SUPPORT TOOLS FOR AN UNDERGRADUATE MANAGEMENT
INFORMATION SYSTEM COURSE

by

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CONTENTS

LIST OF TABLES

Chapter I

INTRODUCTION

Information is defined as meaningful interpretations and correlations of data. We are an information hungry society. Seventy-five percent of all information available to mankind has been developed within the last two decades (1). With over 75 billion new pieces of information being generated annually, how can we store it, let alone retrieve and use it?

For the last two decades businesses have had to deal with this onslaught of information. This increasing quantity of information has forced business leaders to be increasingly selective in the flow of information to them. Modern societies have also been changing their characteristics at an accelerating rate. This has necessitated the need for accurate and timely information. The need for sophisticated information systems was required to meet the information requirements of modern managers.

1.1 THE PROBLEM

Since the first commercial computer was installed in 1954 for a business application of payroll processing, the computer was predicted to play a key role in the future of information systems. As newer and more powerful computers were developed over the years, this key role was becoming realized. The early 1970's brought the advent of cheaper random access storage devices. The decrease in hardware prices allowed many businesses to set up data processing departments, to purchase computing equipment, and to store more and more information.

With these changes in the business world, the College of Business Administration at Kansas State University, along with colleges across the nation, saw a need to expose their business graduates to some fundamentals in the field of computer science. This was accomplished by requiring all Business Majors to take a course on the fundamentals of computer programing, which taught PL/1 programing language.

During that time period, this introductory course was sufficient preparation for business graduates entering the business world. Small businesses could not afford their own computer and large organizations had separate data processing departments to handle the computer information needs. If managers wanted certain information, like sales forecasts or personnel data, they would express their needs

to the computer staff and the reports would be generated and routed to them. College graduates needed an understanding of how a computer worked, but in general, their direct interaction with a computer was not necessary.

The late 1970's and early 1980's has brought computing power to the hands of an ever increasing market. Continually decreasing of hardware and storage costs, the increasing development of powerful data bases and data base management systems, and the advent of powerful mini and micro computers has made computers and information systems cost effective to both large and small businesses. The once futuristic view of a computer terminal on every business managers desk can be realized with the help of office automation systems that are on-line with the organizations data base. Even small businesses can afford the needed computing and information management facilities through the use of mini and micro computers or through a shared distributed computing facility.

The College of Business Administration has sensed this man/machine merger. Over the last five years the College has taken several steps to expose its graduates to more computing environments. Although these steps brought the business student more awareness of the computers role in business, there still existed a void in the area of

management information systems (MIS). The Business College has recently recognized the need to prepare it's business graduates for their entry into the business world where their familiarity with MIS is required.

The problem for the Business College and the purpose of this report is to develop a plan to give these students the adequate preparation in MIS. When approaching this problem one must first examine what these mysterious words, management information system, really mean.

1.2   MIS DEFINED

If we brought together 25 authorities from the computer science and business field and asked them to define MIS, we would probably end up with 25 different definitions. This exemplifies the loose definition MIS has today. Although the definition has been overworked, common properties and interacting components can be seen by looking at some available definitions of MIS:

- an information system which provides the manager with that information he needs to make decisions. (J. D. Aron (2))
- an organized method of providing past, present and projection information related to internal operations and external intelligence. (Walter J. Kennevan (3))

- the system which monitors and retrieves data from the environment, which captures data from transactions and operations within the firm, and which filters, organizes, and selects data and presents them as information to managers. (Robert G. Murdick (1))

- produced, for all levels of management, the information required to make decisions in two areas: 1) predicting what will happen by asking historical data and simulation to give alternatives and 2) outlining or making changes to a present procedure or decision to make the selected prediction possible. (R. L. Martino (4))

The diversity of opinion about what constitutes a MIS and what it's purposes are can be revealed at first glance at the above definitions. But examining these definitions, along with others, certain common interacting functions can be found. These emphasize that a MIS: 1) supports not only operations but also the management processes, 2) is directly linked to the organizational structure of an organization, 3) functions to gather information, measure performance, monitor progress, evaluate alternatives, or provide knowledge for change or corrective action, and 4) is flexible both in structure and in purpose.

Many common properties can be extrapolated from these numerous definitions, but the best definition comes from

looking at MIS from a conceptual view. Gordon B. Davis, a professor of MIS at the University of Minnesota, provides both the question and answer to this problem (5). What is the minimum MIS? Let's say we take a simple data processing system and add a simple data base, retrieval capabilities, and a couple of planning or decision models to give it some MIS characteristics. Is this a MIS? This is not a valid question. Rather than being an absolute state, MIS is a concept and an orientation toward which an information system design moves. The answer is a matter of degree rather than a simple yes or no. The degree to which an information system supports the management functions of an organization and adapts the MIS orientation determines the classification of a system.

This paper supports the idea that it is unproductive to put forth a single definition of MIS and talk in terms of "this system is a MIS and that one isn't." It is more meaningful to identify certain desirable components which facilitate the information management in an organization, like a data base and decision support systems, and then begin to talk in terms of "this MIS is better than that MIS." If authorities would more explicitly explain MIS as a system moving along a continuum, the 'mystery' of MIS would disappear, and literature publications would not have to spend energy attempting to justify their own definition of MIS.

1.3   CHANGE IN SCOPE

Although the computer is an intregal part in any modern, well defined MIS, the concept is not new.   In fact the idea of an information system for management decision making predates the computer.   A short discussion on the evolution of the MIS idea is beneficial to illustrate that modern technology has really affected the capabilities of the MIS recently.   Through the years of evolution of the MIS concept, much literature has been written of the failures and euphoria of the concept.   It is important to understand that the scope of information systems today is different than it was five years ago.

The idea of some all encompassing information system was probably here since the first file cabinet was used in an office.   People had high hopes,   but this MIS concept took time to evolve.   The MIS concept can be viewed as developing out of four other disciplines: managerial accounting, management science,   management theory,   and computer processing.   The MIS concept may be viewed as a substantial extension of concepts of managerial accounting taking into consideration the techniques of management science and the behavioral theories of management and decision making (5). The computer has provided the tool to facilitate implementation of the concept.

As stated earlier in this paper, the evolution of the computer accounted for the realization of the integrated information system. The early practical views of MIS was that it could perform accounting functions and a little analysis. This was a narrow scope but that's all the computer was equipped to handle. As the computer became more powerful with cheaper storage, increased speed, and better software, more and more business functions could be accomplished. These would become lumped into the concept of MIS. With todays modern data base management systems, office automation, and decision support tools, the scope of MIS is seen as handling the organizational information as a total integrated system.

The importance of this discussion is to be aware of the close relationship between the MIS concept evolution and the computer technology evolution. This understanding will explain the partial reason for earlier failures in attempts to integrate organizational information into a single system. It also explains why many business professionals are leery of a total integrated MIS. Many early attempts failed partially because of a lack of good system analysis, but also because of the lack of the required computer technology to allow such a system to be cost effective and also to operate effectively.

A few years later, with the advent of data base technology and office automation, these MIS implementation concerns became viable. The important point is to realize that the scope of MIS is broader and more viable today than it was a few years ago. This means that anyone investigating MIS must concentrate on recent literature to get a true picture of MIS today.

As stated earlier, we discuss information systems in terms of the degree to which they support the management functions of an organization by adapting the MIS orientation. There are certain software/hardware areas that are contained in modern computerized information systems which typify a modern MIS. These three areas are:

1. data base management systems,

2. office automation,

3. decision support systems.

Recent implementations in these areas have greatly enhanced the MIS ability to become a total integrated information system. A short discussion in these three areas is appropriate to outline their role in MIS.

1.4 DATA BASE MANAGEMENT SYSTEMS

One of the most rapidly growing areas of information science is data base technology. Today, the integrated data base is the central component of any modern MIS, and the software system capable of supporting and managing this is a data base management system (DBMS).

Until data base technology came along, organizations fought a costly and ineffective battle to integrate the firms information. Application programs were usually tailored to the data and wide access to the data was impossible. This need for integration led to the concept of generalized data base management systems. The objectives of these systems are discussed by Fry and Sibley: (6)

- to make an integrated collection of data available to a wide variety of users,
- to provide for quality and integrity of data,
- to provide privacy and security measures,
- to allow data independence such that the programs accessing the data base are relatively independent of the storage and access methods.

If a DBMS can achieve some of the above objectives, its contribution to a MIS is evident. To best illustrate the role of data base management in the MIS management, a discussion of the components under a DBMS is needed. We can break out the following main components:

- data dictionary,

- query language,

- data manipulation,

- report writer,

- data base design / analysis aids.

Due to the increasing size and complexity of data and information systems, data dictionaries have recently become popular and necessary. A data dictionary simply contains data about data. Data dictionaries can include: (7)

- general characteristics of data (relation and domain names, synonyms, field lengths),

- characteristics of data distribution,

- data validity controls,

- data access controls,

- report capabilities.

The dictionary can play a key role in the management of the data. It serves many people including the data base administrator, users, auditors, the systems analyst, programmers, and MIS managers. The dictionary can tell managers what data might be used, who controls and who uses it.

A vital aspect of a MIS is its access flexibility, or the ability of being able to access data easily and efficiently. The query languages which interface the user to the data base determine this access flexibility. One of the main

benefits that data base technology has brought to MIS the is ability to connect the user to all areas of the organizations information. A user friendly, English-flavored query language can give access to information for virtually any desired users. The query language is what the user works with and a good language can facilitate MIS acceptance.

Data manipulation refers to the method application programs communicate its data needs to the data base system. This is accomplished through a data manipulation language. It contributes to MIS by its ability to supply data independence and its ability to meet the data manipulation needs of the organization.

A program that provides facilities for editing, tallying, formating data, and performing other related tasks for generating more complex reports is called a report writer. This goes beyond the capabilities of normal programing languages and provides users of a MIS with another avenue to filter and present data.

The last main area is data base design/analysis aids. The importance of these lie in both the initial design and the maintenance of a MIS data base. Designing the data base to meet the organizational information needs is vital to the success of a MIS and these tools aid that process. After the system is operational, continued analysis is required to

evaluate the performance of the data base. More and more tools are being developed in this area and their benefit to MIS maintenance is desired.

This concludes the general discussion of the DBMS's role in MIS. It is an irreplaceable role and ties into all areas of a MIS, including data collection, storage, and dissemination of information.

1.5 OFFICE AUTOMATION

Office automation is a concept involving a number of new technologies that are being introduced into the office to improve office productivity, to facilitate management communications, and also to provide more stimulating and intellectually rewarding work for office workers (8). It includes such technologies as:

- word processing,
- videotext,
- teleconferencing and videoconferencing,
- computer graphics,
- electronic and voice mail,
- electronic filing.

A problem today with most information systems is the focus on operational or local management needs. Very few systems can deliver computerized information of direct use to top management or the organization as a whole. What is

happening instead is that a small fraction of a firms data gets routed to a single source (usually finance) and then some of it is reformulated for top management. The goal of modern MIS should be to merge the communication and office automation technologies with the already existing information processing capabilities. This would allow the MIS to serve the direct users, it would allow communication between departments, and it would better serve the general information needs of all levels of management.

This discussion of office automation could center on detailing what the specific technologies common in most office automation systems entail, but these technologies are generally well known. What will be concentrated on at this point is how office automation has specifically added to an organization's ability to further its information system toward a greater MIS orientation.

The fundamental goal of MIS is to move along the continuum toward a total organizational information processing system. A specific contribution by office automation is in the area of inter-office information. This includes memos, mail handling, scheduling, filing, office communication, and the handling of any office generated information. In the past these areas were handled manually or only certain segments were automated. Integrated office automation attempts to handle this information area by

incorporating it into the total MIS using available technology. The organization will see the same benefits as they did when they automated the operational level information, such as increased productivity and timeliness of information.

Inter- and intra-office communication is another area that is available through office automation. It's benefits in areas of teleconferencing, remote presentations, and inter-office mail facilities are obvious. It's role and benefit in the MIS is simply filling another void in the information handling of the organization.

There is an urgent need to plan, develop, and coordinate corporate-wide networks using office automation. The ability of an organization's managers to incorporate office automation in this manner will dictate how the MIS evolves into the most complete system.

1.6   DECISION SUPPORT SYSTEMS

Decision support systems (DSS's) are interactive computer systems developed to aid managers with problem solving in tasks that involve judgement, and this cannot be automated (9). DSS's are not a complex new concept but a refocusing of attention to the managers and the decision process. Given that attention, DSS's are relatively simple to develop.

The MIS is not only designed to "provide decisions" for repetitive classes of problems but also to provide information to assist managers in making decisions. A framework for DSS's can be formed by classifying decisions and looking at the MIS role in those decisions. Simon classified decisions into structured, unstructured, and semistructured (10). The process of making a completely structured decision is algorithmic ,while the process of making an unstructured decision is heuristic.

1. A structured decision is one in which all the steps in the decision making process are structured.

2. An unstructured decision is one in which all the steps in the decision making process are unstructured.

3. A semistructured decision is one in which some of the steps in the decision making process are structured and some are unstructured.

As table 1 shows, the MIS's role in structured decisions is the automation of the problem solution. If a problem can be algorithmicly structured, then a computer application can be written to provide the decision. Many inventory control decisions with known parameters, such as when to reorder a product, can be made by the MIS.

The role of providing supporting information is the extent that a MIS can provide for unstructured decisions.

TABLE 1

ROLE OF MIS AND CLASSES OF DECISIONS

DECISION CLASSES	MIS ROLE	
	DECISION MAKING	PROVIDING SUPPORTING INFORMATION
Structured Decision	Active	----
Semistructured Decision	Active	Active
Unstructured Decision	----	Active

It would be impossible, for example, to automate the problem of what kind of cars styles for a car manufacture to produce next year. Consumer tastes and environmental changes can not be structured to allow automation.

MIS plays two roles in the middle ground of semistructured decisions. It provides decision making applications to the structured part of the problem and provides supporting information to the unstructured part. A typical situation would be where a manager makes a decision based on several forecasting models and also uses his or her professional judgement.

The question is, do these decision classifications provide a framework for DSS's? By understanding the decision extremes of complete automation and pure judgement, one can understand the role of DSS's in balancing the skills

of the manager and the machine. A DSS represents the merger of data, decision models, and the decision maker. It's goal is to aid the organization with all classes of decisions.

Effective DSS's possess:

1. Flexibility - they should reflect the range and unpredictability of the decision making process.

2. Ease of use and responsiveness - these are essential if the manager is to incorporate the DSS into his or her ongoing problem solving.

3. Adaptivity - this reflects the individualality of both managers and situations.

The effectiveness of DSS depends on its ability to improve the manager's decision processes.

There are many DSS packages available on the market. Several systems in use are:

- IMS (Interactive Media System) - supports media consultants and managers in evaluating alternative advertising strategies.

- PROJECTOR - a DSS with an English-like dialogue that supports strategic financial planning.

- ISSPA (Interactive Support System for Policy Analysts) - a DSS to aid policy analysts in state government in evaluating alternative proposals, responding to legislators' ad hoc questions and requests for analysis, and communicating with legislators.

- AAIMS (An Analytic Information Management System) -
  Used by a major airline for forecasting, analysis of
  industry and economic trends, and ad hoc analysis
  (including a high-level evaluation of a merger
  proposal).

These systems represent the role of the computer in the
management decision making process. The contribution of
DSS's is their extension to the MIS orientation at the
management levels. The combining of DSS's with office
automation will provide MIS with a strong tool to filter and
integrate an organization's information.

1.7 THE SOLUTION

MIS has now been defined and the three areas of DBMS's,
office automation, and DSS's have been discussed as to their
role in modern MIS's. This thorough understanding of these
areas is necessary in order to develop a solution to the
problem of educating a business student in the field of MIS.
Two approaches are possible to fill this void:

1. incorporate MIS concepts into the students present
   course curriculum,

2. develop a new MIS course.

The first solution of incorporating MIS concepts into
present course work side-steps the problem. It would be a
viable solution if the need for information system knowledge
in the business world was not so great. An examination of

computer and information system usage in business organizations today will justify this point.

The most comprehensive solution, which is supported by the Business College, is the introduction of a new MIS course. This alternative would meet the problem head-on and allow adequate time to properly present the vast MIS concepts.

This solution is expanded in this report. Chapter II outlines the behavioral objectives proposed for the course. Behavioral objectives are the actions students are expected to demonstrate as they progress through the course. An outline of proposed course topics and their justification is then presented. Potential text books are reviewed with recommendations included. Chapter III discusses the ideal hardware/software environment that would facilitate this course. The software and hardware available here at Kansas State University is then described. Finally, a survey of supporting software that is available in the marketplace is presented. Chapter IV expands on the behavioral objectives by presenting problem environments that can be software implemented and support the course through hands-on experience. Chapter V presents conclusions and recommendations.

Although this project evolved out of the needs from the College of Business, the Department of Computer Science's

Information System curriculum could also benefit from the results obtained in this report. Providing the Information System majors with a course on design and implementation techniques for MIS would be an asset to their academic background. This extension of the course will also be considered in this report.

Chapter II

THE COURSE

2.1 OBJECTIVES

There are several approaches that can be taken in developing
a new college course offering. One method would be to
search out similar courses at other colleges and build on
their experiences. A second method is to evaluate text
books written in the field of concern and then pattern the
course after a text book that was decided to be the best. A
third method is to draw on the experiences of professors in
the area of study and develop a course to achieve the
perceived objectives of those professors. The development
of this MIS course involved, to a greater or lesser extent,
all three of the above methods.

Many colleges offer MIS courses with some offering
degrees in MIS. With MIS being such a broad concept, each
college had their own concept of what they thought needed to
be offered. It was useful looking at these courses but did
not help in determining what was needed at Kansas State.
Several MIS text books were examined to get a feel for the
topic. A diverse set of approaches was taken by the
different authors, which reinforced the need for an audience

tailored course. With the advice from Dr. Unger in the Computer Science Department, a topics outline for the MIS course was developed.

As stated earlier, the overall objective was to offer a MIS course to both Business and Information Systems majors. Although it would be possible to offer one general course to both majors, it is not reasonable because of the differing objectives of the two groups. MIS covers such a broad range of topics that it is necessary to tailor the course to each group's objectives. The two groups should cover the same general topics but the scope and the approach taken will be different.

The Business students should be given a broad scope of MIS. The objective is not to teach the students how to design or implement any aspects of an information system. They lack the background in computer science to do this and it is not a needed skill for a business graduate. The objective is to give the student a background on what a MIS consists of, how it interacts with the business organizations functions, and how it is managed. These objectives are broad, as will the course be, but can be achieved through a practical approach to MIS. By giving the business students hands-on experience with selected aspects of a MIS, which will reinforce the lectures, the students can gain the necessary background.

Information Systems majors can cover the same topics in MIS that the Business students do, but their approach should be more indepth in the designing and applications involved in MIS. The objective is for the students to know what a MIS consists of, how to design a MIS, how business functions, and how to merge the computer systems to form the MIS. To achieve this, a functional approach is needed. Hands on experience with a MIS is also needed, and the depth of the problems should reflect the computer experience of the students.

In determining what should be taught in a course, a good starting point is to identify the audience and then develop behavioral objectives for that audience. The audience has been identified as Business and Information System majors. At this point it is unclear at what academic level students will take this course. Therefore when considering behavioral objectives for information system students, one must take into account whether the student has had a data base course. If they have had data base experience, then more indepth behavioral objectives will be expected.

The four general areas in which MIS students should display certain behavioral responses are:

1. data base management systems,

2. office automation systems,

3. decision support systems,

4. transaction processors.

In the area of data base management systems, Business students should achieve certain abilities using one data base and one data base management system. On this predefined data base, the Business students should:
- use a query language to retrieve a signal record,
- use a query language to retrieve information from two types of records,
- add a record to a data base,
- delete a record from a data base,
- change a value in a record in a data base.

Information Systems students with no data base background should achieve these same behavioral objectives. With data base experience, the student should also change the structure in some predefined area of a data base.

Office automation systems is an area where Business students should interact with a computerized office system and demonstrate how to:
- create a text file,
- edit that text file,
- print a hard copy of that file,
- send and receive a message on a mail system,
- retrieve a file from a automatic file system,
- put a weeks schedule on a calender system,

- schedule a meeting with a specified number of people using the calender system,
- set up and participate in an electronic conference,
- make a remote presentation.

Information Systems students with and without data base experience should demonstrate all of the above behavioral objectives except creating, editing, and printing of a text file. These text manipulation activities would be mastered in their other interactive programing activities. Information Systems students should also write a small menu driven subprogram for an available transaction processor.

Decision support systems is an important area where the ability to demonstrate the following objectives will give the Business student an appreciation for the power of a decision support system to integrate an organization's information. The Business student should achieve the following objectives:

- structured problem -- use a predefined application program to get the answer to a problem,
- semi-structured problem -- use one or more preprogrammed decision support tools, like forecasting programs, and combine the resulting incomplete pieces of information to formulate a decision to a predefined problem.

Information Systems students without data base experience should achieve these same behavioral objectives. If the students have data base experience then they should do the following:

- structured problem -- use a predefined application program to get the answer to a problem,

- semi-structured problem -- build a semi-structured problem within a predefined scope,

- unstructured problem -- actively retrieve several pieces of information from different records in a data base, and use this information to formulate an answer to an unstructured problem.

Transaction processors are in wide use at the operational level of many organizations. Business and Information Systems students should be able to demonstrate the use of some preprogramed transaction processor.

Providing the students with the support tools to demonstrate these behavioral objectives is important in order to reinforce the classroom lectures of the course. The hands on experience gained by using parts of an information system is vital to the objective of any MIS course.

2.2 OUTLINE OF TOPICS AND JUSTIFICATION

Management information systems are designed to support the operations, management, and decision functions of an organization. There are a great many components in a well defined system, which leads to the problem of being able to cover the subject in one, three hour college course. This is a somewhat difficult problem but it can be handled if the subjects are taught at a high level of abstraction and the areas of more indepth concentration are tailored to the particular group of students. For example, the Business students may want to concentrate more in the area of management of the information system while Information System students would concentrate on structure and approaches to information systems.

Table 2 outlines the topics that need to be covered in this MIS course. Beside each section title is the approximate number of weeks that should be spent on coverage of that topic. This is only an estimate based on completing the course in a three hour, 16 week college semester. As mentioned above, this time frame can be shifted depending on the objectives of the audience. A short justification of each topic is now necessary to explain why each topic needs to be included.

The first section, as shown in Table 2, covers the basics necessary to provide an overview for the course.

TABLE 2

TOPICS FOR AN MIS CCURSE

I. Basics (2-3 weeks)
    A. Communication Systems
    B. Operating Systems
    C. Decision Making Systems
    D. Data Bases
    E. Equipment
II. Systems Approach (3 weeks)
    A. Problem Solving
    B. Model of Information Systems
    C. Systems Life Cycles
III. Structure of Information Systems (1-2 weeks)
    A. Transaction Processors
    B. Decision Support Systems
    C. Data Base Management Systems
IV. Distributed Information Systems (1-2 weeks)
V. Management of Information Systems (3-4 weeks)
    A. User Involvement
    B. Determing System Requirements
    C. Cost / Benefit
    D. Charging
    E. Financing
    F. Maintenance
VI. Controls (1 week)
    A. Auditing
    B. Documentation
VII. Advances (3 weeks)
    A. The Automated Office
    B. Hardware and Software Trends
    C. Security / Privacy Issues
    D. Information Service (Videotex, Utilities,...)

Communication systems is the first topic; communication systems are very important in any computerized MIS. One of the primary concerns of a MIS is the gathering, monitoring, and disseminating of information throughout the organization. This could involve communication systems within a single site or among distributed sites. With modern office automation systems bringing MIS facilities to the desk of virtually anyone in a company that needs it, an understanding of these communication systems is necessary.

A brief overview of operating systems is helpful for a student unfamiliar with how a computerized system is controlled. A short discussion of the functions of an operating system can both dispel some of the possible mysteries of how a computer operates and can demonstrate the important service that a well written operating system can perform for an information system.

When it comes to the management level of an organization, decision making systems provide a irreplaceable service in this era of information floods. An understanding of available decision making systems, how they filter out necessary information, and how they are integrated with the other components of an MIS is necessary before a person should use one of these systems in their decision making processes. At this point in the course this topic should be covered at a high level, with more indepth concentration provided in section III under decision support systems.

An overview of data bases is obviously needed since a data base is the center point of a computerized MIS. Many students will be aware that most components of a MIS will interact with its data base, but a general discussion of some of the important objectives in data base technology are important, such as:

- data independence,
- data shareability,
- non-redundancy of data stored,
- integrity,
- security,
- performance and efficiency,
- administration and control.

The final topic under the Basics section that should be covered is equipment. Depending on the background of the students, a knowledge of the basic equipment necessary in a MIS is important in order for the student to intellectually discuss and understand how information systems operate. For students with little computer science background this discussion may cover such basics as input and output devices. If the students have a good background then the discussion may go into more indepth areas such as modern communication equipment.

The overall justification for covering these areas in the Basics section is to provide the students with an overview

of components in a modern MIS. It should not involve great detail but provide a background to facilitate intelligent discussion of the following topics.

Section II in the outline of topics covers the Systems Approach. A systems approach is primarily a philosophy for creating structures which coordinate in an efficient and optimum manner the activities and operations within any system. A systems approach is the cornerstone of the phases involved in the process of developing an information system. We are in an era in which we are confronted with accelerating diversity and complexity in modern organizations. This diversity and complexity of organizations makes the development of the information system to meet the needs of an organization very complex. A structured approach to the development of information systems should ; therefore, be included in any MIS curriculum.

In this MIS course, a discussion of the systems approach to the design of an information system should logically begin with the steps in problem solving. The steps to problem solving can be identified as:

1. defining problem,

2. gathering data relevant to the problem,

3. identifying alternative solutions,

4. evaluating the cost and effectiveness of the alternatives,

5. selecting the best alternative,

6. implementing and monitoring the selected alternative. Behaviorally, the students should be able to apply the systems approach to the process of information systems development and to problem solving, thus giving them a methodology which can be applied for problems occuring within the complexity of organizations.

In order to understand the role and structure of information systems in organizations, the knowledge of the way organizations are built and act is an important prerequisite to understanding the role of information in organizations. By studying the models of information systems and relating them to the models of organizations, the students will realize the close relationship between the organizational structure and the structure of the MIS. Examining specific models of systems, students will learn from both the successes and failures of these models and will see why tailoring a model to an organization is necessary.

Like the development of a new product, a life cycle applies to an information system. The idea is that the development and operation of any information system must evolve through the same consistent and logical process

without ignoring any steps. This is not saying all
information systems are alike, but the development phases
are identical. The study of the life cycle phases of
definition, construction, implementation, and operation,
give students a framework for the systems development.

The structure of information systems is the topic of
section III of the outline. The justification for this area
is fairly evident. Transaction processors, decision support
systems, and data base management systems (DBMS) provide the
major interface between the users and the organizational
information. Transaction processing systems generally
support the activities of the operations level. Decision
support systems can support the operations, management, and
strategic planning levels of a firm. A DBMS provides a
software system the capability of supporting and managing an
integrated data base. Examination of these three topic
areas are essential to the understanding of any modern MIS.

Section IV covers distributed information systems. With
the escalating power of micro, mini, and midi computers, and
the advent of sophisticated communication systems,
distributed computer systems are rapidly becoming more
popular. Rather than keep purchasing monolithic single-site
computers, organizations are distributing their computing
facilities and data to various sites. Distribution can put
information into the hands of the people who create, use,
and control it.

Distributing an information system introduces many new areas of importance, for example, the questions of what to distribute (data, programs) and how to maintain integrity of information. Distributing of information systems is becoming more and more common in firms, so any complete MIS course should address this area to some degree.

Management of information systems is the topic of section V of the outline. This topic has a broad scope. Although a whole course could be made from just this area, a general discussion on the steps involved in managing the operation of information systems is adequate background.

The first topic under management is user involvement. This comes into play at many stages of development and maintenance of a MIS system. The whole focus of a MIS is to provide the users with useful information. This starts with defining user requirements, feasibility studies, and defining user responsibilities of data integrity.

Determining system requirements is another area that extends over the life cycle of a MIS. Initial system requirements must first be determined. As a MIS evolves, new systems must be developed to meet the necessary requirements.

Cost-benefit analysis, charging for computer services, and financing are all vital to efficient management of the

MIS. These areas are not new to the area of management but a thorough discussion is necessary because information systems involve areas of hardware and software technology unique to MIS.

Maintenance of a MIS can be a costly part of a total MIS investment. In order to control these costs, managers must have a predefined maintenance plan and closely monitor areas that need improvement.

Section VI covers the topic of controls. With information systems integrating so many aspects of a firm's operational and management information sources, controls are necessary to monitor the integrating of the data. Students need to be informed of auditing techniques that are available and understand why a predefined system of control is desirable. Documentation is a vital control. Since information systems are an intangible entity, the only way to evaluate and control their products is through documentation. Its service as a passive control tool needs to be presented to the students.

The final section on topics for this MIS course is section VII titled Advances. No college MIS course is complete without exposing the students to recent advances, trends, and issues. If we expect to send out well informed graduates, then these issues are vital to their education.

The automated office has to be the single biggest advance in information systems in recent years. The automated office has given an organization's users ready access to all areas of the information system. Where a manager used to request a business activity report from the firm's data processing department, now the manager can query the data base or run a application program directly from his office terminal.

A discussion of hardware and software trends is also appropriate. Security and privacy issues are becoming important with the greater use of computer data storage. Information services which provide information to subscribers is growing in use. These issues are affecting today's information systems, and should therefore be presented in this MIS course.

That concludes the justification of the outline of topics that needs to be covered. It should be restated that the outline in table 2 covers the topics necessary in a MIS course but the emphasis on particular topics should be shifted according to the particular audience of students. For example, the Business students may concentrate on management and controls while Information Systems students may concentrate on designing systems. This does not imply topics should be skipped but the time frame may be shifted.

2.3 POTENTIAL TEXT BOOK

After developing the course outline, several text books on
MIS were examined.   The objective was to find a book that
best presented the topics contained in the outline.   The
readability, organization, and the timeliness of the
material were important evaluating factors.   Four of the
best text books that were examined are:

1. "Principles of Information Systems for Management,"
    by Ahituv Neumann (11),

2. "Information Processing Systems for Management," by
    Hussain & Hussain (12),

3. "Information Systems for   Modern Management," by
    Murdick & Ross (13),

4. "MIS - Concepts and Design," by Robert G. Murdick
    (1).

Examination of these four   books revealed the varying
approach each took to MIS.   Taking into account the two
different audiences,   Business and Information System
students, two excellent books are recommended for the
course.

Hussain and Hussain state that the purpose of their MIS
book is to provide managers and students of management with
the basic understanding of information processing systems.
Although their book could be beneficial to students in a
variety of disciplines, it is geared toward the non-computer
science student.   The first 200 pages cover basic computer

hardware, software, and data technology. Most of these areas would be covered in basic computer science courses. The focus of the rest of the book is towards the management of the information systems. There are only 80 pages devoted to the development and design of information systems. The books approach to this area is at a high level, a management level.

After reading this book, a student would not have the background to set up a MIS but would have the basic knowledge of how someone develops and manages a MIS, which makes it an ideal selection for the Business student's MIS course.

Ahituv Neumann's book is much more detailed in the implementation of a MIS. The book is written for both students of computer science and non-computer science majors. Much coverage is given to models and theories of information systems. A good background is given into the psychological and behavioral aspects of information systems, decision making, and the systems approach. Including these areas accurately demonstrates the detail and focus which this book takes in covering the development and design of a MIS.

The Neumann book is suited for the student who does not need to know about basic computer hardware and software but wants to know how an MIS is implemented and what needs to be

done to develop a good MIS.   These criteria suit this text

book for the MIS course for Information System students.

Chapter III

AVAILABLE HARDWARE AND SOFTWARE SUPPORT

A necessary part of teaching any MIS course is the
experience the students should get through actual use of MIS
support tools. The previous chapter outlined the behavioral
objectives the students should demonstrate using these
support tools. This chapter is intended to outline the
hardware/software environment available at Kansas State
University for use in this course. Possible software
products will also be discussed, but first a discussion of
what the ideal environment would consist of.

3.1 THE IDEAL

When people prepare to develop and implement any idea, they
usually dream of the perfect situation. The situation where
they have access to the ideal resources and environment.
They are soon brought back to the reality when the
restraining factors of time, money, and other restrictions
enter the picture. This dreaming is good in providing one
with direction. It gives a goal to strive for to reach the
ideal implementation.

A discussion of some of the ideal qualities the
hardware/software should possess to support a MIS course is

beneficial to provide a guideline for both obtaining new tools, and in adapting available tools to the course. The approach taken will be from the user standpoint.

There are many hardware attributes that can best support this MIS course. To ideally supply the desired capabilities, highly sophisticated terminals would be needed. An intelligent terminal with full screen editing capabilities would provide a modern office environment. Graphics capability is another attribute that would aid in both the office automation and the decision support system environment. Graphics provides for easy interpretation of information and because of its heavy industry use, it should be available. Voice communication capability would allow remote presentation and conferences to be experienced. With travel and people cost continually increasing, businesses are going more and more to this type of activity.

The ideal software environment qualities center around two words, user friendliness. Computing power is getting cheaper and cheaper, with the thrust shifting away from saving execution time to saving people time. To give the students a modern background in MIS, the tools need to emphasize this attribute.

User friendliness begins with an interactive environment. The software tools should not be batch jobs but should be run in a real-time environment. Businesses are getting away

from the 'data processing department' view of information retrieval and moving to a user retrieval system, which requires our teaching tools to follow.

In the DBMS area, user friendliness falls on the type of query language used. The query language is what the user bases an opinion of the DBMS on, not the ease of implementation of the data base structures. An English-like, interactive language would be the best. In this MIS course environment, the students will have only a limited exposure to data base querying, so a complicated language would be a great hinderance.

The other aspect to consider is the data independence of the DBMS. The insulation of users from a wide variety of changes in the specific logical organization, physical organization, and storage consideration of the computerized data base is desired. This is yet another step in a more user friendly DBMS.

The decision support systems used should also demonstrate user friendly qualities, but also be flexible enough to adapt to varying areas. Many DSS's are extremely specialized in the area they support, like accounting or finance. There are some that can support all areas of the organization. These are the type that should be used so that decision tools from all departments of business can be used.

Finally, the office automation ideal is also a system that requires little learning time to use. It should be geared toward people without computer experience and should demonstrate both inter- and intra-office capabilities.

The above discussion of hardware/software ideals is general but identifies some important evaluating characteristics. There will be compromises on the type of tools that will be actually used, but if these certain attributes are strived for, then the tools will best meet the MIS orientation.

3.2   MACHINE ENVIRONMENT AT KANSAS STATE UNIVERSITY

The machine environment at the University is continually evolving. The Department of Computer Science and the University Computing Center have many hardware and software plans they intend to implement in the future. For example, the Computing Center plans to install a new NATIONAL ADVANCE SYSTEM 6130 Central Processing Unit in January, 1983. The Department of Computer Science plans to purchase a VAX/750 in the near future. It is hoped this type of hardware acquisition will continue in the future. In looking at the software MIS tools that we presently have and the tools that may be acquired, two machines are considered as possible candidates for use in this course. The two environments are:

1. NATIONAL AS/5, 4 megabytes of storage, running OS/MVT
    Release 21.8A and HASP Remote Job Entry under VM/SP
    Release 1.

2. VAX/750, 4 megabytes of storage, running either VMS
    or UNIX SYSTEM/3.

The NATIONAL System is the main computer used for academic
and research studies. Due to the estimated 600 students per
year for the course, the most likely machine will be the
NATIONAL AS/5, because of its capacity. For general student
interactive use, the following terminals are available:

- Calvin Hall

  • 2 DecWriter LA36 Terminals,

  • 8 Hazeltine 1510 Terminals.

- Cardwell Hall

  • 4 ITT Courier Terminals.

- Fairchild Hall

  • 1 DecWriter LA36 Terminal,

  • 4 Perkin-Elmer Bantam Terminals.

- Seaton Hall

  • 1 DecWriter LA36 Terminal,

  • 10 ITT Courier Terminals,

  • 8 Perkin-Elmer Bantam Terminals.

The VAX/750 is a machine that will be purchased for the
Department of Computer Science and would be located in
Fairchild Hall. It is presently not known what academic
areas will have access to the VAX. It will have 48 terminal

ports containing 32 terminals, 5 graphic terminals, 5 personal systems, and 6 ports open for expansion.

3.3 SOFTWARE AVAILABLE AT KANSAS STATE UNIVERSITY

Now that the two machine environments have been specified, the software that we presently have available at the University should be presented. There are several software packages available on each of the two machines that fall under the category of tools that could be used for this MIS course. All the software discussed in this section is available to use and would cost nothing to get access to. The software will be explained under the appropriate MIS area that they would be applicable. The discussion on each tool will be at an introductory level, with further interest requiring reading of the specific documentation.

The first machine to discuss is the NATIONAL AS/5, in particular the software that could be considered under office automation. For text editing, three editors are available. The most primitive is the standard IBM editor called EDIT. This is the first editor available on this system and offers very basic text manipulation abilities. A more powerful editor from Perkin-Elmer has been added, which is called PEDIT. It is compatible with the IBM EDIT and can do the following:

- creating and changing of files,
- expand, delete, and change text,

- allow searching and changing of portions of the file through context-directed or by using specific line numbers,
- line evaluation,
- serialization,
- recursive editing.

The next upgrade is the IBM supplied XEDIT. It contains many new commands and supports a very powerful macro facility. It also supports full screen editing functions when used from IBM 3270 compatible terminals. When used with the full screen editing, XEDIT offers a powerful office editing tool. With features like split-screen editing, custom macros and line moving features, the editor can be adapted to many office text processing duties.

Word processing is important in office automation and a text formating system called SCRIPT is supported on the NATIONAL machine. Input files containing SCRIPT commands are created and edited using the CMS editors. From these files, SCRIPT produces formatted text on the communication terminal inself, on the line printer, or into a permanent file. Features include automatic pagination, justified left and right margins, footnoting, indentation, and multi-column text.

SCRIPT offers facilities at two principal levels: 1) at the level of predefined macros which define generally

acceptable formating conventions and 2) at the level of individual SCRIPT formatting commands. The SYSPAPER macro enables the SCRIPT user to produce complex documents in a choice of three different layout styles. The SYSPUB macro provides 9 different layout styles for publications ranging from manuals and research reports to academic theses. Individual formatting commands can be used to tailor reports.

The final office automation software available is a mail facility. A CMS command called MAIL, allows a user to send mail to another user even if he is not signed on. The sent mail will await him until he does signon, at which time a message informing him of the mail will be displayed. The mail can then be saved or deleted.

For a DBMS, the NATIONAL AS/5 supports IDMS (Integrated Data Base Management System). This is an implementation of the CODASYL Data Base Task Group Language specification and is marketed by Cullinane Corporation. On our system, it supports application programs written in ANS COBOL or PL/1. IDMS is currently set up primarily for independent batch program execution, but IDMS application programs will execute under CMS to provide a single-user interactive system.

Cullinane Corporation also puts out a report writer called CULPRIT, that the NATIONAL AS/5 supports. It is a

parameter-driven utility program designed to generate reports both from ordinary sequential files and from data contained in an IDMS data base. CULPRIT was designed to enable people to obtain the results that programmers obtain, without the necessity for a long period of training in a programing language.

In the decision support area, there is really only one package available on the NATIONAL machine, the EMPIRE system. However, there is a reporting system called ADRS2 (A Department Reporting System) available. This is an installed user program written in APL. ADRS is designed to report, calculate, select, sort, tabulate, and print business information. After only a few hours experience, business professionals can produce useful customized reports to their requirements to aid in decision making.

The true decision support system comes from Applied Data Research Services Inc., and is called EMPIRE. It is a business modeling, analysis, and reporting system which provides facilities to construct business models and a set of powerful analytical methods to compare the results of various strategies or decisions. EMPIRE is designed for use by non-programmers and currently runs interactively under CMS. Some of the system features include:

- Modeling Language -- to define any business situation which is to be studied, using an easy to learn language.

- Function Library -- contains many commonly used algorithms like depreciation, rate of return, compounding, trigonometric functions and forecasting.

- Reporting -- a command-driven report writer for information display.

- Graphics -- an interactive graphics facility allows pictorial display of information.

- Data Management -- performs functions of data input, output, error checking, consolidation of data, and other manipulation functions.

- Interactive analysis -- allows user to test assumptions and evaluate alternatives quickly, efficiently, and target value analysis.

- Monte Carlo Simulation -- this risk analysis facility allows for interactive execution of model logic.

- Data Analysis and Forecasting -- a collection of statistical techniques such as multiple regression, exponential smoothing, moving average, seasonal analysis, and adaptive filtering.

As is evident by the above system features, EMPIRE is a powerful decision support system. Its use should be strongly considered in the MIS course.

This concludes the main software packages on the NATIONAL AS/5 that could be utilized in the MIS course. The following discusses the software available for the VAX/750. These software tools will run under UNIX operating system.

For the office automation functions of MIS, the VAX will support a couple tools. First is the Vi (visual) display text editor. This is a full screen interactive editor developed by the University of California, Berkeley. It has a powerful set of commands that perform a wide range of text manipulation functions, much like IBM's XEDIT. Vi will work on a large number of display terminals, both intelligent and dumb. A full command set of more traditional, line oriented editor commands is available.

The VAX will also support under UNIX, the text processors called NROFF and TROFF. NROFF formats text for typewriter-like terminals and TROFF formats text for Graphic Systems Phototypesetter. They both accept lines of text interspersed with lines of format control information and format the text into a paginated document having a user-designed style. Some features included are:

- arbitrary style headers, footers, and footnotes,
- multiple automatic sequence numbering for paragraphs, sections, and chapters,
- automatic overstriking and bracket construction,
- line drawing functions.

NROFF and TROFF are compatible with each other and it is almost always possible to prepare input acceptable to both.

A third office automation tool available on the VAX is a mail system. It is a typical mail environment for sending

and receiving mail. MAIL allows such things as sending to multiple users, building of message lists, and storage of received mail.

The VAX also will support an available calendar program. It allows one to build files with dates and destinations associated with them. Once a day, the calendar program checks the dates of everyones calendar files. If the date is today or tomorrow, then the file is sent to the appropriate destination. Weekends are handled by sending Monday's files on Friday.

The DBMS the VAX/750 will be running is called INGRES, a product of the University of California, Berkeley. INGRES supports a full relational data base. The data manipulation language supported by the INGRES system is called QUEL (QUEry Language).

There are no decision support systems available at the University that will run on the VAX. This is an area that would need improvement if the VAX was to be used for the course.

This concludes the outline of available software for the two systems. The explanation was brief on each package, with further documentation available from the Computing Center Information Services and the Department of Computer Science.

3.4 MARKET SURVEY RESULTS

Besides just surveying available software that was located on campus, an effort was made to survey outside vendors for MIS related tools. In order to decide which vendors to contact, 5 sources were used:

1. ICP Software Business Review (14),

2. Electronic Office: Management of Technology (9),

3. Datapro (16),

4. campus computer science personnel and professors,

5. advertisements in computer science journals.

Appendix A lists the 75 vendors names and addresses that letters requesting information were sent. The areas that were specified as needed software were:

- intra/inter office communication and office automation,

- decision support,

- text editing.

Appendix B shows the letter that was sent to each vendor. Software was requested for the NATIONAL AS/5 and VAX/750.

All letters were sent to vendors by September 11, 1982. Due to the time constraint for this report, only correspondance received before October 29, 1982 was included in these survey results. Some vendors only sent a general description of their products which required further correspondance, and some venders have yet to reply. In these cases, although the full extent of their products may not be represented in this report, continued correspondance

will be made and responses will be collected and turned over to the appropriate administrative persons.

The responses received were varied and many were incomplete as to machine compatibility and the specifics of the products. Appendix C contains a table of the responses received. The heading of 'No Related Products' includes both vendors with no products in the specified area and vendors with related products but are not compatible with our machine environment. The 'Office Automation' heading includes office communication and text editing products since most packages contained either products in both areas or no products at all. Logically there should be a price column indicated in Appendix C. This was ignored since few vendors supplied price information with our initial contact. Where the price of a package was supplied, it will be included in the text discussion below.

The conclusion of this section will now give a summary of the products that are available from vendors and fall in the areas of office communication, text editing, and DSS's. This discussion is intended as an outline of these products, their features, and the area of MIS that they can be used.

DISTRIBUTION IV. This product from Informatics General Corporation has integrated information management systems for inventory, merchandising, retail customer services, and financial applications. Comprehensive education and

management systems consulting programs are also supplied. More information is being sent by the vendor on this system.

INFORMATICNCOM. This is another product from Informatics General Corporation which supplies a dedicated workstation for information analysis and program preparation. It is a micro processor based workstation which operates as a stand alone processor, or as a communication terminal to a central computer. It can be connected under CMS protocol on the NATICNAL AS/5. INFORMATIONCOM has a couple features that could be applied to a MIS course. First it has the capability of querying a central data base and also has local file management capabilities. The advantage of having a personal computer type machine tied into the central computer offers many customizing possibilities.

WYLBUR. This product is supplied by On-Line Business Systems, Inc. WYLBUR is a powerful, TSO-like, specialized application program that interfaces the user to the computer. One aspect is the text editing facilities. WYLBUR supports a full screen editor with English-like commands. A document formating feature allows preparation of manuals, textbooks, contracts, and other large documents. WYLBUR also supports an execution language that can be designed into interactive applications that perform sorting, data base inquiry, calculating, and many other programing techniques. WYLBUR is supported by an interactive training

tutorial called LEARN. There are other capabilities but it's power is evident by it's comparison to TSO. The approximate price is $24,000, excluding maintenance.

PROFS (Professional Office System). This is an IBM office system designed to fill the office-related requirements of managers and other office personnel. Among it's abilities include scheduling meetings, a calendar routine, filing and retrieving of documents, and the ability to enter, edit and store documents. This system is designed for use on IBM 3270 display terminals and could be implemented under CMS. The approximate lease is $400 per month.

NICHOLS. This system is put out by Nichols & Company, Inc., and is a project planning and control system. This is a specialized DSS that attempts to integrate the entire spectrum of project planning and control. The planning function is accomplished by simulating a trial plan and observing the effect of that plan on the current resource load. The control aspect is accomplished through analysis and report programs. NICHOLS is a dynamic, flexible networking application that provides:

- resource management,

- performance analysis,

- up-to-date project status reports,

- forecasting and trend analysis,

- communication and involvement in the control of projects.

This package is easy to use and has powerful report generating capabilities, from trend analysis to path analysis. The approximate cost of this system is $30,000 to $40,000.

THE BIG 8. Developed by Management Science America, Inc., it is an effort to provide a package to share information among all levels of an organization. The concept of this package is to provide software under 3 main divisions, and within these, a total of 8 separate application areas. These applications are outlined as follows:

- Human Resources
  • Payroll
  • Personnel Management Reporting
- Cash Management
  • Accounts Receivable
  • Accounts Payable
  • Supplies Inventory Control and Purchasing
- Financial Reporting and Forecasting
  • Fixed Assets
  • General Ledger
  • Financial Forecasting and Modeling

These various applications may be purchased as a complete unit, by major division, or by individual application. The

application that will offer a DSS tool is the Financial
Forecasting and Modeling package. It offers support in
areas of trend analysis, planning and budgeting functions,
and cost analysis.

ONLINE ENGLISH. This is an Cullinane Database Systems,
Inc. product. ONLINE ENGLISH (OLE) was developed as an
extension to their group of data base products, including
IDMS, CULPRIT, ONLINE QUERY, and other data management
products. OLE is an English-language query system that
allows information retrieval by means of simple requests.
OLE accepts and interprets freely-worded requests, retrieves
the appropriate data, and performs the necessary processing
to display the results in a meaningful format. OLE is set
apart from traditional query languages by it's power to
translate English-like queries. OLE offers the following
benefits:

- ease of use and little training needed to learn,
- enhanced system usage by allowing inexperienced
  personnel to use,
- flexibility in use,
- increased productivity.

OLE is a powerful user-friendly tool and further information
on it's capabilities can be found in the extensive
documentation supplied by Cullinane. It would be a valuable
MIS tool due to its ability to bring the data base in the
hands of inexperienced users.

This concludes the discussion of the relevant tools that can be supplied from vendors. It is hoped that additional MIS support tools will be available from vendors that have yet to reply to our letter.

Chapter IV

PROBLEM ENVIRONMENTS TO SUPPORT BEHAVIORAL
OBJECTIVES

A beneficial enhancement to this report would be a chapter detailing the specific software requirements for the support tools to be used in this course. Although these requirements must eventually be specified, it would be premature to do so at this point. Before this can be done, administrative decisions need to be made as to the hardware support, machine configuration, and the software support to be made available to the MIS course. The focus of this paper is to provide the administration with the background to aid in these decisions. Once this is done, requirements specifications can be developed for the specific software support tools.

What can and should be expanded on in this report is the problem environments to satisfy the behavioral objectives established for this course. Chapter II outlines the behavioral objectives that might be used for this course. It is the focus of this chapter to take these objectives and develop problem scenarios. To implement these problem environments, software can be purchased or leased from an outside vender, can be written here at the university, or

presently available software may be adapted to meet the functional specifications.

Whatever tools are used to implement these scenarios, special attention should be paid to the user friendliness of the tools. The main audience of this course is Business Majors, and the objective is to expose them to these MIS areas. We do not want to expose them to a poor implementation and give them a bad impression of MIS software tools. The students should leave the course with a favorable and accurate impression of the well defined MIS software tools available today. For example, we do not want to allow the students to perform text manipulation on an editor that is burdensome for even simple operations. There are many powerful, user friendly editors available that would accurately demonstrate the ease at which text editing can be accomplished. Favorable acceptance of computerized tools is always enhanced if the initial interaction to those tools is favorable.

In addition to giving the students well designed tools, they should also be shown the limitations of the systems. This means that one problem scenario should be required of the students in each area that can not be accomplished with the tools being used. It is important in the understanding of any system to realize its limitations, especially in a situation where people are exposed to new software systems

for the first time and for only a brief period. This paper will not include these limitation scenarios because they are software dependent. At this time the specific software tools that will be used have not been chosen.

For purposes of describing the problem environments, the following breakdown will be used:
- Office Automation,
- Data Base Management Systems,
- Decision Support Systems,
- Transaction Processors.

A series of scenarios will be outlined for each of the four areas. They will incorporate the behavioral objectives outlined in Chapter II. There will be a series of problems with each described in general. Each problem will build upon the previous one and increase in complexity. The detail of the problems is general in order to allow flexibility in the software requirements specifications depending on the hardware/software environment used.

4.1 OFFICE AUTOMATION

PROBLEM 1. This initial problem is intended to familiarize the student with the terminal environment, the editor or word processor, and the means to produce a hard copy printout. The student should:
- be given a short word text,

- in a specified environment, the text should be typed in on a terminal, without change to errors,

- the file should be permanently stored on disk,

- the file should be routed to a printer,

- the printed output should be presented as evidence of completion of this problem.

PROBLEM 2. This problem is intended to demonstrate retrieval of a file, use of editing functions, and replacement of an old file.

1. The student should be given a list of changes to make to the file created in problem 1,

2. this file should be retrieved from permanent storage,

3. the file should be changed according to the list, which should include:

   - correct the spelling of a word,

   - insert a word within a sentence,

   - make a global change,

   - add a line to the text,

   - delete a line from the text,

   - move a line of text to another location in the text.

4. the old text file should be replaced by the new text file,

5. the new file should be routed to a printer,

6. the printed output should be presented as completion of this problem.

PROBLEM 3.   This exercise is to give the student experience on an intra/inter office mail system.

    1.   The student should be given a text message and the name (location) of a person to whom to send the message,

    2.   a file should be created containing the message,

    3.   the message should be routed to the specified person,

    4.   the receiving of the message will constitute successful completion of this task,

    5.   the student should demonstrate the ability to read-in a message that is sent to them,

    6.   a printed copy of this message will constitute successful completion.

PROBLEM 4. This problem is specified to provide the student with experience using an automatic file system.

    1.   The student should be given the name of a file to retrieve,

    2.   the automatic file system should be used to retrieve the specific file,

    3.   a printed copy of the retrieved file will complete this exercise.

PROBLEM 5.   This problem is intended to give the student experience using an electronic calendar system.

    1.   The student is required to enter a weeks schedule of his own into the calendar system,

2. the student should be given the name of a fellow person on the system,

3. the student should schedule a meeting with this person based on that person's calendar schedule,

4. successful completion of the scheduled meeting will end this exercise.

PROBLEM 6. The ability to setup and participate in a remote electronic conference will be experienced in this problem.

1. The student will be given the names and a time to set up a conference,

2. at the specified time, the people should be called to begin the conference,

3. successful contact with the designated people and a short conversation will indicate completion.

4.2 DATA BASE MANAGEMENT SYSTEMS

The objective during this series of problems is to expose the students to a low level of data base manipulation. A simple, predefined data base should be developed for the students to use. All experience should be limited to one data base management system (DBMS), using the most English-like query language available.

PROBLEM 1. This first problem is to introduce the student to the DBMS by way of a simple retrieval.

1. The student should be presented with the simple subschema describing the data base to be used,

2. a single record to be retrieved should be specified,

3. that record should be retrieved by the student through an interactive query,

4. proof of completion will be the result of the query.

PROBLEM 2. This scenario is to build on the preceding problem through two additional queries.

1. The student should be requested to retrieve two different types of records from the data base,

2. again, retrieval will indicate completion.

PROBLEM 3. This problem is designed to familiarize the student with queries that modify the data base, specificly add, delete, and change a record.

1. The student should be given the name of a specific record,

2. query or queries should be made to locate that record,

3. the record should be deleted,

4. the name of another record in the data base should be specified, along with a change to be made,

5. the record should be located and changed,

6. a record should be presented to the student with instructions as to the place to insert it,

7. the student should locate the designated place in the data base and add the record,

8. completion of the delete, change, and add will terminate this exercise.

All students should perform the above problems, and in addition, the Information System majors should exhibit additional skills by completing problem 4 below.

PROBLEM 4. This scenario is presented to give students with more experience a chance to manipulate the structure of a data base.

1. The student should be given a subschema to the data base,

2. documentation to the data manipulation language (DML) appropriate to the DBMS should be provided,

3. a specific structure change to the subschema should be given,

4. the student should use the DML to make the change,

5. successful subschema change will end this exercise.

4.3 DECISION SUPPORT SYSTEMS

Describing problem environments for the area of DSS's will be general. DSS's cover such a broad category of possible applications and the specific DSS tools to be used in this course are not known. This section will be beneficial in presenting the types of problems that should be preformed to gain experience using the computer to aid in structured, semistructured, and unstructured decision making processes.

PROBLEM 1. This problem is to familiarize the student with a computer solved, structured problem.

1. The student should be presented with a structured decision to make,

2. an application program should be supplied that requires no information from the user,

3. the program should be run,

4. the student should interpret the output and answer the problem to indicate completion.

PROBLEM 2. Another structured decision will be presented in this problem but this one will require input from the user.

1. The student should be presented with a different structured decision to make along with supporting data,

2. an application program should be supplied which partially relies on user supplied data,

3. the student should run the program, supplying the appropriate supporting data,

4. completion of this task will require interpretation of the output.

PROBLEM 3. This problem entails a semi-structured problem. The student will be required to use one or more decision support applications and form a decision based on the output.

1. The student will be given a specific semi-structured problem,

2. the necessary decision support tools should be presented and explained as to their possible support in the decision,

3. the student should choose the appropriate tools to use,

4. the applications should be run,

5. the decision should be made by incorporating fragments of information supplied by the output from the tools,

6. evaluation will be based on the resulting decision.

The above three problems are designed for Business students. These students will not solve an unstructured problem because this type of exercise entails pure judgement, with the computer only suppling supporting information. Information System students will solve this type of problem, but only to gain experience in information retrieval. Information System students should perform problem 3 above as an exercise in semi-structured decisions. In addition, the two problems below should be accomplished.

PROBLEM 4. This scenario is designed to give Information System students a greater understanding of how DSS's aid in semi-structured problems. This will be accomplished by having them design a problem.

1. The student should be supplied with several decision support tools,

2. supporting documentation as to how the tools can be used should be on hand,

3. the student is to design a semi-structured problem that can be solved with the aid of several decision support tools,

4. the solving of the problem should be demonstrated,

5. the incorporation of the different tools into a specialized 'system' to solve the problem will be the factor of evaluation.

PROBLEM 5.   This problem is presented to demonstrate the lack of automation possible for unstructured problems and to gain experience in information retrieval.

1. The student should be given a simple unstructured decision that requires a small amount of retrieval information to make a judgement,

2. the needed information should be retrieved from the data base by way of query,

3. applying the data to the problem and making a judgement signals completion.

4.4   TRANSACTION PROCESSORS

Transaction processing systems (TPS's) handle the major part of the work load of an information system.   They record and store most of the data needed by the information system, and also generate most reports and documents needed by operational users.   This section describes only one scenario for Business and Information System students.   It's important for students to understand them and enforce that by using one, but a series of problems is not necessary.

PROBLEM 1.   This problem is intended to allow students to demonstrate their ability to use a TPS.

1. The students should be presented with the documentation for a specific TPS,

2. data to be entered should be given to the students,

3. a specific operational report should be required,

4. the student enters the data into the system,

5. the outputed report will indicate successful completion of this problem.

This concludes the outline of problem environments to satisfy the behavioral objectives. It should be stressed, at this point, of the importance for these scenarios to be further developed and implemented into the course. The hands-on experience that the students would gain by performing these problems will both maintain student interest in the course and reenforce the classroom lecture discussions.

Chapter V

CONCLUSION

The purpose of this report was to address the problem of providing business graduates with a background in MIS. The solution was to design a college course in MIS. Involved in this design was a course outline, text book review, behavioral objective specification, problem environment development, and software review. It is worth summarizing the results from these design areas and to make some recommendations.

5.1 RESULTS

It was understood from the beginning that this course would be beneficial to both Business and Information System majors. This was discussed at each level of the design and was generally handled by tailoring the topic to the specific audience.

The initial step of any course design is developing an outline of topics. An extensive list of topics was developed to cover MIS. For the Business majors, this course must be taught from a general business view. A mistake would be made to tailor the course to specific Business major areas in order to fit the student, although

some problem environments may be custom designed. For example, if the accountants only learned about the accounting functions of the MIS and management majors only looked at the management of MIS, all would lose. MIS needs to be studied from an overall general view because understanding the total view of organizational information integration is the basis for the course. A reasonable following of the suggested topics will insure this general approach.

The behavioral objectives development and the resulting problem scenarios are an important aspect of this course. It is understood that in order to allow students to get the hands-on experience, as outlined in this paper, it would require a lot of resources, both student time and hardware/software. By committing these resources, the students will experience the MIS concepts discussed in the course lectures, and in turn make themselves more marketable to the business community.

The software tools available to support these behavioral objectives were discussed. The purpose of this analysis was not to recommend the hardware/software to use or purchase. It is intended as a summary of possible tools available, and in turn, an aid to the administrator deciding on the environment to use. A good look should be taken at the available software. Monetary constraints are sure to enter

the picture, which makes available tools such as XEDIT, SCRIPT, and EMPIRE look more attractive. There are many quality software packages that would be good to purchase, but if that isn't possible, there is a lot of computer science student resources that could be tapped for customized program development in areas of weak MIS support tools.

5.2 FURTHER STUDY

Further research possibilities fall into two areas. The initial software survey to outside vendors should be followed up by additional contact to vendors that responded with promising MIS software. The avenue of educational discounts and gifts should actively be pursued since past experience has netted the University several free software packages.

The second area of further development should be the implementation of the problem environments developed in this report. These scenarios would involve a combination of existing tools and of new software development. This is an important extension of this report and the fulfillment of the course development.

It is hoped that neither monetary constraints, academic politics, or indifference stands in the way of offering this MIS course to both the Business and Information System

students.   It will benefit both the students and the organizations that the students go to work for.

Appendix A

VENDOR NAMES AND ADDRESSES

COMPUTER CORRAL
MANAGER SOFTWARE DIVISION
23011 MOULTON PARKWAY -- SUITE G-6
LAGUNA HILLS, CA   92653

XEROX COMPUTER SERVICES
MANAGER SOFTWARE DIVISION
5310 BEETHOVEN STREET
LOS ANGELES, CA   90066

ATLANTIC MANAGEMENT SYSTEMS, INC.
DONALD R. GOODMAN, MARKETING
320 WALNUT ST.
PHILADELPHIA, PA   19106

AVCO CORPORATION
MANAGER SOFTWARE DIVISION
1275 KING STREET
GREENWICH, CT   06830

NICHOLS AND COMPANY, INC.
5839 GREEN VALLEY CIRCLE
SUITE 104
CULVER CITY, CA   90230

BRADFORD NATIONAL CORPORATION
MANAGER SOFTWARE DIVISION
67 BROAD STREET
NEW YORK, NY   10004

COMPUTER ASSOCIATES INTERNATIONAL
MANAGER SOFTWARE DIVISION
125 JERICHO TURNPIKE
JERICHO, NY   11753

CINCOM SYSTEMS INC.
MANAGER SOFTWARE DIVISION
2300 MONTANA AVENUE
CINCINNATI, OH   45211

PERSONNEL DATA SYSTEMS, INC.
MANAGER SOFTWARE DIVISION
15 EAST RIDGE PIKE
CONSHOHOCKEN, PA   19428

NDCR
MANAGER SOFTWARE DIVISION
760 HIGHWAY 18
EAST BRUNSWICK, NJ   08816

FUSION PRODUCTS INTERNATIONAL
MANAGER SOFTWARE DIVISION
317 MILLER AVENUE
MILL VALLEY, CA   94941

TRES SYSTEMS, INC.
JOHN RIZUTI
4255 LBJ FREEWAY
DALLAS, TX   75234

CULLINANE DATABASE SYSTEMS, INC.
MANAGER SOFTWARE DIVISION
400 BLUE HILL DRIVE
WESTWOOK, MA   02090

CYCARE SYSTEMS, INC.
MANAGER SOFTWARE DIVISION
520 DUBUQUE BUILDING
DUBUQUE, IA   52001

INSURANCE SYSTEMS OF AMERICA, INC.
MANAGER SOFTWARE DIVISION
P.O. BOX 47975
ATLANTA, GA   30362

AMERICAN SOFTWARE
MANAGER SOFTWARE DIVISION
433 EAST PACES FERRY ROAD
ATLANTA, GA   30305

AMERICAN MANAGEMENT SYSTEMS, INC.
MANAGER SOFTWARE DIVISION
1777 NORTH KENT STREET
ARLINGTON, VA   22209

THE KIRCHMAN CORPORATION
MANAGER SOFTWARE DIVISION
P.O. BOX 2269
ORLANDO, FL   32802

AUTOMATIC DATA PROCESSING, INC.
MANAGER SOFTWARE DIVISION
405 ROUTE 3
CLIFTON, NJ   07015

APPLIED DATA RESEARCH INC.
MANAGER SOFTWARE DIVISION
ROUTE 206 & ORCHARD RD, CN-8
PRINCETON, NJ   08540

BURROUGHS CORPORATION
MANAGER SOFTWARE DIVISION
BURROUGHS PLACE
DETROIT, MI   48232

COMMODORE BUSINESS MACHINES, INC.
MANAGER SOFTWARE DIVISION
681 MOORE ROAD
KING OF PRUSSIA, PA   19406

SOFTWARE AG OF NORTH AMERICA, INC.
MANAGER SOFTWARE DIVISION
11800 SUNRISE VALLEY DR.
RESTON, VA   22091

SOFTWARE INTERNATIONAL CORPORATION
MANAGER SOFTWARE DIVISION
2 ELM SQUARE
ANDOVER, MA   01810

CONTROL DATA CORPORATION
MANAGER SOFTWARE DIVISION
8100   13TH AVENUE SOUTH
MINNEAPOLIS, MN   55440

DIGITAL EQUIPMENT CORPORATION
MANAGER SOFTWARE DIVISION
146 MAIN STREET
MAYNARD, MA   01754

ELECTRONIC DATA SYSTEMS CORP.
MANAGER SOFTWARE DIVISION
7171 FOREST LANE
DALLAS, TX   75230

BOEING COMPUTER SERVICES COMPANY
MANAGER SOFTWARE DIVISION
P.O. BOX 24346
SEATTLE, WA   98124

HEWLETT-PACKARD COMPANY
MANAGER SOFTWARE DIVISION
1501 PAGE MILL ROAD

MCCORMACK & DODGE CORPORATION
MANAGER SOFTWARE DIVISION
560 HILLSIDE AVENUE
NEEDHAM HEIGHTS, MA   02194

MICROSOFT
MANAGER SOFTWARE DIVISION
10700 NORTHUP WAY
BELLEVUE, WA   98004

PANSOPHIC SYSTEMS, INC.
MANAGER SOFTWARE DIVISION
709 ENTERPRISE DRIVE
OAK BROOK, IL   60521

PLANNING RESEARCH CORPORATION
MANAGER SOFTWARE DIVISION
7600 OLD SPRINGHOUSE ROAD
MCLEAN, VA   22102

THE COMPUTER COMPANY
MANAGER SOFTWARE DIVISION
1905 WESTMORELAND STREET
RICHMOND, VA   23230

COMPUTER SCIENCES CORPORATION
MANAGER SOFTWARE DIVISION
650 N. SEPULVEDA BLVD.
EL SEGUNDO, CA   90245

AGENCY RECORDS CONTROL, INC.
MANAGER SOFTWARE DIVISION
P.O. BOX 1009
BRYAN, TX   77805

ANACOMP INC.
MANAGER SOFTWARE DIVISION
P.O. BOX 40888
INDIANAPOLIS, IN   46240

BATTELLE COLUMBUS LABS
MANAGER SOFTWARE DIVISION
505 KING AVENUE
COLUMBUS, OH   43201

GENERAL ELECTRIC SERVICES
MANAGER SOFTWARE DIVISION
401 NORTH WASHINGTON STREET
ROCKVILLE, MD   20850

COMPUTER POWER INC.
MANAGER SOFTWARE DIVISION
661 RIVERSIDE AVENUE

PALO ALTO, CA   94304

HONEYWELL INC.
MANAGER SOFTWARE DIVISION
HONEYWELL PLAZA
MINNEAPOLIS, MN   55408

INFORMATICS GENERAL CORPORATION
MANAGER SOFTWARE DIVISION
21031 VENTURA BOULEVARD
WOODLAND HILLS, CA   91364

MANAGEMENT DECISION SYSTEMS, INC.
MANAGER SOFTWARE DIVISION
200 FIFTH AVENUE
WALTHAM, MA   02254

MANAGEMENT SCIENCE AMERICA, INC.
MANAGER SOFTWARE DIVISION
3445 PEACHTREE RD., N. E.
ATLANTA, GA   30326

MARTIN MARIETTA DATA SYSTEMS
MANAGER SOFTWARE DIVISION
6303 IVY LANE
GREENBELT, MD   20770

MCDONNELL DOUGLAS AUTOMATION CO.
MANAGER SOFTWARE DIVISION
325 MCDONNELL BLVD.
HAZELWOOD, MO   63042

NATIONAL ADVANCED SYSTEMS
MANAGER SOFTWARE DIVISION
800 EAST MIDDLEFIELD ROAD
MOUNTAIN VIEW, CA   94043

NCR CORPORATION
MANAGER SOFTWARE DIVISION
1700 S. PATTERSON BLVD.
DAYTON, OH   45479

ON-LINE BUSINESS SYSTEMS, INC.
MANAGER SOFTWARE DIVISION
115 SANSOME STREET
SAN FRANCISCO, CA   94104

PERKIN-ELMER CORP.
MANAGER SOFTWARE DIVISION
MAIN AVENUE
NORWALK, CT   06856

POLICY MANAGEMENT SYSTEMS CORP.
MANAGER SOFTWARE DIVISION

JACKSONVILLE, FL   32204

COMSHARE INC.
MANAGER SOFTWARE DIVISION
3001 S. STATE STREET
ANN ARBOR, MI   48104

DASD CORPORATION
MANAGER SOFTWARE DIVISION
9045 NORTH DEERWOOD DR.
MILWAUKEE, WI   53223

DATA GENERAL CORP.
MANAGER SOFTWARE DIVISION
4400 COMPUTER DRIVE
WESTBORO, MA   01581

DYATRON CORPORATION
MANAGER SOFTWARE DIVISION
210 AUTOMATION WAY
BIRMINGHAM, AL   35210

GENERAL AUTOMATION INC.
MANAGER SOFTWARE DIVISION
1055 SOUTH EAST STREET
ANAHEIM, CA   92805

GENERAL INSTRUMENT CORP.
MANAGER SOFTWARE DIVISION
1775 BROADWAY
NEW YORK, NY   10019

LITTON INDUSTRIES INC.
MANAGER SOFTWARE DIVISION
360 NORTH CRESCENT DRIVE
BEVERLY HILLS, CA   90210

LOGICON INC.
MANAGER SOFTWARE DIVISION
3701 SKYPARK DRIVE
TORRANCE, CA   90505

NATIONAL CSS, INC.
MANAGER SOFTWARE DIVISION
187 DANBURY ROAD
WILTON, CT   06897

NATIONAL DATA CORPORATION
MANAGER SOFTWARE DIVISION
ONE NATIONAL DATA PLAZA
ATLANTA, GA   30329

PERTEC COMPUTER CORP.
MANAGER SOFTWARE DIVISION

1321 LADY STREET
COLUMBIA, SC 29202

P.O. BOX 19602
IRVINE, CA 92713

SEI CORPORATION
MANAGER SOFTWARE DIVISION
680 E. SWEDESFORD ROAD
WAYNE, PA 19087

PRIME COMPUTER, INC.
MANAGER SOFTWARE DIVISION
PRIME PARK
NATICK, MA 01760

SPERRY CORPORATION
MANAGER SOFTWARE DIVISION
1290 AVENUE OF THE AMERICAS
NEW YORK, NY 10104

SOFTECH, INC.
MANAGER SOFTWARE DIVISION
460 TOTTEN POND ROAD
WALTHAM, MA 02154

SOFTWARE DESIGN ASSOCIATES, INC.
MANAGER SOFTWARE DIVISION
260 MADISON AVENUE
NEW YORK, NY 10016

STSC, INC.
MANAGER SOFTWARE DIVISION
2115 E. JEFFERSON STREET
ROCKVILLE, MD 10104

SUN INFORMATION SERVICES COMPANY
MANAGER SOFTWARE DIVISION
280 KING CF PRUSSIA ROAD
RADNOR, PA 19087

TRW INC.
MANAGER SOFTWARE DIVISION
23555 EUCLID AVENUE
CLEVELAND, OH 44117

TYMSHARE
MANAGER SOFTWARE DIVISION
20705 VALLEY GREEN DRIVE
CUPERTINO, CA 95014

SYSTEMS MANAGEMENT, INC.
MANAGER SOFTWARE DIVISION
10400 WEST HIGGINS RD.
ROSEMONT, IL 60018

UNIVERSITY COMPUTING COMPANY
MANAGER SOFTWARE DIVISION
UCC TOWER, EXCHANGE PARK
DALLAS, TX 75235

TECHNICON DATA SYSTEMS CORP.
MANAGER SOFTWARE DIVISION
3255-1 SCOTT BLVD.
SANTA CLARA, CA 95051

UNITED TELECOMMUNICATIONS COMPUTER
MANAGER SOFTWARE DIVISION
5454 W. 110TH STREET
OVERLAND PARK, KS 66211

Appendix B

SAMPLE LETTER SENT TO VENDORS

September 11, 1982

Dear Sir:

The Computer Science Department at Kansas State University is preparing to teach an undergraduate Management Information Systems course in the Fall of 1983. I am a computer science masters student involved in locating software packages to support the course-learning objectives. All Business Administration students would be required to enroll in the course (600 students per year).

We are interested in software teaching tools and application software for the following areas:

- Intra/inter office communication and office automation
- Decision support
- Text editing

The two machines we have available to execute the software are:

1) NATIONAL AS/5, 4 megabytes of storage (IBM SYSTEM/370 compatible), running OS/MVT Release 21.8A and HASP remote job entry under VM/SP Release 1 (3330 and 3350 disk drive compatable, with tape drives available).

2) VAX/750, 4 megabytes of storage running either VMS or UNIX SYSTEM/3.

The university is interested in obtaining software by purchase, rental or gift. Please address all correspondence directly to me or my major advisor, Dr. E. A. Unger.

Sincerely,

Neal Strunk
Computer Science Dept.
Fairchild 121
Kansas State Univ.
Manhattan, KS 66502

Appendix C

SURVEY RESPONSES

VENDOR	NO RELATED PRODUCTS	OFFICE AUTOMATION	DSS
Cullinane Database Systems, Inc.			X
IBM		X	
Informatics General Corporation		X	
Management Science America			X
Nichols & Company			X
On-Line Business Systems, Inc.		X	
American Management, Inc.	X		
Capex Corporation	X		
Commodore	X		
Control Data Corporation	X		
Electronic Data Systems Corp.	X		
Fusion Products, Inc.	X		
Hewlett Packard	X		
Microsoft	X		
National Advanced Systems	X		
Sperry	X		

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SUPPORT TOOLS FOR AN UNDERGRADUATE MANAGEMENT
INFORMATION SYSTEM COURSE

by

NEAL VINCENT STRUNK

BS, Kansas State University, 1982

AN ABSTRACT OF A MASTER'S REPORT

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Computer Science

KANSAS STATE UNIVERSITY
Manhattan, Kansas

-1982-

ABSTRACT

This report was initiated to address the problem of providing business graduates with a background in management information systems (MIS). The solution was to design an undergraduate college course in MIS. This design began with a definition of MIS and how it's scope has changed over the years. With this understanding of the MIS orientation, a course topics outline and justification was developed. The next step was to use this topic outline to develop related behavioral objectives for the students. From these behavioral objectives, problem scenarios were constructed. The problem environments would aid the course lectures by giving hands-on experience to the students.

The software/hardware environment available to support the implementation of the problem scenarios was examined. This began by describing the ideal environment, which led into an analysis of the available hardware and software present at Kansas State University. A survey of software products that could be purchased from outside vendors concluded this project.