A SURVEY OF DATA PROCESSING COURSES TAUGHT IN COLLEGIATE SCHOOLS OF BUSINESS

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PREFACE

A large percentage of the universities and colleges in the United States today are faced with a problem of determining what should be taught in the area of business data processing. Since this is a relatively new field, little in the way of standardizing the subject matter has been accomplished. Such problems as text material, testing, and machine operations are a few which have become foremost in establishing programs in data processing. Since no primary research had been done in determining what was being taught at the present time across the nation, it was felt that this should be done in hopes of compiling ideas which could then be used as reference material in future problems of course programs.

Acknowledgement should be made to the sixty-four individuals who answered the questionnaire from which the material was gathered. This study could not have been made without their cooperation. I want to express my gratitude also to Dr. F. E. Jewett, Dr. J. S. Wagle, and especially to Mr. W. L. Zimmerman, for their assistance, and patience, while I was preparing this study. I am also indebted to Mrs. Gordon Culver for her assistance in typing this thesis.

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CHAPTER I

DATA PROCESSING IN COLLEGIATE SCHOOLS OF BUSINESS

The advent of computers in the late 1940's and their availability within the last few years placed the business community in a position similar to one which the first space man might experience in his travels. This first man has no hindsight to guide him through endless problems of space and mass. He cannot look back upon experiences others have had since no flights have been made. No books of authority have been written on the subject which would explain what might be encountered, and thereby relieve the mind of this human guinea pig. Scientists can only hypothesize as to the realm of outer space; they can give little assurance to one actually approaching this experience.

At this time, any picture of America's first man shot into space probably will be exaggerated as to the true facts of the event. Even so, a parallel may be drawn between this man's plight and the position of universities and colleges approximately five years ago when they were faced with the problem of determining the responsibility which they had to the student and to the business world in the field of data processing.

Just as the year 1960 is an early one in the age of space, the years 1953-1955 were the early ones in which concerns were beginning to use electronic computers strictly for business applications. This was not because business was slow in applying machines to its problems

but because electronic computers were not available commercially until 1951, at least not for business.

This is not to say that punch-card equipment was not employed until this time. Such problems as payrolls, accounts receivable, and billings, had been solved on this equipment long before the 1950's, since the machines have been in existence for approximately seventy years.[1]

With this availability of computers for business applications, many business entities were thrown into this position similar to traveling into space without knowing where to go. Management had the machines, or "hardware," but did not know what to do with them as far as applications to the business end of the firm were concerned. The firms could not look to their neighbors to see what experiences they had had since the others were in the same state of confusion. The supervisors could not read any books on the subject of high speed business data processes to acquaint themselves with the problem because at this time none had been written. What little material had been printed on the subject was in technical language for scientists and engineers.

Management had been hearing of these fantastic machines which were capable of accomplishing things which humans could not do within a life time. They were anxious to try these machines, that is, the entire data processing machine system, but they were just as anxious to have informed personnel which could use the equipment intelligently and to the best advantage.

At about the same time, the business departments or divisions in

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[1]The first use for punch card equipment was the 1890 United States census. The development of the punch card was a direct result of the census.

universities and colleges began placing in the curriculum courses dealing mainly with electronic computers, or as commonly called electronic data processing. Many of the colleges of business already had a course or two in which the use of punch card equipment to business applications was explained. These colleges either incorporated the new material into the old courses, set up a course for electronic data processing or established an entirely new course briefly covering the entire subject as it was then known and then did away with the existing courses. Other universities which did not have any type of data processing courses began placing such courses in their curriculum.

There was little similarity in courses from university to university just as any other new field has had to start. The instructors of these courses could not use textbooks since none had been written for the businessman; they had to search for lecture material and for problems to use. One area in which the instructors were fortunate was in the helpfulness of the hardware manufacturers. These makers provided many of their manuals, procedures, and other things such as newsletters in the hope of familiarizing the faculties of colleges with their latest efforts. The instructors began communicating with one another trying to find new material. It seemed that each one had his ideas as to what the course content should be and how it should be taught.

Before the universities can provide the business world with graduates capable of handling the data processing hardware, the universities are going to have to decide what their responsibilities are to the student as well as to the business world. The answer to this could be anywhere between two extremes. The first extreme would be that the responsibility of the college is to produce a well-rounded graduate which has been

introduced to the business processes and which is capable of learning details after he has entered industry. The other extreme would be that the college is to produce a graduate which has been trained in the art of a particular field so that he can qualify for a certain job upon graduation.

The problem of determining exactly the responsibility as to data processing has been hindered somewhat by three things. Little had actually been done five years ago in trying to apply business applications to high speed methods, mainly because of its newness. The factor of speed was so necessary for the businessman that many colleges began trying to provide some knowledge but these could only point to unproven systems. The fact that many machines become obsolete before the new has worn off has also hindered the solution to the problem. Not knowing what will come next limits the instructor because he cannot know what will be of use to his students and what will not. The third drawback has been a lack of accepted systems theory. As long as a particular method worked, it was all right. Before data processing can be taught effectively, systems theory will have to be more concretely formulated.

The larger portion of any business curriculum or for that matter, an engineering curriculum, is composed of handling information or facts which have been or which will be gathered. The accounting major spends four years in courses handling figures to arrive at a reasonable net profit figure; the management major spends an equal amount of time dealing with facts to come to a conclusion as to policy of the firm; and the engineering student spends four or five years in courses handling details to decide what would be best in the way of new construction for the firm. A simplified definition of data processing then could be

"information handling" which would include almost any activity in the business world. Yet data processing as used in this study has a more limited definition than that. Data processing as used herein may be defined as "the application or the use of machine methods to both numerical and alphabetical types of information." Therefore, data processing curriculum would include courses whose main objective was the study of applying machines to the operations of an entity. This includes not only courses in electronic computers but also courses in punch card equipment; in general, any course in the field of machine data processing. These not only include business aspects of the firm but also technical problems. Any of the above problems of the accountant, manager, or engineer could be discussed in such courses. This study though is limited to those courses dealing only with business data processing.

Approximately five years has lapsed since the first commercial computer started the flood of material that is now available to use in courses. Still there is much questionning as to the worthiness of the various approaches to the subject. After this length of time, most universities have had time to consider the merits of this specialized area of data processing. While universities have been exchanging ideas individually and collectively nothing had been done up to this time so far as collecting information on a wide geographic area was concerned. It was felt that such a study should be made in order to see what progress has been made and to see similarities and contrasts of programs. Enough time has passed now since the beginning of the era so that colleges have had a chance to formulate policies of some sort in this field.

This present study was made with the preceding discussion in mind.

A survey of fifty-six universities was made by means of a questionnaire to find out what was actually being taught. The fifty-six schools were scattered throughout the United States in hopes of getting a broad view as well as a view of the problem by areas and by size.

The selection of the schools was not based on random-sampling theory, but more on a judgement sampling base. Therefore, the conclusions drawn from this study cannot be inferred to apply to all schools across the nation, nor can degrees of confidence be placed upon the conclusions. The reader must understand that the schools were chosen with the study in mind, and therefore, the number having data processing courses will be biased toward the affirmative. This limitation of the choosing of schools in no way hinders the usefulness of the study. Since first of all a survey of the present day practices in data processing curriculum was desired and then, secondly, a survey of who was teaching data processing, the necessity of having the selection biased can be seen. As a result of the questionning though a considerable amount of information was also gained in this secondary area.

Membership in the American Association of Collegiate Schools of Business was not considered as a major factor in selecting a university. As it turned out, over half of the returns were associated with the accrediting association in some way. This included members, associate members, and provisional members of the AACSB. Since this was not a major point in selection, a larger number of schools could be used in the preliminary selection.

The list of schools to whom questionnaires were mailed included a group of forty-five known to be interested in this field. The questionnaire was mailed to instructors who attended a conference on data

processing for schools of business, sponsored by International Business Machines in the autumn of 1958. The schools represented at the conference did not necessarily have data processing but the schools were interested enough at least to send a representative. This is why these forty-five schools were selected. It was felt that the instructors would reply and express their feelings on the subject more so than if all the schools in the study had been selected at random.

The other group of thirty-eight schools which received the questionnaire were selected from school bulletins located in the university library. These were chosen on more of a random basis; the only requirement if selected, being that some business-type course be taught by the particular school.

Of the total mailed, there was approximately a 77 per cent response. Thirty-eight, or 84 per cent, of the forty-five attending the IBM conference returned the completed questionnaire, while twenty-six, or 68 per cent, of the "randomly-chosen" mailed an answer to the request. Some of these had to be omitted for various reasons which will be explained later. The final study was composed of the remaining fifty-six.

The present study was limited to those recognized universities and colleges having departments or divisions of business. Therefore no school which has been established solely as a commercial school will be included. Several distinguishing marks can be noted. First, a collegiate school, with which this study deals, is a part of an institution of higher learning. A business school, on the other hand, is not a part of such an institution. Secondly, the collegiate school recommends to the central administration of the institution individuals for degrees whereas the commercial school confers its degrees or certificates directly to the

individual. Third, a collegiate school requires that the student have a required number of courses in general education such as science, art, and humanities. Commercial business schools, though, teach only business subjects. Fourth, a commercial school has been established with the aim of being a profitable business in itself. A collegiate school, as part of an institution, has as its goal education for education's sake.

Some of the universities questionned would not be considered to have a collegiate level school of business, such as Massachusetts Institute of Technology, and would not come under this study. After reviewing the information submitted by these various schools, the conclusion was reached that much valuable information would be lost if these could not be considered. Therefore, it is with full awareness that a few of these universities were included. Consideration of these returns will be made in any conclusions drawn and mention made as to their influence, if any.

CHAPTER II

ANALYSIS OF DATA PROCESSING QUESTIONNAIRE

Since no primary research had been done to determine what progress in curriculum has been made, it was necessary to collect the information by means of a questionnaire. This method, while not the most informative, was used because it was the most practical way of collecting the data.

The questionnaire was prepared and mailed in the early part of 1959. Due to the type of information desired, it was necessary to have the questions in the hands of the informants early in the school semester so that the questions could be answered and returned before the close of that particular semester. The questionnaire consisted of four pages divided into four major categories: general information; courses; data processing machines; and future status.[2] In preparing the questions, effort was made to present them so that the major portion of the answers could be machine tabulated.

The first part, general information, included questions concerning the informant and his university or college. This information was combined with enrollment and other data in determining divisions upon which conclusions should be drawn.

The United States was divided into six major areas: Northeast; Midwest; South; Southwest; West; and Northwest. Twenty-nine states were represented in the study. The states included in each area are shown in Table I. The more populated areas were represented more heavily by the

[2]See appendix for example of questionnaire.

TABLE I

THE UNITED STATES DIVIDED BY AREAS

NORTHEAST

Connecticut	* New Hampshire
Delaware	New Jersey
District of Columbia	* New York
Maine	* Pennsylvania
* Maryland	Rhode Island
* Massachusetts	Vermont

MIDWEST

* Illinois	* Missouri
* Indiana	* Nebraska
* Iowa	* North Dakota
* Kansas	* Ohio
* Michigan	South Dakota
Minnesota	Wisconsin

SOUTH

* Alabama	Mississippi
* Arkansas	* North Carolina
* Florida	South Carolina
* Georgia	* Tennessee
Kentucky	* Virginia
* Louisiana	* West Virginia

SOUTHWEST

Arizona	* Oklahoma
* New Mexico	* Texas

WEST

* California	Nevada
* Colorado	Utah

NORTHWEST

Idaho	Oregon
Montana	* Washington
	Wyoming

* Indicates questionnaires returned from these states.

schools chosen. The Northeast and the Midwest accounted for a little over half of the questionnaires mailed. The areas which are more populated will tend to have more businesses which have an immediate need for data processing techniques. In these areas then, there should probably be a stronger influence on the colleges from these businesses to offer courses in data processing. Also, some of the largest colleges are in these two areas and would be more capable of having not only instructors for courses but also machines and equipment available.

The returns were also broken down as to the size of the school by enrollment. The three sizes were those with an enrollment under 5,000; those with an enrollment of 5,000 through 10,000; and those with an enrollment of over 10,000. The figures are the 1958 enrollments of these particular schools.[3] The sizes are shown in Table II.

The larger the school the more apt they are to have data processing as part of their curriculum. The smaller schools are not only hindered by lack of qualified instructors but also by the extremely high price of the equipment. Some of the manufacturers of the hardware do allow educational discounts on their equipment, but still many are prohibitive for the smaller school to acquire. This is true even of many of the medium-size and large-size schools. Michigan State University, for instance, has had a desire for a medium-size computer but as yet has not had the funds for such.

On the other hand, courses can be taught without any machinery at all. Once again, the larger school not only would have more demand for the course but possibly would have qualified personnel to teach such a course or could acquire personnel for this purpose.

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[3]Harry Hansen (ed.), The World Almanac, 1959 (New York: New York World-Telegram, 1959), pp. 461-474.

TABLE II

SIZES OF COLLEGES REPRESENTED IN STUDY

COLLEGES WITH ENROLLMENT UNDER 5,000

Abilene Christian College
@ Baylor University
Bradley University
Clark University
Clarkson College
+ Darthmouth College
@ Drake University
+ Lehigh University
The Rice Institute
University of Arkansas
University of Chattanooga
+ University of Denver
@ University of North Dakota
+ University of Virginia

COLLEGES WITH ENROLLMENT BETWEEN 5,000 and 10,000

Duke University
+ Fordham University
* Georgia Institute of Technology
Iowa State College
Johns Hopkins University
+ Louisiana State University
* Massachusetts Institute of Technology
+ Oklahoma State University
Sacramento State College
San Diego State College
+ St. Louis University
+ State University of Iowa
Texas A & M College
+ University of Alabama
University of Dayton
+ University of Detroit
+ University of Nebraska
University of New Mexico
University of Notre Dame
University of Tulsa
University of Wichita
+ Washington State University
+ West Virginia University

COLLEGES WITH ENROLLMENT OVER 10,000

+ Columbia University
+ Harvard University
+ Michigan State University
+ New York University
San Jose State College
+ Temple University
The Pennsylvania State University
+ The University of Texas
+ University of Buffalo
+ University of California (Berkeley)
+ University of Cincinnati
+ University of Colorado
+ University of Florida
University of Houston
+ University of Illinois
+ University of Missouri
+ University of Pennsylvania
+ University of Washington
+ Washington University (St. Louis)

Source of Enrollment Data: The World Almanac, 1959.

LEGEND

+ Member of American Association of Collegiate Schools of Business
@ Associate Member of American Association of Collegiate Schools of Business
# Provisional Associate Member of American Association of Collegiate Schools of Business
* Those not having Collegiate Schools of Business.

The foregoing reasons seemed enough to require a division among the schools on the basis of enrollment as this would be an indication of their capabilities.

Another area of interest as far as general information is concerned is the department in which the informant teaches. Twenty-seven informants of the fifty-six in the analysis teach in the accounting department while the next largest number as shown in Table III is in business administration. The management department seems to command some attention as far as those questioned are concerned; in total, they accounted for nine instructors. About the only department not represented in the group was business education. This tabulation gives an early clue as to the departments where data processing courses will be found. This will be discussed later in the section on courses.

TABLE III

ANALYSIS OF DEPARTMENTS IN WHICH INFORMANTS TEACH

Department	Informants in Areas						
	Northeast	Midwest	South	Southwest	West	Northwest	Total
Accounting	8	9	5	2	2	1	27
Business Administration	1	1	1	4	2	1	10
Management	1	2	1	-	2	-	6
Industrial Management	2	-	1	-	-	-	3
Marketing	1	1	-	-	-	-	2
Economics	-	2	1	1	-	-	4
Office Administration	-	1	-	-	-	-	1
Statistics	-	-	-	2	-	-	2
Graduate School	1	-	-	-	-	-	1

The accounting department seemed to dominate in the eastern half of the country. The three areas in the western half had so few returns that it is hard to say that any particular department's staff had a hold on the subject. Seven of those that taught in business administration were in the western half, though, while both of the statistics instructors taught in the Southwest.

Only one of the informants taught strictly in a graduate school of business. This informant was in the Northeast section.

The instructors questioned were not without honor for over 55 per cent of the informants hold a doctor's degree while numerous others were to complete theirs within a short time. Master's degrees, the majority in business administration, were held by twenty-two. The others were: Bachelor of Science, one; Bachelor of Law, one; and none shown, one. Seventeen, or 30 per cent, indicated that they also hold a Certified Public Accountant certificate.

Many manufacturers hold several short courses, within a year's time, on data processing. Usually universities and colleges are invited to send a representative. As mentioned earlier, forty-five of those questioned had had the experience of one of these courses. A large number of these pertain to the actual operation of the hardware. If one is to teach in this field it would be a benefit to him to have the opportunity of the special training. Forty-three (the majority from those attending the sessions mentioned earlier) had received some type of specialized training while the other thirteen indicated that they had none. The midwest section led by far the other areas in the number with this particular type of training. The tabulation of this is shown in Table IV.

TABLE IV

ANALYSIS OF INFORMANTS HAVING SPECIAL TRAINING

Area	Informants Having Training	Informants Not Having Training
Northeast	10	4
Midwest	14	2
South	7	2
Southwest	6	3
West	5	1
Northwest	1	1
Total	43	13

Since the American Association of Collegiate Schools of Business include some of the foremost business schools in the country, it would be thought that some of these might be the leaders in this field of study. Therefore, an analysis was made of those returning questionnaires on this point. Of the small schools (less than 5,000 enrollment) four were members of the Association while three were associate members.[4] In the medium-size class, ten of the sixteen were members and one was a provisional associate member. In the large schools, sixteen were members while two were not. This tabulation includes only those colleges which have collegiate schools; it does not include those colleges with only departments pertaining to business subjects.

While forty-three schools could qualify as collegiate-level schools, the remaining thirteen all had departments or divisions of business.

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[4]See Table II.

These were included because of the interest which they offer to the subject. Most of these were large enough in enrollment to justify their use in compiling the information. For instance, three colleges in California are not classified as having collegiate schools of business, but all three offer a diversified field of business courses. Two of these particular schools are medium size and the other is in the large category. All three do have courses in data processing.

Two universities definitely do not have collegiate schools but do have departments of industrial management offering courses in accounting, economics, and management. The two, Massachusetts Institute of Technology and Georgia Institute of Technology, offer courses in data processing in their management departments. One has on its faculty an individual who has done considerable work in applying machines to business.

The list of those in the final consideration is shown in Table II, broken down to show those having collegiate schools and those not.

Since the advent of the electronic computer, several individuals have wondered about courses being offered in this one particular phase of data processing. The development of these machines also brought about a recent study on the same subject by the American Accounting Association.[5] None of these developed material on the other area of data processing, i. e., any courses using punch-card equipment, as part of their main objective.

This present study tries to discover the entire program of courses which the various schools are now offering. The study included a total

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[5]"Final Report, AAA Committee on Accounting Instruction in Data Processing." (American Accounting Association, 1957-1958. Mimeographed.)

of thirty-nine colleges which offered some type of data processing courses (Table V) and seventeen colleges which did not offer anything in the field. Of those schools accredited by the American Association of Collegiate Schools of Business approximately 71 per cent offer students at least one course in data processing, while the other 29 per cent offer nothing. Of those not associated with the Association in any way, 68 per cent offer at least one course and 32 per cent do not.

There is really not much difference in the analysis of the offering of courses based upon membership in AACSB. There is the point, though, that those schools not connected with the Association see an importance in data processing and are trying to keep abreast of developments just as Association members are trying to do.

Some of the smaller colleges indicated that they could not delve into data processing because of their size. In analyzing the colleges on this basis it was found that six of fourteen small schools, fifteen of twenty-three medium-size schools, and eighteen out of nineteen large schools all had data processing in some form. It can be seen readily that the larger schools tend to have some courses. The division between those having data processing and those not in the small class is almost equal, the negative reply being somewhat larger. In the medium-size college, those offering a course are almost double (lacking one) of those not offering any. Nearly half of those in the study not having data processing are in the small schools class.

A conclusion could now be drawn that the larger the school, the more apt it is to have some form of data processing in its curriculum. Approximately 79 per cent of the medium- and large-size colleges offer

TABLE V

COLLEGES IN STUDY OFFERING DATA PROCESSING
COLLEGES IN STUDY NOT OFFERING DATA PROCESSING

THOSE OFFERING DATA PROCESSING

NORTHEAST

Columbia University
Darthmouth University
Johns Hopkins University
Massachusetts Institute of Technology
New York University
Pennsylvania State University
Temple University
University of Buffalo
University of Pennsylvania

MIDWEST

Bradley University
Iowa State College
Michigan State University
University of Cincinnati
University of North Dakota
University of Notre Dame
University of Dayton
University of Detroit
University of Illinois
University of Missouri
Washington University (St. Louis)

SOUTH

Georgia Institute of Technology
Louisiana State University
University of Alabama
University of Arkansas
University of Chattanooga
University of Florida

SOUTHWEST

Baylor University
Oklahoma State University
Texas A. & M. College
University of Houston
University of Texas
University of Tulsa

WEST

Sacramento State College
San Diego State College
San Jose State College
University of California (Berkeley)
University of Colorado

NORTHWEST

University of Washington
Washington State University

TABLE V -- Concluded

THOSE NOT OFFERING DATA PROCESSING

NORTHEAST

Clark University
Clarkson College
Fordham University
Harvard University
Lehigh University

MIDWEST

Drake University
St. Louis University
State University of Iowa
University of Nebraska
University of Wichita

SOUTH

Duke University
University of Virginia
West Virginia University

SOUTHWEST

Abilene Christian College
The Rice Institute
University of New Mexico

WEST

University of Denver

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data processing, as can be seen in Table VI. In absolute numbers, this means that a total of thirty-three out of forty-two in the respective categories answered positively to this question.

Those offering data processing by area are shown in Table VII. The percentage offering a course is nearly the same in all areas. Four areas have between 66 and 68 per cent offering data processing while the West and Northwest are somewhat extreme in their percentage. These two areas are influenced by having fewer returns received as well as having fewer schools in the mailing list.

TABLE VI

ENROLLMENT OF COLLEGES OFFERING DATA PROCESSING

Area	Number of Schools Under 5,000 Enrollment		Number of Schools 5,000-10,000 Enrollment		Number of Schools Over 10,000 Enrollment		Total Schools
	Have Data Processing	Do Not Have Data Processing	Have Data Processing	Do Not Have Data Processing	Have Data Processing	Do Not Have Data Processing	
Northeast	1	3	2	1	6	1	14
Midwest	2	1	4	4	5	-	16
South	2	1	3	2	1	-	9
Southwest	1	2	3	1	2	-	9
West	-	1	2	-	3	-	6
Northwest	-	-	1	-	1	-	2
Total	6	8	15	8	18	1	56

There were a few groups that did not follow the pattern of the whole. The first was the medium schools in the Midwest. Half of the eight in this class did not offer data processing. This was the most for any group. The group that followed next was the small schools in the Northeast which had three schools not offering data processing and only one offering it. The last two groups are the small schools in the Southwest and the West with one offering and none offering data processing, respectively.

TABLE VII

NUMBER AND PERCENTAGES - COLLEGES OFFERING AND NOT OFFERING DATA PROCESSING: BY AREA

Area	Data Processing Offered		Data Processing Not Offered	
	Number	Percentage of Total Schools in Area	Number	Percentage of Total Schools in Area
Northeast	9	64.3%	5	35.7%
Midwest	11	68.7	5	31.3
South	6	66.7	3	33.3
Southwest	6	66.7	3	33.3
West	5	83.3	1	16.7
Northwest	2	100.0	-	0.0
Total	39	69.6%	17	30.4%

To help determine how much importance the various schools place upon the new field of data processing, a question was asked to find out how many of the faculty members taught courses in this field. It was discovered that one school had as much as 18 per cent of its faculty teaching some phase of data processing. This was the highest percentage of any school reporting although one return not used stated that 25 per cent of its faculty taught courses.[6] Two per cent of the faculty teaching data processing seems to be the most common although six schools have 10 per cent or better teaching. These percentages include both full-time and part-time faculty members teaching some data processing.

[6]The University of Ottawa, Canada.

Those in this area do not necessarily spend all of their time teaching this one subject. The faculty as referred to here means the business school faculty or those that teach business subjects in those colleges not having a collegiate level school.

Georgia Institute of Technology had the most instructors (five) teaching data processing. This composes 17 per cent of their faculty. It includes two full-time and three part-time members out of a total of thirty. It is interesting to note that this school places so much emphasis on this field in its business subjects. This may be partly due to the type of school that it is, i.e., emphasis on technical skill.

The school having 18 per cent of its faculty teaching data processing only has seventeen on its faculty. This, too, would indicate that it is interested seriously in the subject. It is located where there is considerable new industrial activity and in an area that is densely populated. It has an immediate demand from its surrounding area to provide qualified personnel.

Three universities do not have any full-time instructors teaching data processing but do have part-time instructors doing it, one of which has four part-time instructors.

Seventeen colleges just have one instructor teaching in this field. This one though may account for 10 per cent of a particular faculty. Twelve schools have two instructors that at least partially devote some of their time to data processing courses. There are two schools each that have three and four instructors giving time to courses. Finally there is Georgia Institute of Technology with five which has been mentioned already.

A number of schools not only have full-time instructors but also

have part-time instructors teaching classes on data processing. The majority of these schools only have one part-time instructor but there is one school that has two part-time, one that has three part-time, and one which has four part-time. Table VIII shows in summary form the breakdown of the number of instructors.

TABLE VIII

NUMBER OF INSTRUCTORS OF SCHOOLS OFFERING DATA PROCESSING

Area	Geometric Mean of Percentage of Faculty for the Area	Number of Full-time Members on Faculty					Number of Part-time Members on Faculty					No Information
		0	1	2	3	4	0	1	2	3	4	
Northeast	2.6%	1	2	2	1	1	6	-	-	-	1	2
Midwest	3.6	1	6	4	-	-	9	1	1	-	-	-
South	3.6	-	2	3	-	-	4	-	-	1	-	1
Southwest	3.6	1	2	2	-	1	5	1	-	-	-	-
West	3.4	-	4	1	-	-	3	2	-	-	-	-
Northwest	4.9	-	1	-	1	-	1	1	-	-	-	-
Total		3	17	12	2	2	28	5	1	1	1	3

One question which has been discussed occasionally by individuals in the teaching profession is whether a major in data processing should be offered by colleges. A question related to this would be whether the major, if offered, would be on an undergraduate or a graduate level. While this may be causing some debate around the country it is interesting to see that the results of this study show that none of the schools represented as of yet offer the student a major in this specialized field.

Only one informant, the University of Ottawa, indicated that it had a major in data processing and it offered this at the undergraduate level. This school, though, was not included in the study because it was outside of the United States. Due only to the interest aroused by this question in the first place, this school's program is discussed briefly here.

Four data processing courses are offered by the University of Ottawa, but three of these are in the mathematics department of that school. The fourth course is in the accounting department. Other courses necessary in order to complete the major include philosophy, commercial law, beginning and intermediate accounting, cost accounting, tax accounting, and auditing. Although it is a business major, it also tends to be heavily weighted with mathematics since some of the data processing courses require as a prerequisite either elementary or advanced mathematical analysis. All of the data processing courses are upper-division level, i.e., junior or senior level. One mathematics course is at the graduate level.

The accounting course, "Data Processing," requires that the student have had intermediate level accounting. The content of this course includes definition of data processing, elementary programming of machines, description of various pieces of hardware, and applications to accounting and management control.

One mathematics course, "Scientific Computation," has as a prerequisite elementary mathematical analysis. This course introduces the student to computers as well as some more programming. The course is slanted more toward the mathematics side rather than the business side since numerical analysis, linear systems, and integration are covered

during the semester. These subjects are covered in their relation to the computers and other hardware.

The student taking a major in data processing at Ottawa would be well grounded in mathematics. The other two mathematics courses, "Numerical Analysis" and "Functional Analysis," are nothing more than advanced mathematics courses. The University is trying to produce a graduate with a strong knowledge of mathematics in machines and at the same time provide this student with enough basic business subjects (especially accounting) to equip him to work in the business world. Perhaps this graduate would be a good individual to be an interpreter for the management and the scientists in applying machines to business. The basis for this statement stems from one of the primary barriers in this field, that of communications.

The University has provided a data processing center equipped with an IBM 650 electronic computer and the basic peripheral hardware. During a semester course, each individual has an opportunity to actually use the equipment himself but less than five hours during the semester. This is time spent on all the machines; not any particular one.

New York University, while not offering a major, does have a "Certificate" program in their Management Institute. It is their belief that data processing is not for the undergraduate but should be presented to the adult already engaged in business. It feels that actual training on equipment is beyond the scope of responsibility of the college. Therefore, the University provides three programs in its Institute which is a division of its General and Extension Services. Another thing different in their presentation is that there is no formal admission requirements to the courses offered as are usually required by most

colleges. After a certain number of courses have been successfully completed a certificate is awarded in each of the three separate programs. These programs are: 1) Systems and Procedures Program, consisting of designing and controlling business forms, methods analysis, simplifying systems, office automation, and developing managerial abilities; 2) Program in Machine Accounting, offering application of machine equipment and systems, laboratories in wiring and operating punch card equipment, and planning and managing machine installations; and 3) Electronic Data Processing Program, composed of electronic and tape-processing systems, office automation for small and medium computers, programming for computers and random access accounting in business, transistorized intermediate-size computers, large-scale computers, and applications of Operations Research techniques in business and industry.

Each program channels its interest to a particular group. The courses are conducted from the viewpoint of those engaged in the various fields. They provide actual practice with late model equipment up to the point of reaching specialization in some instances. Therefore, the Management Institute has a sufficient market for its courses so that it is able to offer such concentrated programs. It is different from an accredited college major in that it does not try to provide the individual with anything other than the field in which the individual is interested.

None of these programs of the Institute can be applied toward a college degree. As stated, only a certificate is granted at the completion of minimum requirements of the particular program.

It is not the purpose of this discussion to say that the major at the University of Ottawa or the programs of New York University are correct or that they are wrong. The two are used here solely as actual

examples of what might be done in the way of preparing the individual for a career in data processing.

Not all of the schools require that the student purchase a textbook. Of the thirty-nine having data processing, only twenty-three have the student buy at least one text, twelve have no text, and two gave no answer to the question. Besides textbooks, the colleges may use materials furnished by manufacturers of the hardware. Of those that use textbooks, twenty also use these materials. Of the fourteen that do not use required texts, all but two use manufacturer's materials. This type of material is usually free of charge and plentiful in reasonable quantities. These consist of instructions for operations, of applications of the hardware, of newsletters, and as well, of standardized tests.

Since the field of study is relatively new, there have not been too many books written on the subject suitable to use as textbooks in the courses of those schools offering data processing. Many of these that have been written have become outdated by the time they are available for use. Another complication has been that so many of the books approach the subject from the same view. These things, then, have made it difficult in choosing a text, if one was desired, for a particular course. Fifteen authors in total were listed by the informants as now being used. From Table IX one can see that most of the books are used at only one college. This points up the fact that each school has its own ideas as to how these courses should be taught; each with its own opinion as to the best book at the present time.

Only two authors out of the list have gained any following at all from the informants. Ned Chapin and his book, An Introduction to

TABLE IX

LIST OF AUTHORS AND TEXTS USED
IN DATA PROCESSING COURSES
INCLUDED IN STUDY

Author	Title (Publisher)	Number Using Text
Chapin, Ned	An Introduction to Automatic Computers (Van Nostrand)	8
Canning, R. G.	Electronic Data Processing for Business and Industry (John Wiley & Sons, Inc.)	
	Installing Electronic Data Processing Equipment (John Wiley & Sons, Inc.)	6
Kozmetsky, Geo. & Kircher, Paul	Electronic Computers and Management Control (McGraw-Hill)	4
McCracken, D.	Digital Computer Programming (John Wiley & Sons, Inc.)	3
Bell, Wm. D.	A Management Guide to Electronic Computers (McGraw-Hill)	3
Andree, R. V.	Programming the IBM 650 Magnetic Drum Computer and Data Processing Machine	3
Gillespie, C. M.	Accounting Systems: Procedures and Methods (Prentice-Hall)	2
Harvard University	Case Studies On Organization Systems (Harvard University Press)	1
Neuner, J. J. W. & Neuner, U. J.	Accounting Systems Installation and Procedures (International Textbook Co.)	1
Bross, I. D.	Design for Decision (Macmillan)	1
Bowman, E. H. & Fetter, R. B.	Analysis for Production Management (Richard D. Irwin)	
	Analysis for Industrial Operations (Richard D. Irwin)	1
Barish, N.	System Analysis for Effective Administration (Funk & Wagnalls)	1
Gotlieb, C. C. & Hume, J. N. P.	High Speed Data Processing (McGraw-Hill)	1
Moore, Humble, & Chapman	Electronics in Business Management (University of Alabama)	1
Charnes, A. & Cooper, Wm. W.	An Introduction to Linear Programming (John Wiley & Sons, Inc.)	1

Source of Publishers: Library of Congress Catalog - Books: Subjects

Automatic Computers,[7] have been selected by eight of the schools. At least one school in each area, except the South, use this as a text in some course. The writer makes a point to state that his book is written from a business systems approach. There is a minimum of engineering and mathematics included only for help in understanding the operations of a computer. Two main objectives are developed through the book: 1) the computer itself; and 2) uses of the computer. Along with the book, the author has included a group of comparative tables on available equipment, illustrations, an extensive glossary including much technical terminology, and suggested readings.

The other author with some following is Richard Canning. He has written two books, both of which are being used. They are Electronic Data Processing for Business and Industry[8] and Installing Electronic Data Processing Equipment.[9] The latter of the two was a result of the first writing. Together the two books make a complete unit on the feasibility study approach of the field.

Canning's first book was an outgrowth of a university course which he had taught. This book considers the area from the view of one interested in electronic data processing machinery for his firm; this individual does not know how to approach the problem, i.e., what should be done in acquiring the hardware. As in Chapin's book, there is no need

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[7]Ned Chapin, An Introduction to Automatic Computers (Chicago: Van Nostrand, 1955).

[8]Richard G. Canning, Electronic Data Processing for Business and Industry (New York: John Wiley & Sons, Inc., 1956).

[9]Canning, Installing Electronic Data Processing Equipment (New York: John Wiley & Sons, Inc., 1957).

for an engineering or mathematical background; not even one engineering machine is discussed. Besides this, the author considers hardware specifications trivial and no need to discuss except as pertaining to a particular problem. For those in fields of training other than accounting, the author has tried to present more physical control problems of the firm. Accounting problems have been minimized since most accountants are already acquainted with punch card equipment and the problems encountered here would be similar.

If one should desire a single word in describing the approach of Canning, probably "investigation" would be most descriptive. Over half of the book pertains to a systems study. This includes the beginning inquiries of such a study and carries the discussion to such items as what should be done in an extended, detailed study of the possibilities of electronic equipment for a particular firm.

Installing Electronic Data Processing Systems begins where the first Canning book stops. The first started with a feasibility study and concluded with a presentation of a proposal to top management for equipment. The second book discusses what is involved after an order for hardware has been given.

The approach that Canning takes this time is still the systems study but with an extra help included. A case study is used throughout the book. It is based upon a number of actual experiences of different industries. This has been used to generalize the area covered so as to have a wider appeal. Also the problems encountered will probably be similar.

It can be noticed from the titles that about half of the books deal with electronic computers while the other half is a mixture of several

subjects. This still leaves the older subject, punch card equipment, with little to choose from if one is to have a course dealing strictly with these machines.

How much material should be covered in data processing? Probably the number of courses taught by the various schools would give insight into this problem. It was found that the number ranged from no courses taught to five courses taught at any one school. Table X reveals the breakdown by the number of courses. Of course, the seventeen having no courses are those schools not offering data processing. The largest group was in the class having only one course. The percentage for this group was nearly 50 per cent. If those offering two courses were added to the first group, it would mean nearly three-fourths of the total would be included. Only eight schools have more than two courses which they offer.

TABLE X

NUMBER OF COURSES OFFERED AT ANY ONE COLLEGE IN STUDY

Number of Courses	Number of Schools in Area						Total Number of Schools	Percentage of Those Having Data Processing
	North-east	Mid-west	South	South-west	West	North-west		
0	5	5	3	3	1	-	17	-
1	5	6	3	2	2	-	18	47%
2	1	3	1	2	2	1	10	26
3	1	2	1	-	1	1	6	17
4	-	-	1	1	-	-	2	5
5	1	-	-	1	-	-	2	5
Total	13*	16	9	9	6	2	55*	100%

* New York University omitted. See discussion on page 32.

The classification of one course in Table X seems to dominate in the northeast and the midwest areas while the other classifications are fairly well distributed over the country. Of the twenty-nine schools in the Northeast and the Midwest, only four schools have more than two courses in their curriculum.

New York University has been omitted from this analysis since its programs cannot be rightly called either undergraduate or graduate school sponsored. It does though, offer more courses than any other school. As a matter of fact, it offers in its three programs a total of twenty courses, which is four times greater than any other informant's school. This number is even greater than the midwest area which otherwise offers the most courses on an area basis.

If one were to look at the size of the schools and the number of courses taught in an area, he would find that those schools in the Midwest with an enrollment of less than 5,000 had the most courses for its size. This only amounted to three courses. The southern schools with an enrollment between 5,000 and 10,000 had the largest number of courses in its category with a total of nine courses. The large schools in the Northeast had the most courses for its size class with twelve courses offered. A tabulation of this is given in Table XI.

Those schools offering only one or two courses could have several reasons. They could consider that the subject was limited and therefore one or two courses would cover the subject sufficiently. Another idea would be that the student only needed an introduction to the subject matter, therefore, one course would suffice. A final suggestion could be shortage of funds, faculty, equipment, or students.

Those schools offering more than two courses apparently consider

TABLE XI

NUMBER OF COURSES OFFERED:
ENROLLMENT OF COLLEGE AND DEPARTMENT

Size of School	Area	Number of Courses by Area	Departments in which Courses are Offered												Total by Size
			Accounting	Business Admin.	Statistics	Management	Industrial Management	General Business	Industrial Engineering	Marketing	Personnel Admin.	Economics	Business Education	No Information	
Under 5,000	Northeast	1	-	-	-	1	-	-	-	-	-	-	-	-	-
	Midwest	3	2	-	-	-	-	-	-	1	-	-	-	-	7
	South*	2	2	1	-	-	-	-	-	-	-	-	-	-	-
	Southwest	1	-	-	1	-	-	-	-	-	-	-	-	-	-
Between 5,000 and 10,000	Northeast	2	-	-	-	-	1	-	1	-	-	-	-	-	-
	Midwest	7	-	5	1	1	-	-	-	-	-	-	-	-	-
	South	9	3	-	3	-	3	-	-	-	-	-	-	-	-
	Southwest	8	2	6	-	-	-	-	-	-	-	-	-	-	32
	West	4	-	2	-	1	-	-	-	-	-	-	1	-	-
	Northwest	2	-	2	-	-	-	-	-	-	-	-	-	-	-
Over 10,000	Northeast	12	7	1	-	-	1	1	-	-	-	-	-	2	-
	Midwest	8	4	-	1	-	-	1	-	-	1	1	-	-	-
	South	1	1	-	-	-	-	-	-	-	-	-	-	-	35
	Southwest	6	2	-	1	-	-	1	-	-	-	-	-	2	-
	West	5	1	1	-	3	-	-	-	-	-	-	-	-	-
	Northwest	3	3	-	-	-	-	-	-	-	-	-	-	-	-
Total		74	27*	18*	7	6	5	3	1	1	1	1	1	4	

*Area includes course that can be taken in either Accounting or Business Administration.

that the subject is sufficiently broad so that several courses are needed to cover the material adequately. It is possible that they believe that the subject should be more thoroughly covered if the students desire to enter this area of study more deeply.

Generally the courses taught in the thirty-nine schools were in the accounting department but there were many other departments represented also. If the various departments were to be ranked by the number of courses offered they would fall into the order as shown in Table XII. Twenty schools have courses in the accounting department, while only nine schools have courses in business administration, the second department in rank. The Northeast area seems to be concentrated in the accounting department but has about half of the courses scattered in six other departments, one of which is in the electrical engineering department. Three of the schools in this area have courses in industrial management or in industrial engineering. Massachusetts Institute of Technology, one of these, has its only course in industrial management.

The midwest area has the majority of its courses about equally divided between accounting and business administration with six other departments also having at least one course. This is the area in which courses are offered in marketing, personnel administration, and economics. This is the only area in which these departments are represented.

Of the twelve courses offered in the southern area, six are accounting courses with the remaining six in industrial management and in statistics. This area is one that is more homogeneous as far as the decision where a data processing course should be taught since only three departments are represented. Georgia Institute of Technology accounts for the three courses in industrial management and therefore if this school was omitted only two departments would be left.

TABLE XII

RANK OF DEPARTMENTS IN WHICH COURSES ARE TAUGHT

Rank	Department	Number of Courses in Department
1	Accounting	27
2	Business Administration	18
3	Statistics	7
4	Management	6
5	Industrial Management	5
6	General Business	3
7	(Industrial Engineering	1
	(Marketing	1
	(Personnel Administration	1
	(Economics	1
	(Business Education	1
	No Information	4
	Total	74

Rank	Department	Number Enrolled in Department, Fall, '58
1	Accounting	638
2	Business Administration	354
3	Industrial Management	155
4	Statistics	141
5	Management	80
6	General Business	67
7	(Personnel Administration	20
	(Economics	20
9	Marketing	15
10	Industrial Engineering	6
11	Business Education	N/I
	No Information	90
	Total Enrolled	1,586

Something unusual occurs in one of the schools of the South. This school has a course listed in two different departments, but the number and the content of the course is the same as shown by the description. The student may enroll in the course in either department, whichever he wishes. The material which the student would receive might vary depending on whether he chose accounting or business administration as the department.

Business administration plays an important role in the Southwest, even over accounting. One school has four of its five courses in this department. This is the most concentration of any one department in the schools in the study. This and only one other school account for the business administration influence though. Four schools have courses in accounting and two have statistics courses.

The West pays little attention to the first in rank but has about half of its courses in the department of management, with business administration following closely behind. This is not as if the courses were spread among the six schools, that is to say, that several schools have courses in several departments, for each school has its course(s) in one particular department. An exception to this is the school that has a course in the business education department also has one in management.

On casual inspection, one might think that the schools in the Northwest were most homogeneous in department offerings since only the two leading departments are represented. Another look and the thought might change to just the opposite. Of the five courses offered, three are in accounting and two are in business administration. As evidence of lack of homogeneity one school has its three courses in accounting and the other has its two courses in business administration. Of course, this analysis as to a common belief or lack of it is harmed by the fact of only two schools replying for this study.

This discussion on departmental offering can also be seen in Table XI, which has divisions by size of school in each area as well. As another basis of determining ranking of the departments, one could consider the number enrolled in the various departments. Accounting

and business administration, as shown in Table XII, again are at the top of the list but below this the list changes from that based on the number of courses offered. While accounting makes up only about 36 per cent of the number of courses offered, it accounts for 40 per cent of the students taking data processing. Business administration has 22 per cent of the students enrolled while having 24 per cent of the total number of classes. The industrial management department and the statistics department each accounted for about 9 per cent of the students leaving the remaining 20 per cent to the other eight departments.

Three areas had over 300 students enrolled during the fall semester of 1958. Of these the Midwest was the largest, but only by a few students over the Northeast. The Southwest area came in with third place in having the most students. None of the areas, though, fell below one hundred in enrollment.

As for the number enrolled in any particular school, only five of the schools had over one hundred enrolled. Two of these were in the Northeast, two were in the Southwest, and the fifth (Georgia Institute of Technology) was in the southern area. Although the Midwest led in the total number of students, this area had no schools with enrollment over sixty. The school which had the second highest enrollment is a medium-size school while the others are in the large-size class.

While both analyses seem to place accounting and business administration as the two most popular departments for data processing, there is still considerable variation among schools. The material to be covered in a data processing course can be adapted to many fields, as is shown here by some extreme cases.

Once it has been decided to teach courses in data processing, then

it is necessary to decide at what level it will be taught. As has already been mentioned, New York University does not feel that such courses are college material but should be taught as adult education courses. Other colleges believe that graduate school is the place for the courses. From this study, though, it appears that the majority believe that data processing should be taught to the undergraduate. Even at the undergraduate level, there is still the problem of determining whether the course will be senior, junior, or what.

Six of the colleges in the study have only graduate level courses to offer their students. Four of these schools are in the Northeast, one is in the Midwest, and one in the West. All of these schools are in heavily populated areas, such as Detroit or New York City, where one would think that there was a heavy demand for trained individuals. One of these schools is a small school and this might be the reason for limiting the courses, but the others are medium- and large-size schools and this probably is not their reason. Membership in AACSB is also held by five of the six schools.

Both graduate and undergraduate level courses are taught at five schools. These schools are located in four of the areas for good representation. All but one of these colleges are large-size, and the remaining school if medium-size. Also, four hold membership in AACSB.

The one college above which offers both graduate and undergraduate courses and is a medium-size school also is the school which had the second largest enrollment in the analysis mentioned earlier. It is the school which offers the most courses of all in the study. This school is the College of Business at Oklahoma State University.

The remaining schools only offer undergraduate programs in data

processing. These account for approximately 70 per cent of the schools that offered data processing. There was a total of fifty-nine out of seventy-four courses which were at the undergraduate level. This level of the courses tended to dominate in all sections of the country.

In deciding the level of the undergraduate courses, it appears that 69 per cent of them are upper division, i.e., of junior or senior rank. The analysis showed that twenty-six of the fifty-nine undergraduate courses specified that one should be of at least junior standing before taking the course, while fifteen courses specified that one be of senior rank. Freshmen and sophomore level courses accounted for only 14 per cent. Seventeen per cent only showed that the course was undergraduate with no further information given.

To help tie in the above discussion with an earlier one, Table XIII is presented. It gives an analysis of the level of the seventy-four courses by the department in which they are taught as well as on an area breakdown.

Although data processing is not considered as a major field by any of the informants, it is a subject which has its foundation laid in other courses. It is different then, from other "electives" in that the majority of these do not have prerequisites, at least, for the first courses. This fact is pointed up in the analysis of prerequisites which are required before one is allowed to enroll in the various courses of data processing. Only twenty courses specifically stated that no prerequisites were necessary while forty-nine stated that there were prerequisites to the course. Five courses gave no clue as to their position on this.

The number of courses that the student must have before taking a

TABLE XIII

ANALYSIS OF LEVEL OF COURSES:
DEPARTMENT AND AREA

Department	Area	Level of Course						
		Freshmen	Sophomore	Junior	Senior	Under-graduate	Graduate	Total
Accounting	Northeast	-	-	1	1	4	1	7
	Midwest	-	1	1	4	-	-	6
	South	-	1*	4	1	-	-	6
	Southwest	-	-	2	1	-	1	4
	West	-	1	-	-	-	-	1
	Northwest	-	-	-	-	3	-	3
Business Administration	Northeast	-	-	-	-	-	1	1
	Midwest	-	-	2	-	-	3	5
	South	-	1*	-	-	-	-	1*
	Southwest	-	1	4	-	-	1	6
	West	-	-	2	-	-	1	3
	Northwest	-	1	1	-	-	-	2
Management	Northeast	-	-	-	-	-	1	1
	Midwest	-	-	1	-	-	-	1
	West	-	-	1	1	1	1	4
Industrial Management	Northeast	-	-	-	-	1	1	2
	South	-	-	-	3	-	-	3
General Business	Northeast	-	1	-	-	-	-	1
	Midwest	1	-	-	-	-	-	1
	Southwest	-	-	1	-	-	-	1
Industrial Engineering	Northeast	-	-	-	-	-	1	1
	Midwest	-	-	1	1	-	-	2
Statistics	South	-	-	3	-	-	-	3
	Southwest	-	1	1	-	-	-	2
Marketing	Midwest	-	-	-	1	-	-	1
Personnel Administration	Midwest	-	-	-	-	-	1	1
Economics	Midwest	-	-	-	1	-	-	1
Business Education	West	-	-	-	-	1	-	1
No Information	Northeast	-	-	-	-	-	2	2
	Southwest	-	-	1	1	-	-	2
Total		1	7	26	15	10	15	74

* Duo-course - take in either department.

particular data processing course was sometimes surprising. There were six courses which required from four to six prerequisites. In the two cases where six courses were required, the prerequisites were in entirely different departments. One course required that the student have at least three years of accounting. This would mean no less than six courses and more would probably be desired. The other course, at another school, required two years of mathematics through calculus as well as a year of statistics.

This required background could provide one with an insight as to the type of course which he could expect. The first was channeled from the beginning on an accounting view. The second course would be slanted definitely toward the mathematics view. Both of these courses can be found in the same area. This again strengthens earlier statements that there is a wide variation in belief as to what should be taught.

One course and two courses were the most common numbers of prerequisites for a data processing course. Of the forty-nine requiring prerequisites, twenty-four required one course before enrolling in the data processing course. Ten other courses required two prerequisites. Seven courses stated that a prerequisite was required but other than courses. Table XIV reveals the number of prerequisites by area. This discussion has not included any mention of standing of the student, i.e., the student must be of junior standing, etc. This is in addition to the prerequisites here.

Accounting courses dominated the prerequisites which were required, too, just as they accounted for a large proportion of the total data processing courses. The tabulation of Table XV shows that a number of various accounting courses were required by the schools in the study.

TABLE XIV

NUMBER OF PREREQUISITES REQUIRED FOR
A COURSE IN DATA PROCESSING

Area	Number of Courses Requiring No Prerequisites	Number of Prerequisites Required for a Course						Number of Courses Requiring Prerequisites other than a Course	No Information	Total Number of Courses for Area
		1	2	3	4	5	6			
Northeast	4	4	2	-	2	-	-	1	2	15
Midwest	3	8	1	3	-	-	2	2*	-	18
South	4	2	2	-	-	-	-	1	3	12
Southwest	5	4	3	-	1	1	-	2*	-	15
West	3	4	1	1	-	-	-	-	-	9
Northwest	1	2	1	-	-	-	-	1	-	5
Total	20	24	10	4	3	1	2	7	5	74

* Each includes one course that required courses as well as other prerequisites.

TABLE XV

PREREQUISITES REQUIRED FOR COURSES

Area of Course	Area in which Required						Total for Department
	Northeast	Midwest	South	Southwest	West	Northwest	
Accounting: Elementary	9	4	3	9	4	-	-
Intermediate	-	6	-	2	-	-	-
Cost	1	6	1	2	-	-	-
Auditing	-	2	-	-	-	-	-
Systems	-	-	1	-	-	-	-
Managerial	-	-	-	-	2	-	52
Theory & Practice of Business Administration	-	1	-	-	1	-	2
Management: Business	1	-	2	-	-	-	-
Ind. or Prod.	1	-	-	-	1	-	5
Statistics: Business	1	1	-	2	-	2	-
Mathematics	-	2	-	-	-	-	8
Data Processing: IBM 650	1	-	-	-	-	-	-
Systems & Procedures	1	-	-	1	2	-	-
Introductory EDP	1	1	-	2	1	-	-
Manage. Applicat. EDP	-	1	-	-	-	-	11
Marketing Principles	-	1	-	-	-	-	1
Mathematics	-	6	-	-	-	-	6
Other: Grade Point	-	1	-	-	-	-	-
Consent of Instructor	-	1	-	-	-	1	-
Ability to Type	-	-	-	2	-	-	-
Approval of Advisor	1	-	-	-	-	-	-
Departmental Major	-	-	1	-	-	-	7
No Information	2	-	3	-	-	-	5
Total	19	33	10	21	9	5	

Elementary accounting made up over half of the different accounting courses listed. This course was strong in every area except in the Northwest. Eight courses of data processing required that the student have intermediate accounting while ten insisted that one should have through cost. Auditing and a "managerial accounting" course were required of the student by two courses. Accounting systems was only mentioned by one course. One course mentioned that one year of accounting approved by his advisor was necessary.

The fact that accounting courses played a big part in the prerequisites is not surprising. It has been shown that the majority of the courses are taught in the accounting department and that the majority of the courses in that department are upper-division courses. Yet a large number of other departments offering data processing considered accounting important as a prerequisite to their course.

A wide variety of prerequisites were encountered as Table XV shows. Statistics proved to be popular also as a prerequisite. This was required by some departments outside statistics. A number of strictly data processing courses were required. These were necessary mainly for advanced courses in the field.

Seven data processing courses required other than class standing and other courses before a student was permitted to enroll. Two courses required the consent of the instructor while one required the approval of the student's advisor. Ability to type was stated as being necessary in two courses. One course which is being offered is limited to students that are majoring in a particular department. Only one school requires that the student have a stated grade point average before being allowed in the data processing course.

Some of the titles of the prerequisites proved to be interesting. A few selected ones are given here:

"Theory and Practice of Business Administration."
"Managerial Applications of the Electronic Computer."
"Data Processing for Business."
"Statistical Analysis."

There were many other titles but they were not unusual in any particular way.

Data processing course titles themselves were interesting to read and study. The titles should provide one with information as to what will be found in a particular course. The titles included a range all the way from office automation to market research. The two most popular titles would be "Punch Card Accounting" and "Data Systems and Processing."

The field of electronic data processing in general came up with many interesting titles, some of which are listed here:

"Problem Solving with Electronic Computers."
"The Feasibility Study of the Electronic Computer."
"Special Topics in Operations Research."
"Applications of Large Scale Digital Computers to Business and Industrial Systems."
"Application of Computers to Problems in the Social Sciences."
"Planning Computer Applications."

The management phase showed up in a number of course titles:

"Management Information Systems."
"Management Application of Data Processing."
"Management Aspects of Computers."
"Management Programming and Control."
"Managerial Decision Making."
"Automation and Management."
"Management Decision Laboratory."

A few course titles were by themselves as far as classifying together are concerned but are just as interesting.

"Market Research."
"Advanced Business Systems."
"Communication Systems and Procedures in Industry."
"Machine and Electronic Accounting Methods."

"Tabulating Machine Operation."
"Principles of Systems and Procedures."
"Business Problems and Data Processing."
"Integrated Data Processing."

While there is a wide divergence among the titles there is still similarity. What would one say is the magic topic today? It would not be difficult to decide after reviewing the course titles given in the study.

It is understandable that many of the above titles are attractive. As appealing as they may be, it still remains that the title sometimes reveals little in the way of what is actually taught. One might think that the lists of titles were long, but the various items which are discussed in the courses were even longer. If categorizing were attempted, then the items would fall into about eleven groups or areas ranging from general accounting problem applications to wiring machines to symbolic representation of systems. From here the general areas would need to be divided into over thirty sub-topics.

Applications of data processing were discussed in forty-four of the courses. Applications in general were stated as being covered by eleven courses while many others were more specific in this area. It appeared that punch card and electronic accounting problems were important as was management control. While these two could well be placed in another category below, the courses specified that these were of an application nature and therefore should be included here.

Two courses stated that marketing applications were included in the course. Neither of these two courses was the one entitled "Market Research." This course only covers description of data processing equipment and general applications of the machines. The applications

probably are in the area of marketing, but this would only be an assumption of the writer.

The applications that are referred to here are not what would be called case problems. Application would be how the hardware could be used in the different areas; not with a concentration on any particular method used by a particular firm. These applications were given more detailed explanation by some of the informants. Accounts receivable, inventory, payroll, production control, and cost control were mentioned numerous times, probably the most widely covered applications.

The areas of systems study and data processing were the next two general areas which were most common among the courses in the study. Each of the areas was mentioned thirty-three times as being touched upon in a course.

Systems study differs from application of data processing in that here systems refers more to the overall picture of a process or function. For instance, an inventory control on machines would be application to one item whereas systems would include the whole accounting function.

The area of systems was divided among four main topics. The most common of these was systems design principles, but this was only mentioned in nine courses. Undoubtedly, other courses considered this topic as part of another. It would seem difficult to try to discuss systems without some knowledge of the principles. Possibly the various schools depend upon accounting courses to provide this for the student. The large number of accounting prerequisites may show this. It was stated in the first few pages of this study that there was uncertainty in this area.

Following closely behind design principles was the use of flow charts in order to help the student visualize the system. It is

surprising that no more than eight of the courses use this technique of teaching data processing. The flow chart method does not involve the student in minute details but does provide a sound overall picture of the flow of information. Most of these courses have the student do some flow charting during the semester.

Accounting systems was mentioned as part of seven courses. In some cases, the course consisted of nothing more than an accounting systems course with data processing included as a separate "system." In these instances, the section on data processing was more than an introduction to the subject. At the same time this course was not the only data processing course in these schools. This only occurred in four courses.

The fourth topic of importance was systems analysis. Along with this was interest in systems reports. This included analyzing the flow of information culminating with the decision as to what reports were needed. The courses specifically stated the content as analysis with no mention of flow charting being used.

One informant believed that a systems approach was the only way which a data processing course should be taught. The emphasis in a course would be on a symbolic representation of that particular method. The type of information in a particular system would be immaterial insofar that any system would be reduced to abstract terms. This could consist of flow charting, coding, or other types of symbols. After this had been thoroughly presented, then part of the course could be used for general study of machine usage. The entire course would be presented, though, from the abstract concepts of information systems.

The general area of data processing was covered in about three major subjects. These were components of punch card and electronic equipment,

case histories, and history of data processing. Every area of the country incorporated some of this information into their courses.

Description of the equipment, or the components, of an installation was the most popular in this area. The describing of the hardware did not include any operation of the equipment. Only a certain portion of the hardware would be covered in a particular course. For instance, in a course of punch card accounting, only punch card equipment would be discussed; in a course of electronics, electronic computers and tapes would be described. Occasionally, in a general overall course, both types of hardware would be described.

Case histories were popular in nearly every area. These were actual installations of equipment which various firms had. They did not necessarily present problems to be solved by the student but problems which had already been solved by the firm. These cases were distributed through the courses just as was the description of the equipment. Some of those which have provided cases are listed below.

United States Treasury
Army Signal Corps
Curtis Publishing Company
Price Waterhouse and Company
American Airlines, Inc.
Metropolitan Life Insurance Company
General Electric Company
Lockheed Aircraft Corporation
Allstate Insurance Company
International Harvester Company
Bank of America

All of these present problems, or histories, from different areas of the subject. This list does not contain all that are available but it does show companies which are well known, and therefore have a general appeal.

Some of the courses required that the student solve case problems during the semester. These might be anywhere from an actual case adapted

so that a solution was necessary to a case where the student was required to analyze a local firm and suggest improvements. Others presented a problem and required that the student design a data processing system for it.

History of data processing was presented in several courses. Little information was given by the informants as to what was covered under this topic. This was not considered important by the majority of the schools; only a few included it in their courses.

Machine operations, that is, the actual use of the machines in some form by the students, was part of several courses. The majority of the courses just covered the operations in a general way while others went much more into detail.

Punch card equipment operations were covered in a large way in those courses having machine operations included. One course in the study was mainly training the student in the operation of key-punch machines to a point one might call technical skill. Wiring of control panels for the hardware was stressed in several courses. The operations here also covered designing reports for particular machines.

Programming, in the sense of learning the operations of electronic hardware, was stressed just as much, if not more than, operation of punch card machines. Programming would cover the same area as machine operations of the respective equipment. Again, there was a wide span of ideas on programming. Some courses covered advanced programming. Many, as will be seen later, used the actual hardware to test out and to prove their problems. In other words, some schools possibly turned out accomplished programmers. Other schools covered this in varying degrees.

A conclusion could probably be drawn that in those courses of

electronic data processing, the consensus was that some programming should be introduced to the student. How technical the study of this should be would still be debatable. It is the belief of some that a hypothetical machine should be devised and a method of programming for it worked out. Those which follow this line of thinking continue to give the impression that learning an actual machine is technical work and should be left to the manufacturers to teach. The idea of a hypothetically-created machine would provide the basis of learning this type of equipment and would be sufficient for the student.

On the other hand many are of the school that think that if any programming is to be taught the student should have the benefit of an actual piece of hardware. This way, it would be possible to try the programs and thereby see what would really happen. Many schools have equipment and are doing just this.

An impression may be left that only those schools which have equipment hold to this second belief and those without hold to the first. This is not so. There are advocates of the first in schools with hardware. As well, advocates of programming commercially-produced equipment can be found in those schools with no hardware available.

Management aspects of data processing equipment was the next most numerous subject covered in the seventy-four courses. This does not refer to the application of the machines, but rather the impact which they have on management. Every area in the country included this in some course.

Three courses were of particular interest, each at a different school. One course, it will be remembered, was entitled "The Feasibility Study of the Electronic Computer." This course considered

only this aspect of the machines; other subjects were covered in earlier courses. Another course was one of survey-type covering the "electronic processes and their impact on management and industrial organization."[10] This included not only data processing but also entered the field of automation. A third course spent half of the semester studying problems of computer acquisition, feasibility, and cost and application of machines to the business entity from the management view.

Other courses considered impact on decision-making, control, planning, and economic evaluation of data processing and its hardware. In these courses, the management aspect was not as detailed as it was in the above three courses. They did give the student an insight into the problems which one might have to face if he entered this field.

A number of other subjects were mentioned but were not used to any great extent by the various schools; in most cases just two or three would mention them. Several, though, were of a nature that could be put to good use in other courses.

Operations Research, or analytical methods, was discussed as part of the content in six courses. Mentioned earlier was a course, "Special Topics in Operations Research," which would fall in this area. Linear programming, or mathematical techniques for solving problems, not related to machine programming, was presented in some of the courses. Other subjects, such as the "Monte Carlo" systems or gambling techniques, have been applied in this area as ways of solving business applications.

Closely related to this same idea is the use of management gaming techniques as tools of learning. Several associations have developed

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[10]Georgia Institute of Technology.

games which simulate a business community. The students are divided into companies and are competitors of the other students. Each group is required to make management decisions in order to promote its particular company in the business community over a number of years. The decisions are translated into machine language. From here the computer simulates the business economy and provides answers as to what the company has accomplished for that period. This technique, while there are several models, all provide an intriguing method of presenting problem solving on the management level.

While there was much discussion on the operations of the various pieces of hardware, both punch card and electronic, there was very little said on how information would be designed so that they could be processed by the equipment. The area of designing and coding of data was surprisingly covered by very few courses. A few courses had the student design actual forms for reporting as well as how the information was to be placed upon the primary source document. Coding systems were also included in a few courses. One project in a particular course was to set up a workable code for a specified problem to be used on a specific type of machine.

Three different schools thought that a seminar-type course should be offered the student. One of these three schools had only this course. These courses were either of graduate level or of senior level. The courses included special studies such as construction of programs, bibliographic work, studies of local computer-using firms, and investigation into use of computers for problems in the social sciences. The student was fairly well his own leader as to the area which he wanted to study; one could say, individual research work.

Only the more interesting aspects of the topics included in the seventy-four courses have been presented here. Numerous others were mentioned but were not important enough or were not explained clearly enough. One should remember that in most cases, courses included more than one topic; therefore, Table XVI would show totals greater than the number of courses. Also other items could be covered in such a slight way that it would be considered as not being covered by the informant.

The preceding discussion of course content has been on the topics covered in general. Only slight mention has been made of the similarity of topics covered in the various parts of the country. Overall there is a likeness found in all of the areas. Yet each has its own peculiarities.

The northeast area follows along with the general consensus of all the schools. The first three topics in popularity as far as all schools were concerned were strongly supported by the Northeast. The various sub-topics under applications as shown in Table XVI were all covered in some course in this area with the exception of marketing. In the other two, systems and data processing, at least half of the sub-topics were discussed.

The only topic in which the Northeast was weak in comparison to the remainder was that of management aspects of data processing. Only one course mentioned this as a specific topic of discussion. This course was the only one offered by this particular school and it was offered only at the graduate level. This as compared with the other areas, is a poor representation of this subject for the number of courses which are offered in the area.

While the Northeast followed suit in the first three categories, it also was generally well represented in some of the less-frequently

TABLE XVI

ANALYSIS OF CONTENT OF SEVENTY-FOUR DATA PROCESSING COURSES

Topic Covered	Area						Total of Topic
	Northeast	Midwest	South	Southwest	West	Northwest	
Application of Data Processing:							
a. Applications - general	2	3	2	3	1	-	11
b. Accounting - general	1	-	2	-	-	-	3
c. Punch card accounting problems	2	1	3	4	-	1	11
d. Electronic machine accounting problems	1	3	1	2	-	-	7
e. Management control	3	5	-	1	-	1	10
f. Marketing	-	-	2	-	-	-	2
Systems:							
a. System design principles	4	3	-	2	-	-	9
b. Flow charts	-	3	2	3	-	-	8
c. Accounting systems	-	4	2	1	-	-	7
d. Analysis	2	2	-	-	-	2	6
e. Reports	-	1	-	1	-	-	2
f. Firm problems	1	-	-	-	-	-	1
Data Processing:							
a. Punch card components	1	4	2	2	-	-	9
b. Electronic components	3	2	1	2	-	1	9
c. Case histories - general	-	2	-	-	1	1	4
d. Case histories - punch card	-	1	1	-	-	-	2
e. Case histories - electronic	1	2	-	-	-	1	4
f. History of data processing	3	-	-	-	-	-	3
g. Data processing - general	-	1	-	1	-	-	2
Machine Operations:							
a. General	-	-	5	3	-	-	8
b. Punch card equipment	-	-	-	4	-	2	6
c. Wiring	-	-	-	2	-	1	3
Programming:							
a. Introductory	2	1	1	-	1	-	5
b. Intermediate	1	2	-	-	-	1	4
c. Advanced	2	-	1	2	2	-	7
d. General	-	-	-	1	-	-	1

TABLE XVI (Concluded)

Topic Covered	Area						
	Northeast	Midwest	South	Southwest	West	Northwest	Total of Topic
Management Aspects	1	5	1	2	2	1	12
Introduction to Computers	1	2	2	1	1	1	8
Operations Research, Analytical methods, etc.	3	3	-	-	-	-	6
Integrated Data Processing	3	1	-	-	-	-	4
Management Gaming	-	1	1	-	-	-	2
Designing and Coding Data	-	-	-	4	-	-	4
Symbolic Representation	2	-	-	-	-	-	2
Seminar Study	-	-	-	-	3	-	3
No Information	-	-	1	-	3	-	4

mentioned items. In the first place, this area was the only one which had definite convictions about symbolic representations as was discussed earlier. The Northeast also seemed to be fairly interested in the concept of integrated data processing. Another interest of this area was Operations Research and other analytical methods.

An observation was made pertaining to the Northeast and the Midwest. Eight different courses covered machine programming in some form or another. On the other hand, not a single course in the two areas bothered with machine operations of punch card equipment. The two topics are somewhat similar in that each is used to accomplish the same purpose on the respective hardware. Undoubtedly, if computers are available in a course, some punch card equipment is also available. Now a question comes to the mind of the writer. Is the operation of punch card equipment too technical to be taught in a college course? Is programming computers not technical work and therefore can be taught at the college level?

The midwest area is also strong in the three most popular topics but yet it is not so varied in its offerings of the less popular items listed in Table XVI. The various sub-topics of applications, systems, and data processing were well represented in the courses of this area. An important item for the Midwest also was the topic of management aspects of data processing which was included in five of the courses. Another item of interest for this area was the management gaming is used as one of the techniques of learning this field. On the whole, the Midwest seemed to be more certain of what should be offered in a course since it appears that the area is heavy in applications, systems, and data processing.

Half of the topics covered in the South appear in the application of data processing and systems while the other half seems to be pretty well scattered. For instance, the South is the second of the two which offer management gaming, but, in only one course. Also little programming is presented yet five courses cover machine operations to some degree. Introduction to computers, case histories, and data processing components all appear in the area.

The Southwest was somewhat different than the other areas previously mentioned. This area's first choice as to the topic covered in a course was punch card machine operation. But one must confess and reveal that this was strongly influenced by only one school in the area. The next two most common topics for the Southwest were applications of data processing and systems. This area did tend to hold to the more common topics other than the first choice. The one topic peculiar only to the Southwest was that of designing and coding of data.

The West was the only area of the six that did not follow the

general consensus of the other informants as to what should be covered during the semester. Their strongest emphasis was in the presentation of seminar-type courses. Applications and data processing were mentioned only once each. Systems was not mentioned by the informants by itself but only as part of seminar case problems. The West did cover, though, fairly heavy in comparison with its other topics, items concerning computers. It also laid some emphasis on management aspects in comparison not only with its other subject matter but also with other areas' coverage of this subject.

Nothing is really unusual with the northwest area. Actually there are too few courses to obtain much information. Those courses that were given, though, show compliance with the majority of the other sixty-nine courses. One thing that should be noted is that the subject matter is strongly slanted toward electronic data processing.

If one were to enroll in a typical course of data processing, that is, typical as based upon the finding of this study, he probably would have presented to him the following topics. The student would first of all encounter management aspects of data processing. The time spent on this topic would be approximately two and a third weeks of an eighteen week semester. This would not mean that the first two weeks of the semester would be devoted to this but rather tha amount of time in total for the semester. The approximate length of time that would be alloted to this and the other topics is shown in Table XVII. Punch card accounting applications and other applications in general would take up a little over four weeks of a semester's work. Management control over the business entity such as production control, process movement, and inventories would be alloted approximately two weeks of study. Systems design

TABLE XVII

TOPICS COVERED IN TYPICAL COURSE OF EIGHTEEN WEEKS BASED ON SEVENTY-FOUR COURSES FOUND IN STUDY

Topic Covered	Per cent of Total	Number of weeks of 18 week Semester
Management Aspects of Data Processing	12.6%	2.3
Application of Data Processing - general	11.6	2.1
Application of Data Processing - Punch Card Accounting Problems	11.6	2.1
Application of Data Processing - Management Control of Business Entity	10.5	1.9
Systems Design Principles	9.5	1.7
Punch Card Components	9.5	1.7
Introduction to Electronic Computers	8.4	1.5
Electronic Components	9.5	1.7
Systems - Flow Charting	8.4	1.5
Machine Operations - general	8.4	1.5
Total	100.0%	18.0

principles, and punch card components each will be important enough to demand a little over a week and a half of the time. Introduction to electronic hardware and then the use of such will be presented to the student for a period of about three weeks. Finally, the student will spend about a week and a half during the semester on actual operation of the various machines.

One will notice that there are two topics relating to electronic computers in the table. That referring to introduction to computers is the study of the electronic hardware in a basic course of data processing; no detailed study is made. The topic of electronic components is a more detailed study of these in a course pertaining mainly to this equipment. Many of the courses, especially those pertaining to punch card equipment, stated that it introduced the field of electronics to the students while

many others stated that electronics was the main item of the course. Therefore, the two topics, while related, were counted as separate items.

The preceding discussions have been based upon the course offerings in general that are found among the informant schools. Table X shows the number of courses offered by any one school but nothing has been mentioned about the actual programs offered by the schools. This will now be done.

As Table X shows, there were two schools which offered five courses to the students. One of these two schools offers two accounting systems design courses covering components of systems, systems analysis, and data processing systems. Two other courses at the same school also pertain to systems; integrated data processing, information flow developments, and problems of the individual firm are a few of the topics in these two. The fifth course, "Application of Large-Scale Digital Computers to Business and Industrial Systems," covers a wide scope ranging from manual and mechanical data processing to history to linear programming to applications in specific situations.

The undergraduate student had the choice of one of the accounting systems courses and one of the advanced systems courses found in the industrial management department. The accounting systems course does not use a textbook but the other course uses the text by Kozmetsky and Kircher.[11] Each of the two requires prerequisites; the accounting systems requires two courses in basic accounting while the other requires a basic course in industrial management.

The other three courses are offered at the graduate level. The advanced systems course uses the text by Bross and the one by Kozmetsky

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[11] See Table IX.

and Kircher. The accounting systems for the graduate does not require a text but the computer course uses Canning's Electronic Data Processing in Business and Industry and the book by Charnes and Cooper. This course on computers is offered in the electrical engineering department. No prerequisites are given other than that it is open to graduate business students. The informant stated that this was the fifth year that this particular course had been offered.

The other school which offers five courses gives the undergraduate student more to choose as only one course is at the graduate level. One course at this school is sophomore level, one is junior, one is senior, and one is junior-senior level. All of the courses are in the business administration department except one, a systems course, which is in the accounting department.

The sophomore level course has no other prerequisites other than that the student could type. This course uses no textbook as such but uses a manual supplied by a manufacturer. The course is mainly for secretarial administration majors but others may take the course. The content of the course consists of operations of coding data and then recording of that data.

The junior level course does not use any particular text but uses supplies furnished by the manufacturers of hardware. The theory and application of punch card equipment in preparing reports, flow charting, card designing and the use of coding are some of the topics covered in this course. Also one of the features of this is the extensive operation, by the student, of some punch card equipment.

The senior course is the one in the accounting department. Before one is allowed to enroll he must have taken the junior level course

discussed above as well as approximately four courses of accounting. Here the student learns advanced theory and practice in the application of not only punch card equipment but also electronic hardware to accounting principles. This course is entitled "Punch Card Machine Accounting" which fairly well describes the course. Again, no text is used, but only manufacturers' material supplemented by notes kept up to date by the instructor.

A beginning course in electronic data processing is offered at the junior-senior level. No other prerequisite is required other than that of class standing. This course introduces the student to the theory and application of business data on a high-speed electronic computer view. Much use is made of the IBM 650 Magnetic Drum Data Processing Machine in this course. This machine is used by the student during the semester. In preparation for this flow charting, systems study, programming, and operation of computers are topics which are covered.

The only course in this second school which uses a textbook is the course in advanced electronic data processing. The books which are used are Chapin's and Kozmetsky and Kircher's. For this course the student must first take the beginning course and, secondly, be at least of senior standing. Whereas the first course in electronics covered mainly the operation of the equipment, this second course gives the student an opportunity to study the various sizes of computers and the differences in their installations. Also covered here are subjects of management of the systems, procedure development as well as some individual research by the student in areas of interest to him. The other four courses include actual operation of the hardware as mentioned but this fifth

course does not include any unless the student should have a project which he wishes to do himself.

Two schools in the study offer four courses in their respective data processing programs. These two programs are not too different from the two offering five courses. While the first two had a strong emphasis on systems, these latter two are stronger in machine operations.

One school's offering includes a punch card accounting course, a course in operations of punch card equipment, one introducing data processing, and a fourth dealing with electronic data processing. The first three are of junior level work while the electronic course is considered senior level. The accounting course requires that the student have had introductory accounting; the electronic course requires the student take the data processing introductory course. As far as texts are concerned, the informant stated that the student was required to purchase a text but that there was too much indecision to state what was used.

The introductory data processing course covers a wide variety of data. The informant described the course as covering the processing of data of all types including engineering, financial, educational, and psychological. It develops the subject from the beginning from manual methods through electronics methods.

The systems approach is used in the electronic data processing course. This includes the study of systems of data but also includes various systems of equipment. Also covered in this is advanced flow charting and programming techniques.

The second school's program is very similar to the first. Machine accounting and machine tabulation are the fields covered in two courses

here just as in the first school discussed above. These two are junior level courses. The machine tabulation course is offered in the statistics department while the other is in the accounting department. Neither of these use textbooks but they do use printed material of manufacturers of equipment.

The other two courses are both in the field of electronic data processing; both of the courses are in the statistics department. The two of these cover approximately the same subject matter as the electronic data processing of the first school. Canning's Electronic Data Processing for Business and Industry and Moore, Humble, and Chapman's Electronics in Business Management are used in these courses. As far as the prerequisites are concerned, none are required for either; it would be assumed that the introductory course would be taken first but this is not stated.

Three of the schools which offer three courses have programs consisting of machine tabulation and electronic data processing in varying degrees but the other three offer some differences. Two of the schools lean toward the management view of computers because one school offers such as automation and management (senior level), management application of data processing (senior level), and a management decision laboratory (senior level) while the other offers two courses in applications (graduate level) and one on the feasibility study (graduate level). The sixth school offers a slightly different program from the other five. Its program consists of a machine tabulation course (sophomore level), an accounting systems course (senior level), and a course on management programming and control (graduate level).

Four of these six schools use textbooks in at least one course.

For the accounting course above, the particular school uses both Gillespie's book and Chapin's as required texts. The school with only graduate courses uses the books by Bell and Canning. Kozmetsky and Kircher are used at one school while the books of Andree, Chapin and Canning are all required in one course at the fourth school.

As far as manufacturers' materials are concerned, five of the six use these as helps. Both of the schools which do not use texts do use this material.

Those schools offering two courses are too numerous to discuss in detail. The most common combination among these schools is an electronic data processing course along with either a punch card data processing course or machine tabulation course. The others have combinations such as data systems and processing and machine accounting systems; accounting systems and market research; introduction to data processing and principles of systems; and office automation and electronic data processing. Eight of the schools use texts in their courses of which Chapin's and Bell's are the most popular; all of them use manufacturers' material. At least two courses of accounting appears to be the most common prerequisites of these schools with statistics courses playing an important part as a prerequisite also.

Of those schools with only one course, punch card accounting and introduction to data processing are the two most popular courses. Although the schools were numerous in this category only six use required texts; McCracken and Canning being those used most frequently. Even though only a few texts were used, every school except three uses materials supplied by manufacturers. The majority of these courses are either junior level or graduate level although there are three at the sophomore level.

The discussion up to this time has been based upon what the schools in the study have at the present time. Since up to this time there has been a question as to what should be taught, it was thought that there might still be some changes to be made that would affect the present curriculum. Ten colleges that teach data processing and eight that do not teach data processing indicated that there were plans in development that would change their present curriculum. Some of the more interesting of these will be discussed.

Of those ten teaching data processing probably the largest change to take place will be at one college where a computer is to be installed soon. This particular university at the present teaches one course of machine accounting methods. When the computer is installed the present course will be discontinued and another course established that would deal mainly on operations and programming. If a student so desired, one to six additional credit hours could be earned by applying a special problem in his particular major field to the computer. From the information given, it appears that the college will change its program entirely.

One school of the ten is considering a major in the "computational" area.[12] This would include such as statistics and linear programming. The data processing course which it now has will also be included in this area. At the same time, the school is also contemplating adding another data processing course at the graduate level, also to be included in the major. No indication was made on the questionnaire that this particular program would be followed during the next regular term of school.

Four schools had plans to include during the next term a new course

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[12]The University of Virginia.

dealing with computers while a fifth college would offer its students a course in this field taught by the liberal arts school. Three of these have not yet had courses involving the operation and programming of computers such as the new courses will be offering. One of these schools now teaches a computer course only for accounting majors; the new course will be for all students.

The remaining ones only indicate that some plans are underway but nothing concrete has been decided in any direction.

Those not teaching data processing now which indicated consideration of doing so in the near future consisted of eight of the seventeen. Two of the schools indicated that the matter was now in the hands of university committees and had not been reported on yet. Another stated that when a course was placed in the curriculum it probably would be in the management department. One said that a course would be established shortly that would include the use of equipment. Another indicated that the school was in the talking stage at the present but eventually the results could even cause some basic modifications in the senior curriculum of this particular school.

CHAPTER III

DATA PROCESSING HARDWARE

University interest in data processing has been shown in the preceding chapter. Has this interest been created by the availability of equipment to the university? Has the presence or absence of machines made a difference as to the courses offered by the schools which were questioned? If the hardware has been available, has it been put to use? These and other questions pertaining to the hardware will be discussed in this chapter. The discussion will be divided into those offering data processing, with which chapter two was mainly concerned, and those not offering data processing.

Almost all of the universities teaching data processing have some hardware available to them. Only three out of the thirty-eight offering courses do not have any machines available. All three of these schools happen to be in the West. The other universities and colleges have anywhere from a minimum installation to a completely equipped computing center. These installations are not necessarily under the control of the business schools but at least the equipment is available to the school.

Eighty per cent of the schools have the hardware on the campus of the university. Approximately 6 per cent of the schools have the use of equipment of private businesses but do not have their own. A little over 11 per cent not only have their own equipment on the campus but also have available hardware of nearby business enterprises. One

informant replied that his university had available for use in courses machines on campus and in private business as well as that of a service center.

The three most common machines available were those of a basic installation, including card punch, sorter, and accounting machine. All of the universities having an accounting machine also had the other two machines. At the same time many of those having these three also had other hardware. Some more of the common ones were computers, card verifiers, reproducers, interpreters, and collators in that order of importance. Less common among the informant schools were summary punches, calculators, tape units, electronic statistical machines, and typewriter tape punch. This latter equipment was usually found in the more complete installations.

Whereas thirty-five of those offering data processing have equipment available for use in the courses, not all of them allow the student to use the machines. Only twenty-nine schools give the student an opportunity to use the machines himself during a course. At these schools, most of the machines that are available for use can be used by the student at some time during the course.

No reference is made by the six schools as to why the equipment is not used by the student when it is available. Three of these six can be found in the Northeast while two can be found in the Midwest and one in the West.

As to the time allowed the student on the machines as a whole, it was discovered that 55 per cent of the schools allow less than five hours during the semester. The time as stated in the questionnaire was an estimate made by the informant as to the total time each student used all

the equipment. Eight schools let the student use the hardware at least five but not more than fifteen hours; three allow the student between fifteen and twenty-five hours; five schools give the student more than twenty-five hours on the equipment. This listing includes four schools which allow different lengths of time depending upon the course taken. The remaining schools gave no information as to the length of time machines were used.

With the exception of those not answering the question, it was easily seen that those schools in the southern portion of the United States - South and Southwest - allow the student more time on actual operations than do the rest of the United States. For instance, none of the schools in the Northeast, Midwest, West or Northwest let the student use the machines over fifteen hours. All of the schools reporting in the Southwest permit the student to spend over twenty-five hours a semester in operation of the equipment while two of the schools in the South allow over fifteen hours. This time allotment was not due to the individual university's having its own data processing center either for five out of the seven schools do not have such centers.

Data processing centers were popular with the informants questioned. Twenty-three of the thirty-eight offering data processing courses stated positively that their schools had a data processing center. These centers are ones which have been established independently of other functions. That is to say, the center was not created as a result of some need or problem such as staff payroll procedure of a university division. The center's main purpose is one of instruction, not limited to just one department, but available to all units of the university. Of those reporting such centers, approximately 30 per cent can be found in the

Northeast, 26 per cent in the Midwest, 13 per cent in the South, 13 per cent in the Southwest and 9 per cent in each of the other two areas of the West and the Northwest. This breakdown was for the distribution of centers for the entire country. What about the comparison within each area? Each area, with the exception of the Northeast and the Northwest reported that data processing centers existed at about 50 per cent of the schools answering the questionnaire.

As strange as it may seem after the discussion prior to this analysis, all of the schools (with the exception of one that did not answer) in the Northeast have data processing centers. No other area had any more, either in numbers or percentagewise. The unusual thing to the writer was that this area limits its students to less than five hours apiece on actual operations while from casual observation one would think that with the facilities present, more time would be utilized on the hardware.

The only case which equaled the Northeast's was the Northwest area. Percentage-wise, both of these areas had 100 per cent reporting data processing centers. The item making the Northwest's percentage questionable as a significant figure is the fact that there are only two schools which answered the questionnaire.

The hardware housed in these data processing centers is similar throughout the country. The only variation found among the centers is in the auxiliary machines without which the work still could be done. In this group, two of the schools are thinking seriously of adding an electronic computer whereas now, the two centers each have a calculating punch to do the work. Table XVIII gives an overall picture of those machines to be found in the data processing centers.

TABLE XVIII

MACHINES INSTALLED IN DATA PROCESSING CENTERS
OF THOSE SCHOOLS TEACHING DATA PROCESSING

Type of Machine	Area						
	Northeast	Midwest	South	Southwest	West	Northwest	Total
Card Punch	5	6	3	3	2	2	21
Sorter	5	6	3	3	2	2	21
Accounting Machine	5	6	3	3	2	1	20
Interpreter	3	4	2	1	2	1	13
Collator	4	4	2	1	2	2	15
Reproducer	3	5	3	1	2	1	15
Verifier	3	4	3	1	2	2	15
Calculating Punch	3	2	1	-	1	-	7
Computer	5	5	2	3	2	2	19
Other	-	1	-	-	1	-	2
Comtemplating Computer	1	1	1	-	-	-	3
No Information	2	-	-	-	-	-	2

With the advent of the computer, problems of data processing courses have arisen to new heights as brought out earlier in the introduction. Since the computers were one of the basic causes of these problems, it would be enlightening to discover what computers are found at the colleges in the survey.

A total of thirty-four computers are to be found on the campuses of those schools teaching data processing. The IBM 650 is the most popular computer of those represented, composing over 50 per cent of them. Two of the machines, the IBM 704 and the Burroughs 220, each have two on campuses. Others such as LGP 30, Univac, Royal-McBee, Remington-Rand ERA 1101, Datatron, Burroughs EC 102, Bendix, and IBM 701, each have

one represented. Besides these commercially manufactured computers, three "one-of-a-kind" can be found, all built from the Illiac[13] plans.

Although a total of thirty-four computers are located at the colleges, it does not mean that thirty-four schools have these. Quite the contrary, for only twenty-two have computers. This means that some have more than one computer. Four colleges, three with an enrollment over 10,000, have two computers while three colleges, two with an enrollment of between 5,000 and 10,000, have three computers. Two schools which already have computers are in the process of acquiring larger computers but will also keep the older equipment.

At the time of the survey sixteen schools did not have computers but some had begun working toward acquiring one. Of the sixteen, ten are seriously considering obtaining one, while three had no plans whatsoever of acquiring a computer; three gave no information. Five of those obtaining computers want to get an IBM 650, one desires an ElectroData 205, one wants a Datatron, and the remainder gave no information.

There are two ways in which one can purchase a computer. The first is to purchase just the basic parts, such as console, read unit, power unit, etc. The other way is to also get extra or peripheral equipment, either at the time of the initial purchase or from time to time. Twenty-two of the computers in this survey are of the later type, i.e., with auxiliary features attached; only eleven out of the total are basic machines. Of those acquiring computers, six will have peripheral equipment, two will be basic, and two gave on information.

[13]The Illiac itself is based upon one of the most popular computer designs, that of the IAS, developed at Princeton University. The original Illiac was put into operation in September, 1952, at the University of Illinois. It is not commercially available.

It was stated earlier that the size of the school had some effect upon the data processing curriculum. As support of this, Table XIX is presented. The table shows that only two schools with an enrollment of less than 5,000 have a computer and only two of the same size are obtaining some type of computer. All except one of these four machines are the basic installation. The remainder of the table shows that a larger number of the larger schools have, or are obtaining, computers, the majority of which are with peripheral equipment.

TABLE XIX

ANALYSIS OF SCHOOLS TEACHING DATA PROCESSING AND HAVE, OR ARE OBTAINING, A COMPUTER

Size of School	Area	Have Computer			Obtaining Computer		
		Number of Basic Install.	Number of Other Install.	Number of No Information	Number of Basic Install.	Number of Other Install.	Number of No Information
Under 5,000:	Northeast	1	-	-	-	-	-
	Midwest	-	-	-	-	1	-
	South	1	-	-	1	-	-
Between 5,000 and 10,000:	Northeast	1	3	-	-	-	-
	Midwest	1	3	-	-	-	-
	South	-	3	-	1	1	-
	Southwest	1	1	-	-	-	1
	West	-	-	-	-	1	1
	Northwest	-	1	-	-	-	-
Over 10,000	Northeast	-	4	-	-	1	-
	Midwest	2	3	-	-	-	1
	South	3	-	-	-	-	-
	Southwest	1	1	-	-	-	-
	West	-	2	1	-	1	-
	Northwest	-	1	-	-	-	-
Total		11	22	1	2	5	3

No clear-cut conclusions can be drawn concerning machines availability nor data processing centers at those colleges not teaching data processing courses for the reason that so many of the informants failed to complete this section of the questionnaire. But from those answering, some interesting facts were found.

Of the seven out of seventeen which answered, five of the schools have data processing centers. Included in these centers are only the basic equipment necessary for an installation. Only one of the centers had anything which would be in the realm of an auxiliary machine, this being a calculating punch.

Four of the colleges having centers have computers while the fifth college has just an electrical calculator. One school, while not having a data processing center and therefore not included so far, has a computer on the campus. The types of computers in these schools range all the way from an IBM 650 to the original Miniac.[14]

As far as data processing courses being taught in the near future at these schools, there is little upon which to base a judgment. Three schools have no plans whatsoever for changing the status quo. Two of the five do have sketchy plans of adding courses some time in the future. One of these two informants stated that while there is a computer on campus there was only little interest shown on the part of the faculty at the present.

One school in the group of not teaching data processing stated that it had plans for acquiring a computer with floating decimal unit and magnetic tape unit. At the present it has no center. The size of

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[14]Not in operation at the present time. This machine was also based upon the IAS computer design.

this particular college is medium. Yet with this interest, no data processing courses will be taught.

For comparison of those teaching data processing and those not Table XX is given. The table is presented on the same basis as Table XIX except that it is for those not teaching data processing.

TABLE XX

ANALYSIS OF SCHOOLS NOT TEACHING DATA PROCESSING AND HAVING, OR ARE OBTAINING, A COMPUTER

Size of School	Area	Have Computer			Obtaining Computer		
		Basic Installation	Other Equipment	No Information	Basic Installation	Other Equipment	No Information
Under 5,000:	Northeast	-	-	1	-	-	-
	West	-	-	1	-	-	-
Between 5,000 and 10,000:	Midwest	1	1	-	-	-	-
	South	-	-	-	-	1	-
	Southwest	1	-	-	-	-	-
Total		2	1	2	-	1	-

CHAPTER IV

SUMMARY AND CONCLUSIONS

Even after some years now there is still considerable uncertainty about data processing courses in colleges and universities. The problem was stated that since data processing was so new no study had been made over a wide area concerning the worthiness of such courses, the content of the courses, or course programs. A study was needed to see what progress had been made, to find similarities, and to see what plans were being considered. After studying this survey, though, one can see that many of the problems mentioned still exist.

The basic question of whether data processing should even be taught in colleges has not been settled in many minds. Along this same line, and before this basic question can be answered, each university has to determine its responsibility to the student and to society.

None of the schools in the study offered a major in data processing at either the graduate or the undergraduate level. The closest that any school came was New York University's Management Institute. This plan was not included in the study, though, because one could not receive a degree from the University for this work. A number of courses were offered at various schools although these did not consist of a major field. The number of courses ranged up to five at any one school. Two courses, on the average, was offered at most schools. In fact, three-fourths of the schools fell in this category.

It was the general concensus of opinion that if courses were to be taught then it should be at the undergraduate level. Seventy per cent of the schools only offered courses at this level. Also, approximately 80 per cent of the courses were at the undergraduate level. This tendency was prevalent over all sections of the country; these percentages were not influenced to any great degree by one or two sections of the country.

Although the majority of courses were at the undergraduate level, the courses tended to be of the junior-senior rank. Sixty-nine per cent of the courses fell in this group. Even though the majority of the informants considered an undergraduate capable of comprehending the subject matter, the informants still thought that the student should wait until he had reached the upper division level of courses.

One of the aims of this study was to determine if there was a particular department offering data processing. After studying the returns, courses could be found in almost any department of a college of business. There was considerable variation among department location, but an overall picture showed that there was some similarity of choice of a department. For the country in general, it could be said that the accounting department has accepted this field more than any other department. Fifty-one per cent of the schools have courses in this area. Possibly this is the most logical place for it. Second in line was the business administration department then the department of management. On an area basis, accounting dominated in four of the areas while business administration did in the Southwest and management in the West. As far as departmental offerings in any one area, the South was the most homogeneous.

The prerequisite courses which are required before a data processing

course can be taken can give an insight into the course itself. For example, the course requiring twelve semester hours of accounting is oriented toward that particular subject. Others required other prerequisites depending upon the department offering the course.

Overall, forty-nine of the seventy-four courses required that students meet a particular requirement. The majority of these required only one course; however, twelve required more than this while some courses required other than class work. Accounting dominated the prerequisites. In fact, this subject was strong in every area. This is not surprising, though, since most of the courses are offered by the accounting department. Other departments, too, considered accounting important as a prerequisite.

From the study of the returns a composite course was designed consisting of the general content of all the courses. This course might be suggested as an "average" course. The topics covered would be: (1) management aspects of data processing, (2) general and punch card accounting applications, (3) management control, (4) system design principles and flow charting, (5) punch card components, (6) introduction to electronic data processing, and (7) general machine operations.

This typical course could be approached in two ways: (1) theoretical, or (2) practical. If approached theoretically, then the course would be taught symbolically, possibly with the aid of applications, case histories, and history of data processing. If approached from the practical view, the course would consist of machine operations. While many talk of a strictly theoretical approach, the majority end up with a course using both approaches.

Not many of the schools suggested that the present programs would

be changed to any extent in the near future. Of those that were changing the curriculum the majority seemed to be turning toward courses of punch card machine operation and programming of electronic machines. Those that were initiating entirely new courses appear to be basing them on electronic computers.

Only as time passes will anyone be able to say what should be taught and what should not in the field of data processing. As schools and individuals launch out into new material, more experience will be gained to help formulate more concretely a plan or an approach to data processing. To help, some more research studies could be made in this field. Numerous studies are made on electronics; possibly more need to be made on punch card machines, too. Reasons for not teaching data processing could be informative if a study was made. The approach to the method of teaching would be enlightening to the field as a whole.

The space man of today has not been able to get off the ground so far. Progress is being made though, and some day that space man will have a rocket which will make him conqueror of another planet. Likewise, the field of data processing may still be faultering but soon it, too, will have a solid foundation upon which to build.

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APPENDIX

DATA PROCESSING CURRICULUM QUESTIONNAIRE

A. General Information.

1. Name_____

2. Address_____

3. Name of University or College_____

4. In what department do you teach?_____

5. What is the highest degree which you have earned? (Also include such as CPA)_____

6. Have you had any special training, such as short courses, in the field of data processing? Yes_____ No_____

7. Is your school on a quarter system?_____
   semester system?_____

B. Courses.

1. Are any Data Processing courses of any kind offered by the school of business? Yes_____ No_____

2. How many full-time business faculty members instruct in some data processing course?_____ Total Number on Business Faculty_____

   How many part-time members instruct in some data processing course?_____

3. Is a major in data processing offered? Yes_____ No _____
   If yes, at what level? Undergraduate_____ Graduate_____

4. If a major is offered, what other courses besides data processing courses are required to complete the major?

Department	Course Number	Title

5. List the courses offered:

a. Department_____ Course Number_____ Course Title_____
Credit Hours_____ Level of Course_____ Prerequisite, if any_____
Number enrolled in Fall, 1958_____
Brief Description of course:_____

b. Department_____ Course Number_____ Course Title_____
Credit Hours_____ Level of Course_____ Prerequisite, if any_____
Number enrolled in Fall, 1958_____
Brief Description of course:_____

c. Department_____ Course Number_____ Course Title_____
Credit Hours_____ Level of Course_____ Prerequisite, if any_____
Number enrolled in Fall, 1958_____
Brief Description of course:_____

d. Department_____ Course Number_____ Course Title_____
Credit Hours_____ Level of Course_____ Prerequisite, if any_____
Number enrolled in Fall, 1958_____
Brief Description of course:_____

6. Are the students required to purchase textbook(s) for the course listed above in question 5? Yes_____ No_____
If Yes, list the following:

Course Number	Title of Textbook	Author

7. Do you use printed material furnished by the manufacturers of data processing equipment, such as IBM? Yes_____ No_____

C. Data Processing Machines.

1. Are any data processing machines available for use in the courses?
Yes_____ No_____

Check the machines available:

____Card Punch
____Card Verifier
____Reproducing Punch
____Interpreter
____Sorter
____Collator
____Electronic Statistical Machine
____Tabulator (accounting machine)
____Multipliers or Calculators
____Typewriter Tape Punch
____Electronic Computer
____Cardatype Accounting Machine
____Tape Units
____Summary Punch

_____ _____

2. Are these machines: on the school campus?_____
in a service center? _____
in a private company?_____

3. Does the student have an opportunity to use the machines himself during a course? Yes_____ No_____

If yes, check which machines:

____Card Punch
____Card Verifier
____Reproducing Punch
____Interpreter
____Sorter
____Collator
____Electronic Statistical Machine
____Tabulator (accounting machine)
____Multipliers or Calculators
____Typewriter Tape Punch
____Electronic Computer
____Caratype Accounting Machine
____Tape Units
____Summary Punch

_____ _____

4. Does the student get to use the machines:
   a. less than five hours during the semester?_____
   b. at least five but not more than fifteen hours?_____
   c. at least fifteen but not more than twenty-five hours?_____
   d. more than twenty-five hours?_____

5. Does the university or college have its own data processing center? Yes_____ No_____

   If yes, check the type of equipment housed in the center:

____Card punch	____Reproducer
____Sorter	____Verifier
____Accounting Machines	____Calculating Punch
____Interpreter	____Computer
____Collator	____ _____

6. a. If the university or college has a computer, what kind is it?

   _____

   b. If the college does not have a computer, is it contemplating getting one? Yes_____ No_____

   If yes, what kind?_____

   c. Check the features included with the computer you now have, or with the computer now considering:

____Core Storage	____On-Line Printer
____Tape Storage	____Floating Point Arithmetic
____Disk Storage	____ _____

D. Future Status.

1. Are you considering making changes in your curriculum which will materially affect the answers given herein? Yes_____ No_____
   If yes, state briefly the changes which are being considered.

2. If, at the present, the school of business in not offering any data processing courses, is it considering doing so within the near future? Yes _____ No_____

   If yes, then briefly, what are your plans?

VITA

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