mr. William Harless, Manager of Educational

Applications at the Center, report satisfaction with this first attempt and are enthusiastic over future extension.

This type of research and experimentation is being carried out at other colleges and universities across the nation. Eventually, it may be possible to establish terminal stations in smaller colleges and universities with the central processing units located in larger university computer centers. This will not only provide the smaller schools with computer services which they may not be able to afford otherwise, but it will also provide programmed instruction from specialists outside the immediate faculty. Thus, the area of computerized instruction holds many opportunities for higher education and especially small colleges and universities.

CHAPTER VI

EQUIPMENT, PERSONNEL, ORGANIZATIONS AND PUBLICATIONS

The development of a successful data processing system must include workable equipment and a trained staff. The employment of an efficient well organized group of data processing employees is probably more important than the brand of equipment used; however, both areas are important in developing an efficient data processing center. The two areas are reviewed below with considerable thought given to various stages of development.

Equipment

The previous chapters were written without considering a specific manufacturer's equipment, except for Chapter IV where the unit record system was developed using the equipment Langston University has on order. There are two companies which manufacture punch card equipment, International Business Machines and Sperry Rand, and several companies which manufacture computer systems.

The competition in manufacturing the above equipment has forced all manufacturers to market competitive machines and the related software. Thus, the prospective buyer should consider such things as service, discounts, systems help, and so forth in addition to the type of machine desired. Probably the most important item to consider is service. The availability of service engineers is a basic factor in

reducing equipment down-time. This particular item should be given a thorough review since the efficiency and overall standing of the data processing center with relation to the college or university is dependent on a successful machine operation.

The unit record equipment presently on order at Langston University is manufactured by International Business Machines Corporation. Due to this commitment and the author's training with similar equipment, the data processing machines reviewed in this chapter will consist only of IBM equipment. It is not the intention of the author to recommend one manufacturer's equipment over other manufacturers', but rather an attempt to use specific equipment for clarification purposes.

The equipment is reviewed by considering the least expensive unit record system, then Langston University's proposed system, and finally several small IBM computer systems. For the reader not familiar with IBM unit record equipment, an inspection of Figures 84, 85, 86, 87, 88, 89, and 90 is suggested. Within the individual figures, a brief description of the capability of each of the following machines is given: 526 keypunch, 082 sorter, 402 accounting machine, 548 interpreter, 024 keypunch, 514 reproducing punch and 085 collator, respectively.¹

The smallest system which would still provide a college or university with the unit record services outlined in Chapter IV, includes a 526 keypunch, 082 sorter, and a 402 accounting machine.

¹The descriptions, specifications and costs listed in each figure represent one possible configuration. There are many other possible arrangements, depending on the special purpose devices that may be desired on each machine. The listed prices are approximate prices which are listed to give the reader an idea of the costs involved. The costs are given for rental, purchase and maintenance for purchased machines.

The 526 keypunch has the special features which permit summary punching with the 402 accounting machine and interpreting punched cards. These machines will provide the functions offered by the 548 interpreter, 024 keypunch, and the 514 reproducing punch, which were illustrated in the flow charting of Chapter IV. However, this machine does not completely fulfill, in detail, all of the functions of the other machines. The interpreting feature does not provide flexibility to interpret anywhere on the first two lines of the card; only directly above the column where the information is punched. Also, the speed of this machine is much slower than the 548 or 514 machines and in addition it does not have the 514 mark-sensing and end printing capabilities. Thus, the unit record system of Chapter IV must be redesigned to compensate for these changes.

The Langston University system has been used to demonstrate the administrative procedures in Chapter IV. The equipment includes 024 keypunches, 548 interpreter, 514 reproducing punch, 082 sorter, 085 collator, and a 402 accounting machine with the calculating feature. This equipment provides Langston University with a strong unit record system which can be used for administrative applications and for teaching courses in the two-year terminal program.

After developing the unit record system of Chapter IV, the author feels the following recommendations should be considered by Langston University before the equipment is received:

1. The addition of the alternate programming feature on one of the 024 keypunches is recommended. This feature allows the keypunch operator to keypunch, at the same time, two separate sets of cards from the same data source, using program control on both card formats.

2. The 514 reproducing punch should be replaced with a 519 reproducing punch with a counter, ten positions of mark-sensing and the end printing feature. The counter and end printing attachment can be used to make class cards, dining hall cards, and inventory cards. The two features used together permit the cards to be end printed and punched at the same time. These attachments permit one less pass of the cards through the equipment than is needed when a counter is used on the 085 collator. The end printed card is very helpful in registration when enrollments in courses are being determined.

The mark-sensing feature can be obtained on the 514 or 519 reproducing punches and is very useful in punching grades into class cards, as explained in Chapter IV.

3. The card counter should be removed from the 085 and placed on the 514 or 519 reproducing punch as explained in number 2.

4. Additional panel boards, wires, files, card trays, and forms and cards should be available when the equipment arrives on campus. This will allow the University to begin using the equipment as soon as it is installed.

The IBM computer systems which are within the price range and capacity of a small school are the IBM 360-20 system (Figure 91), the 1401 system (Figure 92) and the 1130 system (Figure 93). These systems may be obtained with various configurations and levels of sophistication; one of these possibilities has been illustrated in each of the figures as an example.

Personnel

The second necessity of an efficiently working data processing center is the employees of that center. As was recommended in Chapter III, the data processing center should be a separate department of the college or university with the director, in charge, reporting directly to the academic dean or academic vice-president.

The director should be hired as soon as it is decided to install a data processing system. He can help plan the system and also provide cohesiveness to the program. This individual should have, as a minimum, a master's degree in computer science or in an academic field with education and experience in the use of computers and unit record equipment.

The other members of the staff should be hired as needed, with the smallest organization having a combination keypunch operator and machine operator as the other member of the staff below the director. This individual should have training on machine operation and keypunching, and preferably some experience. As the center develops and additional help is needed, a machine operator and supervisor should be employed who has a baccalaureate degree and can teach some of the data processing courses in the two-year terminal program. The addition of other personnel would depend on the growth of the center and academic program.

The author recommends the following positions for Langston University's data processing center:

1. The immediate employment of a director who is qualified to teach college level computer science courses and has some experience with unit record equipment. This individual should be employed as soon as possible to help develop the recommended unit record system and the

beginning data processing courses.

2. The employment of a machine operator and supervisor who is qualified to teach the data processing courses. This individual should be employed at least two months before the equipment is received so he can begin wiring panels and also help develop the overall system.

3. A keypunch operator should be employed as soon as the equipment is installed. The individual could be trained on the job to operate the other equipment if necessary. Possibly, this employee should be employed before the equipment is installed if service bureau equipment is available.

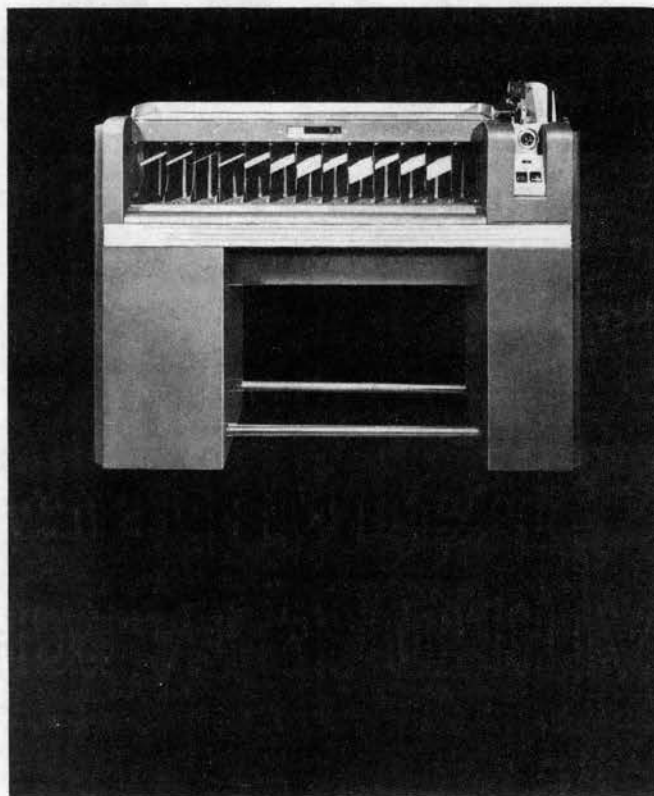
The recommendations of this section should help the new data processing center of a college or university to establish a firm foundation on which to build a strong integrated electronic data processing system. The system will be capable of processing administrative applications as well as supporting a strong academic program.



Description: This machine can serve as a summary punch, card punch, interpreter, and gang punch. It has a summary punching speed of 17 columns per second, punches indicative information while totals are being accumulated, will punch a separate card for each class of total when used with the IBM 402, 403, or 419 accounting machine and when equipped with optional selectors, data being punched can be printed along top edge of card. Also, it can be used as a standard card punch, performs gang punching operations, and when equipped with the optional interspersed gang punching feature it serves as an automatic reproducing punch.

Cost: Rental price per month is \$100.00.
Purchase price is \$5800.00.
Maintenance per month is \$20.00.

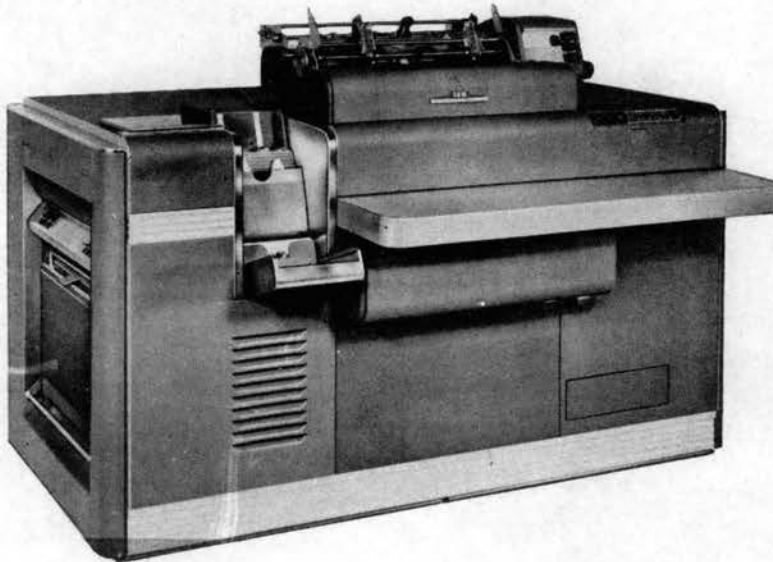
Figure 84: IBM 526 Keypunch



Description: This machine groups all cards of similar classification, arranging such classifications in numerical or alphabetic sequence. Alphabetic sorting is accomplished by double sorting each column. The machine sorts 650 cards per minute per card column. The card pockets have a capacity of approximately 550 cards per pocket. A selection dial permits sorting out cards with any individual punch or punches while the remaining cards are sorted into the reject pocket without disturbing their sequence.

Cost: Rental price per month is \$55.00.
Purchase price is \$2600.00.
Maintenance per month is \$13.00.

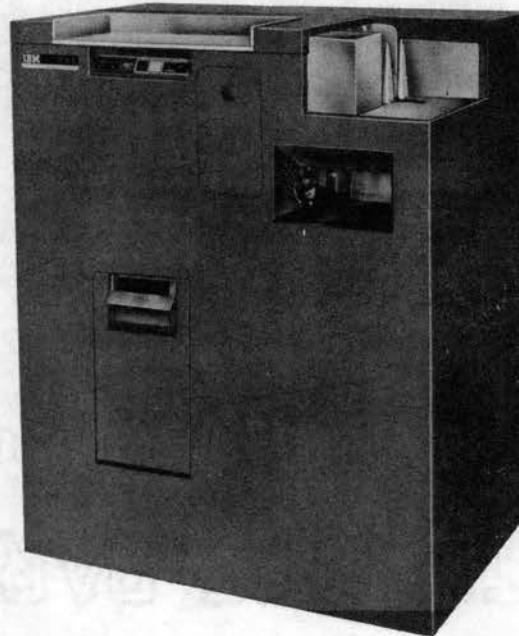
Figure 85: IBM 082 Sorter



Description: This machine is designed for the requirements of small business where it prepares reports and records from punched cards. The machine reads 80-column cards, records details, adds, subtracts, and prints any desired combination of totals. It has a maximum of 88 type bars, 45 numerical and 43 alphameric, detail prints at 50 lines per minute, accumulates totals at 50 cards per minute, and is capable of crossfooting three amounts from one card. It handles simple multiplication problems by means of an optional multiplier unit, available for either single product ($A \times B = C$) or double product ($A \times B = C$, $A \times D = E$) operations. Also, the machine has connections available for cable attachment of IBM summary punches, and a tape-controlled carriage for automatic feeding and spacing of continuous forms.

Cost: Rental price per month is \$355.00.
Purchase price is \$26,000.000.
Maintenance per month is \$86.00.

Figure 86: IBM 402 Accounting Machine



Description: This machine translates the holes punched in IBM cards and prints the corresponding data across the face of the punch card. Both numerical and alphabetic characters are printed. It has two lines available for printing at the top of each card with a maximum of 60 characters printed on each line at a speed of 60 cards per minute. The feed hopper capacity is 700 cards, and the stacker capacity is approximately 900 cards.

Cost: Rental price per month is \$100.00.
Purchase price is \$5400.00.
Maintenance per month is \$22.00.

Figure 87: IBM 548 Interpreter



Description: This machine provides fast, continuous punching of alphameric data and special characters from source documents into cards. It has automatic or manual card feeding, a 500 card capacity hopper and stacker, and a program controlled skipping and duplicating feature. The keyboard contains all operating keys and automatic switches.

Cost: Rental price per month is \$40.00.
Purchase price is \$2000.00.
Maintenance per month is \$19.00.

Figure 88: IBM 024 Keypunch



Description: This machine combines the features of gang punching, reproducing and comparing. For summary punch operations, the machine is attached to an IBM accounting machine by means of a flexible cable. It reproduces numerical or alphabetic information from one set of cards to another at a maximum speed of 100 cards per minute. Also, it can convert pencil marks on punch cards to punched holes when the mark sensing device is attached.

Cost: Rental price per month is \$100.00.
Purchase price is \$7000.00.
Maintenance per month is \$32.00.

Figure 89: IBM 514 Reproducing Punch



Description: This machine performs many card filing and selection operations. It simultaneously can feed two sets of numerically punched cards, merging the matched cards and selecting the unmatched cards. During this processing, the machine can also check the sequence of the primary file of cards. It pulls or files cards automatically, interfiles cards in sequence, substitutes new cards for old, selects predetermined cards in random sequence, merges master and detail cards, and separates matched and unmatched cards. It feeds up to 120 cards per minute in each feed while performing the above operations.

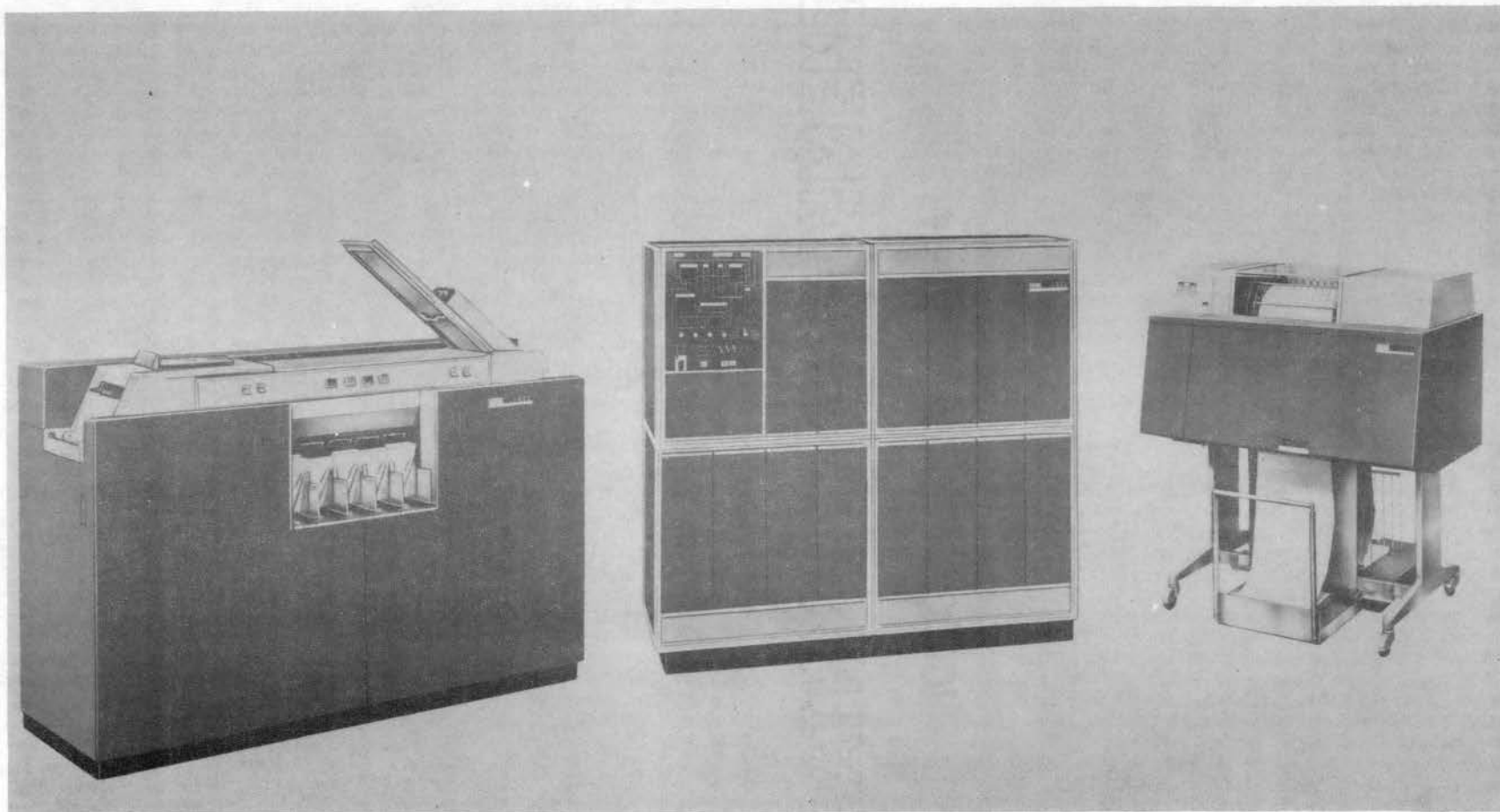
Cost: Rental price per month is \$95.00.
Purchase price is \$6625.00.
Maintenance per month is \$26.00.

Figure 90: IBM 085 Collator



Cost: This system has many configurations with the smallest system renting for approximately \$1700.00 per month or selling for approximately \$80,000.00. The above picture contains a central processing unit, printer, multi-function machine and four tape drives.

Figure 91: IBM 360-20 System



Cost: This system has many configurations with the smallest system renting for approximately \$2000.00 per month or selling for approximately \$120,000.00. The above picture includes a card reader punch, central processing unit and an on line printer.

Figure 92: IBM 1401 System



Cost: This system has many configurations with the smallest system renting for approximately \$900.00 per month or selling for approximately \$42,000.00. The above picture includes a central processor, printer, console printer, disk drive, plotter, paper tape and a card reader punch.

Figure 93: IBM 1130 System

Organizations and Publications

The computer science field is rapidly developing into a professional field, in its own right, with professional organizations and publications. This development officially had its beginning in August of 1955 (13). At that time, representatives of the Rand Corporation, the Lockheed Company, and North American Aviation met in Los Angeles and decided it was too expensive, in the rapidly changing computer field, to have each company solve programming problems individually. They decided to exchange information and programs, and take advantage of the combined experience of these companies. Thus, from this meeting came the idea for a new kind of organization; the computer user group.

The growth of these user groups has been tremendous with a growth record equaling that of the computer itself. Three of the larger groups are (1) SHARE, (2) GUIDE, both formed in 1956, and (3) COMMON formed in 1962. These organizations have a combined world-wide membership of more than 2000 installations, with additional application oriented groups being formed to pool programming knowledge in such specialized areas as engineering, hospital administration, and higher education.

The presently acknowledged professional organization for the computer science field was formed approximately one year before the user groups had their beginning. This organization was called the Association for Computing Machinery and was founded in 1954. The organization has chapters throughout the United States in colleges and universities, and also in commercial areas.

The ACM organization publishes a monthly magazine, *Communications of the ACM*; a quarterly journal, *Association for Computing Machinery*

Journal; and a bi-monthly review, called Computing Reviews. In addition to these publications, ACM is sponsoring various research projects to help in the development of the computer science field. One of the leading projects is the one referred to in Chapter V on computer science curriculums.

There are many publications besides the ACM publications which are primarily concerned with computers and automation. The reader is referred to Ulrich's International Periodicals Directory for a complete listing. A partial listing from the computer section of this directory is printed below for the reader's benefit. The information is printed alphabetically, giving year founded, when published, editor, publisher, and publisher's address.

1. Abstracts of Computer Literature. (In 2 parts: Part I, Marketing; Part II, Engineering) 1957, bi-monthly, Ed. Technical Librarian. Burroughs Corp., Electro-Data Manufacturing & Eng. Division Library, 460 Sierra Madre Villa, Pasadena, Calif.
2. Association for Computing Machinery Journal. 1954, quarterly, Ed. M. L. Juncosa, 211 E. 43rd St., New York, N. Y. 10017.
3. Communications of the ACM. 1958, monthly, Ed. C. C. Gotlieb, 211 E. 43rd St., New York, N. Y. 10017.
4. Computer Abstracts. 1957, monthly, Ed. B. A. Fancourt, Technical Information Co. Ltd, Chancery House, Chancery Lane, London, Eng.
5. Computer Applications Service. 1962, monthly, Ed. Rosemary Dorr, American Data Processing, Inc. Book Tower, Detroit, Michigan, 48226.
6. Computer Bulletin. 1957, quarterly, Ed. M. Bridges, British Computer Society, Finsbury Court, Finsbury Pavement, London E. C. 2, Eng.
7. Computer Characteristics Quarterly. 1961, quarterly, Ed. Allen F. Rousseau, Charles W. Adams Associates Inc., 142 Gread Rd., Bedford, Mass.
8. Computer Journal. 1958, quarterly, Ed. H. W. Georing & E. N. Mutch, British Computer Society, Finsbury Court, Finsbury Pavement, London, E. C. 2, Eng.

9. Computer Survey. 1960, bi-monthly, Ed. M. Moseley, United Trade Press Ltd., 9 Gorgh Square, Flect St., London, E. C. 4, Eng. /Covers the electronic digital computer industry in Britain/.
10. Computers and Automation. 1951, monthly, Ed. Edmund C. Berkeley, Berkeley Interprises, Inc., 815 Washington St., Newtonville 60, Mass.
11. Computing. (archives for elect. computing). 1965, irregular, Stiasny-Verlog, Annenstrasse 65, Groz, Austria.
12. Computing Review. 1960, bi-monthly, Ed. A. Finerman, Association of Computing Machinery, 211 E. 43rd St., New York, N. Y.
13. Data and Control. (The journal of data processing and control system). 1963, monthly, Ed. Graham Weiner, Bus. Publications Ltd., Mercury House, 103-119 Waterloo Rd., London S. E. 1, Eng.
14. Data Processing Digest. 1955, monthly, Ed. Margaret Milligan, Data Processing Digest, Inc., 1140 S. Robertson Blvd., Los Angeles 35, Calif.
15. Data Processing Equipment Encyclopedia. Vol 1 & 2, 1961, monthly, up-dating, Ed. Alan D. Meachan, American Data Processing, Inc. Book Tower, Detroit, Michigan, 48226.
16. Data Processing for Education. 1962, monthly, Ed. Dr. John W. Sullivan, American Data Processing, Inc. Book Tower, Detroit, Michigan.
17. Data Processing Magazine. 1958, monthly, Ed. Edith H. Goodman, North American Publishing Co., 134 N. 13th St., Philadelphia, Pa. /Incorporates Data Processing for Management and Data Processing for Science/.
18. Data Systems Design. 1963, monthly, Ed. Duffy Marks, Richard W. Nielson, Nielson Publishing Co., 217 Broadway, New York, N. Y.
19. Datamation. 1957, monthly, Ed. Robert B. Forest, F. D. Thompson Publications, Inc., 1830 W. Olympic Blvd., Los Angeles, Calif. 90006. /The automatic handling of information/.
20. EDP Analyzer. 1963, monthly, Ed. Richard G. Canning, Canning Publications, Inc., 614 S. Santa Fe Ave., Vista, Calif. 92083.
21. EDP Weekly. Vol. 5, no. 3, May 11, 1964, weekly, Ed. Jane P. Titus, Industry Reports, Inc., 514 10th St., N. W., Washington, D. C.
22. IBM Journal of Research and Development. 1957, quarterly, Ed. A. L. Samuel.
IBM Systems Journal. 1962, quarterly, Ed. J. S. Lawrence.
IBM Technical Disclosure Bulletin. 1958, monthly, Ed. A. H. Dickinson, International Business Machines Corp., 590 Madison Ave., New York 22, N. Y.

23. Information Processing Journal. 1962, monthly, Ed. Geoffrey Knight, Jr., Cambridge Communications Corp., 238 Main St., Cambridge, Mass. /A reference journal devoted to the theory, fabrication and application of computers/.

24. International Association for Analog Computation Proceedings. 1958, quarterly, Presses Academiques Europeennes, 98 Chauss'ee de Charleroi, Brussels 6, Belgium.

25. Journal of Data Management. 1963, monthly, Ed. Jack Linden, 524 Busse Highway, Park Ridge, Ill.

26. Journal of Machine Accounting Data Processing Systems and Management. 1950, monthly, Ed. Herman F. Hinz, Jr., Journal of Machine Accounting, Inc., 1750 W. Central Rd., Mount Prospect, Ill. 60056.

CHAPTER VII

SUMMARY, RECOMMENDATIONS AND EDUCATIONAL IMPLICATIONS

The material in this paper has been organized with the smaller college or university in mind. The presentation was developed to provide the reader with an overall view of the electronic data processing field. Special emphasis has been placed on the establishment of a unit record system, complete with examples, which would provide a model for small colleges and universities [in particular Langston University] to follow in developing their own systems.

Summary

In Chapter I the statement of the problem, scope of the paper, methods and procedures, and expected outcomes are presented. A listing of data processing terms and definitions are also included for the reader's benefit.

Chapter II presents a brief resume' of the early history of electronic data processing equipment development. In section two the historical development of this equipment in higher education is discussed. The University of Iowa's installation, installed in 1925, was found to be one of the first unit record installations to be installed in a college or university for administrative uses. The third section of Chapter II presents a review of several research reports which are related to this study.

The development of an electronic data processing system, a student numbering system, course numbering system, and a data processing center are discussed in Chapter III. The rules for a data processing staff and a brief discussion of flow charting are also reviewed in this chapter.

In Chapter IV a complete discussion of electronic data processing in college administrative offices is covered with special emphasis placed on flow charts, card and form design, and systems development for an integrated system.

Chapter V outlines two programs which small colleges and universities should consider when developing a computer science curriculum. These programs are illustrated with course descriptions and recommendations for Langston University. A brief review of the new area of computerized instruction is also outlined in this chapter with a suggestion that this may be the approach small colleges and universities should consider.

A review of equipment and personnel needs of a data processing center are outlined in Chapter VI. Since Langston University has IBM equipment on order and the author's experience is with this type of equipment, the review covers only the International Business Machines systems. The leading organizations and publications are also reviewed in section two of this chapter.

Recommendations

One of the purposes of this study was to develop an electronic data processing system model which small colleges and universities [in particular Langston University] could use as a reference in developing

their own systems. Several recommendations have been suggested throughout the paper, both in general and specifically for Langston University. These recommendations are summarized in each category as follows:

General Recommendations:

1. An integrated systems approach should be used in developing an electronic data processing system. This approach requires implementing a numerical code system for students, courses, faculty, accounts, and so forth.

2. A student alpha-number should be assigned to each student and issued to the student on an embossed ID card. This number should be used as the student identifying number in the administrative offices; such as, account number in the Business Office, check-out number in the library, permanent record number in the Registrar's Office, and so forth.

3. The data processing center should be a separate department with a director who is responsible to the academic dean or academic vice-president. The center should be developed using the centralized control approach.

4. The data processing center should be located, physically on campus, where it is readily accessible to users, both during the day and after hours.

5. The director should establish a uniform set of rules for the data processing center staff.

6. Before a data processing system is implemented a complete analysis of the present system should be made and the areas defined where the new system could be implemented with beneficial results. The analysis should be of the form illustrated in Chapter IV of this paper.

It is recommended the change of systems be implemented systematically to allow time for staff members to adjust to the change.

7. Small colleges and universities should implement plans immediately, if they have not already started them, to install computer science courses in their curriculums. Some of these courses will be new to the curriculum and others will entail a revision of present courses. If money is not available for a computer system, an investigation should be made to determine if near-by systems are available for processing computer programs. Also, it may be possible to make arrangements to install remote stations using the IBM 1500 system approach. Two possible curriculum programs are the two-year terminal and the four-year applied mathematics programs recommended in Chapter V.

8. The college or university should become a member of the ACM organization and its library should subscribe to several of the leading computer science journals.

Langston University Recommendations:

1. A student numbering system with embossed ID cards should be installed immediately. It is also recommended that a four digit course numbering system be considered.

2. The student number should be used as the account number in the Business Office.

3. A director of data processing should be employed immediately to help plan the initial phases of the data processing system, and curriculum additions and changes.

4. A machine operator and supervisor should be employed by the director as soon as he determines it is feasible.

5. A keypunch operator should be employed as soon as the equip-

ment is available, to begin coding and punching master card information. If service bureau equipment is available or if the keypunches can be installed early, it would be advisable to start this employee as soon as possible.

6. One of the 024 keypunches should be ordered with the alternate programming feature.

7. The 514 reproducing punch should be ordered with the ten position mark-sensing attachment and if money is available it should be replaced by the 519 reproducing punch with mark-sensing and end printing. A card counter should be installed on the machine that is installed.

8. The card counter should be removed from the 085 collator if one is available on the 514 or 519 machine.

9. Additional panel boards, wires, files, card trays, and forms and cards should be ordered immediately, so that they are available when the equipment is installed.

10. The data processing center should be a separate department within the university, preferably located on the ground floor of the administration building.

11. Immediate plans should be implemented to make arrangements, with the Oklahoma State University Computer Center or some other installation, for computer time on the University computer. This computer time will be needed when the computer science courses are initiated.

12. The University Curriculum Committee should consider the recommended programs and curriculum changes.

Educational Implications

The discovery and development of computers has had and will continue to have a great impact on the American Society. As was pointed out by two leaders in the educational field, referenced in this paper, small colleges and universities also must prepare their students for this changing society. It is important that these smaller schools of higher education have a plan to follow in developing a data processing system for their particular program. A study such as this one, in addition to developing a model data processing system, presents a background of material in historical development, related research, curriculum development, and information on professional computer science organizations and publications to many students, faculty and college administrators.

The reader of this dissertation should gain an awareness of the overall computer science field, starting with its beginning, its development, and what can be expected in the instructional area for the near future. It is also expected that college administrators of small colleges or universities may find the material beneficial in determining what plans should be made at their college in this important area.

It is also of significance that the proposed unit record system and curriculum should be of particular benefit to Langston University in developing their data processing system and curriculum.

Undoubtedly the most significant result of this paper lies in the experience the author gained in its preparation. As part of this experience, the author noted two areas which should be investigated further. There seems to be a historical vacuum in the available reference material on the development of machines preceding the analog and digital

computers. A second area is the need to investigate: what mathematical concepts and ideas should be taught to students outside of the field of mathematics who are planning to work with computers in their particular discipline? Some of the areas of mathematics used by people working in the data processing field were suggested in the data processing mathematics I and II courses. Undoubtedly, there are other topics which should be considered and included in these courses which would offer students a better preparation for data processing positions. This area could be investigated by studying the mathematics used in commercial and educational data processing positions and then developing courses which satisfy these requirements.

It would be very interesting and beneficial to have the results of these investigations.

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APPENDIX A

CARD DESCRIPTIONS

The following alphabetic listing represents all of the IBM cards which were designed and recommended for the Langston University unit record system:

<u>Card Name</u>	<u>Figure Number</u>	<u>Page</u>
1. Class Admission Card	22	88
2. Class Card (IBM)	21	87
3. Class Master Card	19	85
4. Class Summary Card	39	112
5. Course Header Card	36	109
6. Current Earnings Card	74	160
7. Daily Summary Card	48	134
* 8. Dining Hall Card	78	169
* 9. Duplicate of Fee Payment Card	26	91
10. Employee Master Data Card Set	72	159
Includes: (i) Master Card		
(ii) Deduction Card		
(iii) Year-to-Date Earnings Card		
(iv) Address Card		
*11. Fee Payment Card	25	90
*12. Housing Application Card	13R	71
13. Housing Card	12	69
14. ID Punched Card	28	92
15. Informational Services Card	79	170

<u>Card Name</u>	<u>Figure Number</u>	<u>Page</u>
16. Laboratory Card	80	170
*17. Ledger Account Card	62	150
18. Master Control Card	62	150
19. Mark Sense Card	81	171
20. Payment Card (Accounts Payable)	62	150
21. Permit to Register	24	89
*22. Reference Card (Application for Admission)	5cR	62
23. Religious Census Card	82	171
24. Request for Change of Records Card	37	110
*25. Selective Service Card	83	172
26. Statistics Card	9	64
27. Student Assistant Time Card	69R	158
28. Student Master Card	10	66
29. Student Name and Address Card	11	68
30. Summary Card	40	113
31. Time Card or Record	73	160
*32. Validating Card	29	93
33. Vendor Summary Card	65	151

The cards designated by an asterisk (*) represent final records which are generated by the unit record system and distributed to individuals or offices outside the system. The other cards represent intermediate records which are used in data processing to obtain the final records. A short description and summary of each of the final record cards is printed below:

Dining Hall Card: This type of card is given to every student who has paid for his board in the college or university dining facili-

ties. The card is the same size as the ID card and validating card, and can be carried by the student in his/her wallet or purse. The card can be any of seven colors and can have an end printed number which is the student's residence hall number and dining number, if this is desired.

Duplicate of Fee Payment Card: This card is used to generate several reports, as outlined in the accounting section of Chapter IV, but in addition it also can serve as a permanent record in the Business Office. These cards, both old and new together, represent a complete ledger for each account number. If these cards are used in this way, there is no longer a need to keep each account posted on a single ledger card. This would eliminate one of the large clerical tasks in the Business Office.

Fee Payment Card: This card is generated to serve as a fee statement to the students. Once the student pays his fees at the Business Office, the cash register prints a receipt number, date and amount paid on both halves of the card with the student keeping the student copy and the Business Office keeping the Business Office copy. These two copies now represent permanent records which are kept for future auditing purposes.

Housing Application Card: The housing contract between the student and the college or university is represented by this card. This eliminates having large files for sheets of paper, folding the paper sheets for mailing, alphabetizing by hand, and so forth. The punch card is easier to work with, and can be punched and processed on the data processing equipment.

Ledger Account Card: This card can be used to print gum labels which are then posted on the register of claims ledger or the register of purchase orders and claims. A better approach, however, is to use the cards as the ledger and eliminate the single ledgers which must be posted by hand with gum labels or by manual recording on a hand operated accounting machine.

Reference Card: The entrance requirements at many colleges and universities require the student to furnish several references with the application for admission form. The request for this information can be made on a punch card which provides several advantages over a paper sheet, as was outlined in the housing application card summary.

Selective Service Card: The processing of a multi-copy paper form for every male student enrolled in a college places a heavy clerical burden on the Registrar's or Personnel Office. The change from this form to a punch card provides a means of fast machine processing without placing an extra clerical burden on any office.

Validating Card: This card is used to validate the plastic embossed ID card each semester. This allows the student to use the embossed ID card throughout his college career. The validating card is the same size as the ID card and can be carried in the same plastic holder. The card can be processed on data processing equipment or on a small printing machine, using the ID card; thus providing flexibility to the system. Usually, a different color would be used each semester to provide easy identification when the system is used at sporting events and other college functions.

APPENDIX B

FORM DESCRIPTIONS

The following alphabetic listing represents all of the data processing forms designed and recommended for the Langston University unit record system.

<u>Form Name</u>	<u>Figure Number</u>	<u>Page</u>
1. Backing Sheet	23	88
* 2. Certificate of Admission Form	7R	63
* 3. Check and Current Earnings Statement	75	161
* 4. Check Blank	56R	143
5. Check Register	64	151
* 6. Claim Form	57R	145
* 7. Class Roster	32R	104
8. Course Listing by Department	20	86
9. Deductions Register	76	162
*10. Fee Statement Form	50	136
*11. Grade Label	42	114
*12. Gum Labels (Ledger Card)	49	136
13. Invoice Register	63	150
14. Mailing Labels	8	64
*15. Mid-semester Progress Report Form	34R	106
*16. Official Grade Roster	38	111
*17. Registration and Fee Payment Form	30	94
*18. Student Grade Report	41	114

The forms designated by an asterisk (*) represent final records which are generated by the unit record system and distributed to individuals or offices outside the system. The other forms represent intermediate records which are used to obtain the final records. A short description and summary of each of the final record forms is presented below:

Certificate of Admission Form: This form is a revision of the form presently used. Since the master card, and name and address cards are punched from the application for admission form as soon as the applicant is accepted, the above certificate can be printed on the 402 printer from these cards. This saves typing the form manually and eliminates the possibility of making an error in recording the student number on the form.

Check and Current Earnings Statement: This combination form provides the printed check and the employee earnings statement. It is obtained from the new year-to-date, current earnings, and deduction cards on one pass through the 402 printer. Since these cards are necessary to produce other records, this application is really a by-product. This form would eliminate the manual generation of the employee earnings statements.

Check Blank: The conversion of the manual generation of checks to the unit record system requires the redesign of the check as illustrated in Figure 56R. Since the cards needed for generating these checks are already made for other records, the check generation is a by-product which would take very little time on the 402 printer compared to the time it takes manually.

Claim Form: This form is a revision of the form which is presently used. The reason for this revision is similar to that described

for the check blank. The necessary cards for generating the form are available, and the form can be printed much faster and with greater accuracy on the 402 printer than can be done by hand.

Class Roster: This form is used to furnish the faculty with an alphabetic listing of the students in each of their classes. In the two card registration system, the class admission cards furnish the instructor with a temporary record of those students attending his classes while late registration is in process. When late registration closes, the class rosters are printed in duplicate from the class cards and sent to the faculty. The faculty members record on the second copy the names of students not attending class and also those who are attending but are not listed. This second copy is returned to the Registrar's Office where the necessary corrections are processed.

The original copy of the class roster is designed so that the faculty member can separate the perforated edges from the roster and by making one fold the form will fit in the standard grade book. This is helpful to the faculty since they have a printed alphabetic list for their grade books which includes the student number with the student name for identification purposes.

Fee Statement Form: If students are allowed to pay their fees in installments, a standard business approach is to notify the payee by a fee statement for each installment period. This form would be used in place of the fee payment card, having the advantage of furnishing a better detailed description of charges and credits than possible on the fee payment card.

Grade Label: The grade labels are used to post a listing of courses, final grades, accumulative credit totals, and grade point

average on the student's permanent record card. The posting of grades in this way permits posting while the permanent record remains in a visual file, rush requests for transcripts can be handled first, several individuals can post at the same time, the label in a complete updating record complete with grade average, and the labels can be printed on the 402 accounting machine without purchasing additional equipment.

Gum Labels (Ledger Card): These labels are similar to the grade labels with the size changed to the size desired for the ledger cards. The advantages are found in the posting process, as discussed for the grade labels, and in the additional speed and accuracy.

Mid-semester Progress Report Form: This form is a revision of the form which is presently used. By placing the mid-semester progress reports on data processing forms, they can be printed on the 402 accounting machine from the class admission cards and the student name and address cards. The address is positioned on the form to allow mailing in window envelopes, eliminating the need to address envelopes. However, if the window envelopes are not available, mailing labels can be printed from the student name and address cards, and posted on regular envelopes.

Normally, this report is printed on a four-part form with the first copy sent to the parents, second copy to the student adviser, third copy to the student personnel or counseling office, and the fourth copy to the Registrar's Office for reference purposes.

Official Grade Roster: The official grade record for each class is kept on the official grade roster which contains a complete listing of the students in the class, final grades, and the instructor's signa-

ture. This roster is printed on the 402 accounting machine from the course header cards and class cards (IBM). It replaces the class roster (Figure 32) which is presently used as a class roster and official grade roster.

Registration and Fee Payment Form: This form could be used to provide the student's class schedule and fee statement on one record. The information would be taken from the class cards and housing card, and printed on the 402 accounting machine or on-line printer. This form ties two records together for the Business Office, Registrar's Office, and the students, thus providing a quick and accurate record for reference purposes. The advantages are apparent when an error in tuition charges must be checked since at that time the student's class schedule must be reviewed.

Student Grade Report: The student grade report is printed on the 402 accounting machine from the summary cards, student name and address cards, and the class cards. The design and advantages of these forms are similar to those expressed for the mid-semester progress report.

VITA

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Doctor of Education

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Major Field: Higher Education

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