A Graduate Curriculum in Business-Oriented Computing*

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Introduction

The Department of Computer Science at the University of Colorado has recently developed a graduate curriculum in Business-Oriented Computing. The program was developed in recognition of the increasing demand for individuals who are trained in both business methodology and computer science. The 30 semester hour program is designed to produce masters level computer scientists capable of integrating the needs of the business community with the technology of computer science.

Prerequisites for the program include a Bachelor's degree in Business (or the equivalent), ten semester hours of computing, and nine semester hours of upper division mathematics. The prerequisite computing courses are: Introduction to Computer Science for Business Majors (CS 202), a four hour course in COBOL programming; Business Data Processing Methods (CS 312), a three hour course in FORTRAN emphasizing business applications; and Assembly Language and System Software (CS 400). The mathematics courses are typically in the areas of statistics, probability theory, mathematical programming, computability, and linear algebra. At the University of Colorado, the programming and mathematics courses can be taken in the undergraduate Computer Based Information Systems option of the Business School curriculum.

Students entering the program with a Bachelor's degree in a discipline other than Business can acquire the necessary business background by taking 24 semester hours of senior level business courses, in addition to the 30 hours of computer science.

Curriculum Description

Recommended courses in the program include the following:

CS 401	Introduction to Programming Languages and Processors
CS 402	Hardware Structure and Software Design
CS 465	Intermediate Numerical Analysis I
CS 540	Computer Decision Modelling
CS 545	Data Structures
CS 546	Automata Theory
CS 559	On-Line Computing Systems
CS 616	Topics in Data Processing
CS 581	Data Management and File Systems
M.SC. 445	Information Systems Analysis
M.SC. 635	Mathematical Programming
CS 700	Master's thesis
or	
CS 701	Master's Reading Option

Brief descriptions of these courses are contained in an Appendix.

All of the above are three semester hour courses, with the exception of Master's thesis (CS 700), which receives four to six credit hours. The Master's Reading Option (CS 701) may be completed in lieu of a thesis. Reading option students are required to demonstrate their ability to read journal articles by reading assigned papers and passing an oral examination covering those papers.

In addition to course requirements, students are required to pass a written comprehensive examination covering material from the following courses:

CS 202	CS 401
CS 312	CS 465
CS 400	CS 546

Thus, graduates are expected to be familiar with the terminology and techniques of automata theory and numerical analysis.

Curriculum Design

Guidelines followed in designing the curriculum were:

1. to adhere to the ACM Curriculum Recommendations for Graduate Professional Training in Information Systems*.
2. to utilize existing courses.
3. to introduce new courses of interest to students in both the Business option and the Programming Systems option of the Master's program.
4. to allow students some flexibility in choosing courses.

The objectives set forth in the ACM Recommendations are achieved by requiring a prerequisite Bachelor's degree (or equivalent) in Business, and by following the recommendations of Section 5.4: "Options in Computer Science Master's Degree Programs".

The correspondence of University of Colorado courses to ACM Recommendations is summarized in Table 1. This correspondence is not perfect. Some topics receive less emphasis than recommended, while other topics receive more emphasis than recommended. Some topics are covered in the undergraduate Business program. For example, ACM Course B2 is not covered in the graduate program. However, students do take courses in Human and Organizational Behavior as undergraduates.

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* "Curriculum Recommendations for Graduate Programs in Information Systems"; R. L. Ashenhurst, Editor; Association for Computing Machinery; 1972.

Table 1

Comparison of ACM Recommendations and
University of Colorado Courses

ACM Course #	CU Course #
A10	M.SC. 445
B1	CS 540
C1	CS 545
C2	CS 402
C3	CS 559, CS 581
C4	CS 401, CS 202, CS 312
D1	CS 581
D2	CS 616

Summary

The Business-Oriented Computing Curriculum is expected to evolve dynamically as experience is gained in administering the program. The program has been designed to produce technically skilled computer scientists who possess a much broader perspective of business oriented information systems than is gained from the typical Master's degree program in computer science. Ideally, a student can complete the entire program in five years by taking appropriate computer science and mathematics courses as an undergraduate Business major, and completing the program as a graduate student in computer science.

Appendix

Computer Science Course Descriptions

CS 202 Introduction to Computer Science for Business Majors.

An elementary course in computer science covering computer programming methods, and COBOL programming. Applications discussed are chosen to reflect the interests of Business majors.

CS 312 Business Data Processing Methods.

This course is designed to introduce the student to some of the prevalent problems in business data processing. The student will study FORTRAN and its use in the implementation of some methods for handling these problems.

CS 400 Assembly Language and System Software.

Computer structure, machine language, instruction execution, addressing techniques, and digital representation of data. Data structures, subroutine linkages, reentrant code, and macros. Assemblers, linkers, and loaders. Job control and file systems. I/O systems, and alternate architectures.

CS 401 Introduction to Programming Languages and Processors.

A study of programming languages and digital processors. Conceptual aspects of programming languages and translators. Run time structure of programming languages. Programming in FORTRAN, ALGOL 60, PASCAL, and SNOBOL.

CS 402 Hardware Structure and Software Design.

A course designed to present an overview of computer hardware concepts to software oriented people. The course deals with individual hardware devices and large scale hardware systems.

CS 465 Intermediate Numerical Analysis I.

Solution of algebraic and transcendental equations. Solution of linear and nonlinear systems or equations. Interpolation, integration, solution of ordinary differential equations, least squares, sources of error, and error analysis. Computer implementation of numerical methods.

CS 540 Computer Decision Modeling.

Application of the methods of computing science to problems in management decision making. Emphasis is placed on simulation as a method for studying the behavior of dynamic systems and the use of optimization models for their control.

CS 545 Data Structures.

This course covers techniques for representation and manipulation of structured information in a digital computer. Topics include linear lists; sequential and linked storage allocation; multi-linked and multi-dimensional lists; circular lists. Trees, traversal algorithms; representation and mathematical properties of trees. Dynamic storage allocation and garbage collection.

CS 546 Theory of Automata.

The idea of computability will be discussed. Computational models ranging in complexity from a Turing machine up to a caricature of a modern digital computer. The formal theory of languages and its relation to these computational models will be explored.

CS 559 On-Line Computing Systems.

Principles of on-line hardware and software. Survey of applications, on-line systems architecture, interrupt and I/O systems, real time operating systems, and data structures. Data communications hardware and software. Terminals and other peripheral devices. Queuing models. On-Line system analysis and design.

CS 581 Data Management and File Systems.

A study of file system hardware; file system structure and organization. Analysis of file systems and data management systems. Comparative evaluation of several data management systems.

CS 616 Topics in Data Processing.

Selected topics in data processing. Possible topics are: Computing Center Management, Information Retrieval, Data Base Security, Commercial Systems, System Evaluation and Selection, Economics of Large Scale Systems.

CS 700 Master's Thesis.

Students pursuing the Plan I thesis option will enroll for 4 to 6 credit hours of CS 700 while working on the thesis.

CS 701 Master's Reading Option.

An alternative to the Master's Thesis. Students will read selected papers and pass an examination.

M.SC. 445 System Analysis and Design.

A study of techniques required for the analysis and design of information systems. Topics include: concept of system, system life cycle, analysis tools, hardware/software selection and evaluation, software engineering, and past implementation analyses.

M.SC. 635 Mathematical Programming.

A study of linear and non-linear programming algorithms, including linear programming, dynamic programming, integer programming, quadratic programming, and related techniques.