An undergraduate/graduate program in information systems

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A recent report\(^1\) by the Association for Computing Machinery (ACM) Curriculum Committee on Computer Education for Management (C\(^3\)EM) offered recommendations for graduate professional programs in information systems development. The integration of the disciplines of computer science and business administration led to the development of a curriculum whose objectives are: "(1) to develop a systems point of view, (2) to provide a conceptual basis for the analysis of information systems in large complex organizations, (3) to develop an understanding of how to create an economically viable and technologically feasible computer-based system, and (4) to provide experience in the implementation of a complex information system." Thus, the program is designed to prepare students for a career as a designer and manager of computer-based information systems. It is assumed that students entering this graduate program will have sufficient preparation in basic mathematics, operations research, statistics, psychology, economics, and computer programming.

In a subsequent report\(^2\) the C\(^3\)EM proposed a curriculum for an undergraduate program based on the same general concept of the information systems specialty in organizations. In both reports the life cycle of an information system was viewed as consisting of an iterated process of information analysis, system design, and implementation. The graduate program was structured to include both information analysis and system design, but the undergraduate program offered two concentration options. The organizational option prepares students as computer users while the technological option prepares them for an entry level position as a programmer. Each option requires the student to choose a field of application in which he will complete 15 semester hours of course work or the equivalent of a double major. Since the two options will typically reside in the schools of business and engineering respectively, the undergraduate student is faced with "school requirements" as well as "university requirements." As a result, the undergraduate program imposes strict requirements on students and limits their flexibility.

It is the author's belief that an undergraduate program can prepare students for entry level positions in the field of information systems. Additional on the job training and/or advanced education should enable these individuals to make significant contributions to the development of effective information systems. If structured properly the undergraduate program can provide sufficient background to enable students to complete a master's program in one additional year.

BEHAVIORAL FACTORS

In the aforementioned ACM reports, the need for better understanding of human behavior in information systems was clearly expressed. For many years hardware/software problems demanded the most attention while "people" problems were often ignored. As a result, sophisticated information systems were often developed, but people experienced difficulty in interacting with these complex systems. Since information systems are used, operated, and maintained by people, it is essential that students develop an understanding of human behavior.

It is the author's opinion that the field of information systems must identify and apply the specific behavioral principles involved in system design. The design of effective information systems will only result if man's perceptual, cognitive, motor, and motivational capabilities are taken into consideration. For too many years, we have bemoaned the fact that a "communication gap" between the manager and the information system specialist prohibits effective system development. A better understanding of the manager's personality should help to narrow this gap.

Current societal problems cannot be packaged for solution by specific disciplines. Their solution depends upon the contributions of individuals from many disciplines who often speak different "languages." In an attempt to foster interaction across traditional disciplinary lines, the University of Maryland has recently undergone an academic reorganization. The new organization is based upon the grouping of related disciplines into Divisions in the hope that this will facilitate the joining of theoretical and empirical aspects of knowledge and enhance the ability to develop interdisciplinary programs. The departments of economics (ECON), geography (GEOG), government and politics (GOVT), information systems (INSY), psychology (PSYC), and sociology (SOCIY), and the college of management (BSAD) constitute the Division of Behavioral and Social Sciences. This structure provides an ideal opportunity for students and faculty to cross traditional barriers to interaction.

From the collection of the Computer History Museum (www.computerhistory.org)
TABLE I—Undergraduate Program

General Requirements for Bachelor's degree in Information Systems.
A minimum of 120 semester hours with 30 hours in general university
requirements, 30 hours in electives, and 60 hours in courses constituting
Groups I-IV below.

<table>
<thead>
<tr>
<th>Group</th>
<th>Course</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>INSY 200 Introduction to Electronic Data Processing Systems</td>
<td>3</td>
</tr>
<tr>
<td>I</td>
<td>INSY 201 Advanced Electronic Data Processing Systems</td>
<td>3</td>
</tr>
<tr>
<td>I</td>
<td>INSY 202 System Development</td>
<td>3</td>
</tr>
<tr>
<td>I</td>
<td>INSY 203 Systems Analysis</td>
<td>3</td>
</tr>
<tr>
<td>I</td>
<td>INSY 204 Management Information Systems</td>
<td>3</td>
</tr>
<tr>
<td>I</td>
<td>INSY 205 Computerized Planning Systems</td>
<td>3</td>
</tr>
<tr>
<td>II</td>
<td>BSAD 240 Personnel Management</td>
<td>3</td>
</tr>
<tr>
<td>II</td>
<td>BSAD 241 Management and Organization Theory</td>
<td>3</td>
</tr>
<tr>
<td>II</td>
<td>PSYC 100 Introduction to Psychology</td>
<td>3</td>
</tr>
<tr>
<td>II</td>
<td>ECON 100 Principles of Economics I</td>
<td>3</td>
</tr>
<tr>
<td>II</td>
<td>ECON 101 Principles of Economics II</td>
<td>3</td>
</tr>
<tr>
<td>III</td>
<td>MATH 100 Calculus I</td>
<td>3</td>
</tr>
<tr>
<td>III</td>
<td>MATH 101 Calculus II</td>
<td>3</td>
</tr>
<tr>
<td>III</td>
<td>MATH 102 Calculus III</td>
<td>3</td>
</tr>
<tr>
<td>III</td>
<td>CMSC 100 Elementary Algorithmic Analysis</td>
<td>3</td>
</tr>
<tr>
<td>III</td>
<td>CMSC 101 Language and Structure of Computers</td>
<td>3</td>
</tr>
<tr>
<td>IV</td>
<td>BSAD 110 Business Statistics</td>
<td>3</td>
</tr>
<tr>
<td>IV</td>
<td>BSAD 210 Operations Research for Management</td>
<td>3</td>
</tr>
<tr>
<td>IV</td>
<td>BSAD 211 Linear Statistical Models in Business</td>
<td>3</td>
</tr>
<tr>
<td>V</td>
<td>At least 18 of the 30 hours must be taken at the 200 level or above. Subgroup VA (Related Discipline)</td>
<td></td>
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<tr>
<td>V</td>
<td>Choose one group of three courses (9 credits) from the following disciplines:</td>
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<tr>
<td>V</td>
<td>1. Accounting and Finance</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>2. Operations Research and Statistics</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>3. Marketing and Transportation</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>4. Government</td>
<td></td>
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<tr>
<td>V</td>
<td>5. Sociology</td>
<td></td>
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<tr>
<td>V</td>
<td>See Table 2 for suggested courses in each of the related disciplines</td>
<td></td>
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<tr>
<td>VI</td>
<td>At least 9 of the 30 hours must be taken at the 200 level or above.</td>
<td></td>
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</tbody>
</table>

UNDERGRADUATE PROGRAM

As a result of the preceding discussion, it is proposed that undergraduate students choosing information systems as their major field of study be responsible for the body of knowledge contained in the groups of courses shown in Table I. Emphasis is placed on understanding the fundamentals of the courses studied in Groups II-IV and applying the acquired knowledge to the field of information systems. In recent years a trend has evolved toward a broad general education at the undergraduate level. In keeping with this philosophy, Group V (electives) and Group VI (general university requirements) allow the student flexibility in fulfilling the requirements for 120 total credit hours.

The following is a collection of descriptions of undergraduate courses in information systems. Each course description specifies prerequisites or preparation expected of students taking the course. In addition, references (textbooks) are included to assist in further identifying the subject matter of the course.

INSY 200. INTRODUCTION TO ELECTRONIC DATA PROCESSING SYSTEMS

Description

The objective of this course is to develop an understanding of the digital computer and its role as a tool in the information systems of organizations. Topics include an orientation to the stored program computer and its use as an automatic data processing system, concepts and use of a problem oriented computer language (COBOL), and the impact of computer-based information systems upon organizations and their management.

INSY 201. ADVANCED ELECTRONIC DATA PROCESSING SYSTEMS

Prerequisites: INSY 200 and BSAD 110

Description

Intensive study of advanced COBOL topics and computer applications in scientific, information, and control systems with particular emphasis on information systems. Hardware and software features of third generation computers. Topics include COBOL for tape and direct-access devices, management information systems, multiprogramming and multiprocessing systems.

INSY 202. SYSTEM DEVELOPMENT

Prerequisites: INSY 201, MATH 102

Description

Techniques for identifying an organization's information requirements and methods to design systems to meet these
needs. Emphasizes systems development process and participation of management in this process. Topics include systems methodology, data analysis, data processing files, systems technology, systems economics, systems management.

INSY 203. SYSTEMS ANALYSIS

Prerequisites: INSY 202, BSAD 211, MATH 103

Description

Application of systems analysis techniques to the development of information systems. Measurement, simulation, and evaluation of information systems. Topics include the principles of systems analysis, simulation models, network analysis, hardware/software performance.

INSY 204. MANAGEMENT INFORMATION SYSTEMS

Prerequisites: INSY 202

Description

Conceptual approaches for the analysis and design of management information systems (MIS). Methods used in designing, establishing and maintaining a data base for a MIS. The role of data management in information systems. Topics include the concept of MIS, information structures, elements of data management systems, query systems and report program generators.

INSY 205. COMPUTERIZED PLANNING SYSTEMS

Prerequisites: INSY 202, BSAD 211

Description

An examination of the techniques used in the design and implementation of computer-based planning and analysis models. Formulation of mathematical models and analysis of information requirements for the data base to operate the model. Verification and validation of models. The use of management information systems to support corporate strategic and tactical planning. Topics include industrial dynamics, statistical analysis, forecasting techniques, and conceptual framework for planning models.

The undergraduate program, as constituted should provide students with the necessary prerequisites for related graduate study in management, personnel, economics, and psychology. However, if a student expects to choose accounting and finance, operations research and statistics, marketing, trans-
TABLE IV—Suggested Courses in Related Discipline at the Graduate Level (Continued)

8. Psychology
- PSYC 201 Personnel and Organizational Psychology 3
- PSYC 202 Engineering Psychology and Training Models 3
- PSYC 400 Quantitative Methods I 3
- PSYC 401 Quantitative Methods II 3
- PSYC 402 Seminar in Human Performance Theory 3

9. Government
- GOVT 201 Governmental Organization and Management 3
- GOVT 202 Quantitative Political Analysis 3
- GOVT 203 State and Local Administration 3
- GOVT 400 Metropolitan Administration 3
- GOVT 401 Scope and Method of Political Science 3

10. Sociology
- SOCY 200 Formal and Complex Organizations 3
- SOCY 201 Industrial Sociology 3
- SOCY 400 Intermediate Procedures of Data Analysis 3
- SOCY 401 Practicum in Data Analysis in Field Research 3
- SOCY 402 Computer Methods for Sociologists 3

portation, government, or sociology as his area of specialization it is recommended that nine of his 30 electives hours be utilized to complete the appropriate courses in Table II. In any event, careful planning and counseling is required at the undergraduate level to ensure adequate preparation for graduate study.

MASTER'S PROGRAM

The master's program in information systems is structured to provide students with increased skills in information systems and a specialization in a related discipline thereby preparing them for careers as designers or administrators of information systems. With the trend toward less rigidity in undergraduate education it seems more appropriate to encompass a related discipline at the graduate level. As such, the program requires students to complete the groups of courses shown in Table III. In addition, students are required to pass a final written examination which emphasizes the integration of course material.

The following is a collection of descriptions of graduate courses in information systems. Each course description specifies prerequisites or preparation expected of students taking the course. In addition, references (textbooks) are included to assist in further identifying the subject matter of the course.
INSY 400. DESIGN OF LARGE-SCALE INFORMATION SYSTEMS

Prerequisites: INSY 204

Description

Application of systems analysis techniques to the design and implementation of large-scale information systems for organizations. Emphasizes systems concepts, user's requirements, and the measurement, coding, and classification of data. Programming techniques for large-scale information systems, including time sharing and real time.

INSY 401. INFORMATION SYSTEMS MANAGEMENT

Prerequisites: INSY 205

Description

An intensive study of the functions, requirements, and problems of managers of information systems. Methods and models for evaluating information system performance. Data security, legal considerations, and social impact of an information system. Personnel requirements and documentation procedures.

INSY 402. APPLICATION OF ADVANCED DEVELOPMENTS IN INFORMATION TECHNOLOGY

Prerequisites: INSY 204

Description

Equipment useful in implementing information systems including key-to-tape, key-to-disc, mini-computers and microfilm. Data communicating devices including telegraph, telephone, microwave, and broadband telephone. Applications in business information systems.

INSY 403. HUMAN FACTORS IN INFORMATION SYSTEMS

Prerequisites: INSY 204

Description

Sensory, motor, and cognitive functions related to man's capacity to perform information system tasks. Man as an information processor and transmitter. Intensive study of relationships between man and the computer. Topics include measurement and psycho-physic, personnel subsystems, computer I/O devices, programming languages, time sharing and interactive programming MIS and management decision systems, mini-computer systems.

INSY 404. CONCEPTS OF INFORMATION SYSTEMS

Prerequisites: INSY 203

Description

Thorough investigation of the systems approach to problem solving and decision making in large-scale systems. Emphasizes the interrelationship of the systems approach and the planning process. Techniques and methods involved in systems analysis. Topics include general systems theory, information theory, cybernetics, and decision theory.

Table IV offers suggested courses in the related disciplines at the graduate level. However, through counseling with a faculty advisor the student may choose any five coherent courses compatible with his career objectives.

CONCLUSION

The recommendations in this paper are consistent with the curriculum models proposed by the C3EM. It has been a well accepted fact that the field of information systems requires the contributions of many disciplines. As a result, many undergraduate/graduate programs incorporate certain aspects of computer science, operations research, and other quantitative techniques within their purview. It is the author's opinion that the behavioral aspects of information systems design must form an integral part of such programs.

LIBRARY LIST

The following list is not exhaustive, but represents the author's attempt to compile a list of books which he deems valuable for the undergraduate and graduate courses in information systems described in this paper.

REFERENCES


