College of Computer and Information Science

Bachelor of Science in Information Science

Program Description

http://www.ccs.neu.edu/infosci/

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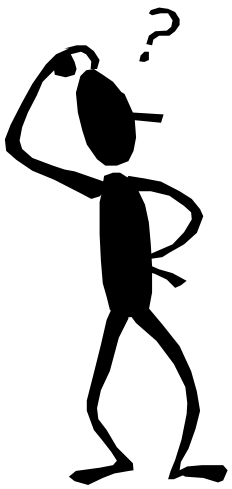
I. Program Description

In today's information society, computers have spread into so many areas of life they seem indispensable. From e-commerce to medical diagnosis, from weather forecasting to computer-assisted learning, from Supreme Court decisions to Star Wars movie clips, people are interacting more and more with computers.



But making the most of information technology -- making sure it serves the goals and needs of the people who depend on it -- is a tremendous challenge. Studies show that many large information systems do not meet the expectations of users, and people struggle with computers in their homes, workplaces and communities.

The interaction between information, technology, and users is the focus of a new B.S. degree in Information Science, offered by Northeastern University beginning in the fall of 1999.

What is Information Science?

Information science is concerned with the *application* of information technology - that is, the *purpose*, the *design*, and the *impact* of computer-based systems. IS students acquire a strong technical foundation along with the ability to analyze information needs, and to plan, design, and develop the computer applications that users want. Information science is an interdisciplinary field that draws on concepts and techniques from computer science, business, and behavioral/social science. Communication and organizational problem-solving are just as important as technical problem-solving for creating successful applications of information technology, and the B.S. in Information Science stresses both.

As professionals, information scientists are able to bridge the gap between domain specialists who define the high-level goals of an information system, and the software engineers who translate functional specifications into working programs. Whether their job title is information system architect, systems analyst, software designer, consultant, usability engineer, application programmer, computer services director or project manager, the information scientist is likely to be working at the interface of information technology and its users. Their role is similar to the architect who analyzes the needs and behavior patterns of a client, and creates a detailed blueprint to be followed by the builder.

The basic principles of information science apply across all domains: business, government, health care, science, education, the arts and entertainment, just as the basic principles of good architecture apply to all kinds of buildings. Although an information scientist may eventually choose a career specialization such as health informatics, mastering the fundamentals is the first step.

Who is the program aimed at?

The information science program is designed for students who enjoy abstract puzzles and solving computer problems, but who also want to be involved in solving human/organizational problems. If you are looking for a major that combines these two interests: the computer and the user, and if you are highly motivated to help realize the benefits of information technology for people and society, while avoiding negative impacts, then the information science degree may be right for you.

What will I study?

In the first year, the same courses are required of all College of Computer and Information Science students: a year of computer science including basic programming, algorithms and data structures, along with math, English, and social science. In the sophomore year you continue to build strong foundations in both computer science and behavioral/social science, with courses in computer organization, object oriented design and psychology. A course in Principles of Information Science gives IS majors the "big picture" of the field, introducing many of the concepts and techniques they will study in depth later on.

The core curriculum in information science covers three broad areas: computing technology, information system design and development, and the human/organizational context. Courses such as database design, systems and networks, information system design and development, human-computer interaction, and information resource management provide a solid understanding of each of these broad areas and the connections between them. Through courses in statistics and empirical research methods, IS students also learn to design experiments and collect and analyze data in order to objectively answer questions about the usefulness, usability, and impact of information technology.

Two information science elective courses add depth to your understanding of information, its processing and its use. With your choice of electives, you can put greater emphasis on the technical, business, or behavioral/social science component of your education. Elective courses are drawn from the fields of information and computer science, business, economics, political science, linguistics, psychology and communication studies.

A capstone course for IS students includes a field study during the final coop experience, where students, with faculty supervision, observe first hand the relationship between technical/design issues and the human/ organizational context. This is followed by a senior seminar where students write and present a paper based on the field study. Figure 1 describes the curriculum framework and courses that IS students take.

Why Northeastern?

Northeastern is one of very few major universities offering an undergraduate degree that combines a strong technical foundation with a sophisticated understanding of IT applications. Why? Because only recently has the need for this type of program been recognized. IS students at NU pursue a balanced curriculum where computer science, system design, and the human/organizational perspective are integrated into an intellectually stimulating set of core courses.

Information Science students also participate in Northeastern's top-rated cooperative education plan, which integrates classroom study with professional, paid work experience. Cooperative education offers students an opportunity to practice and extend their classroom knowledge and skills through on-the-job experience.

Summary of the Information Science Curriculum

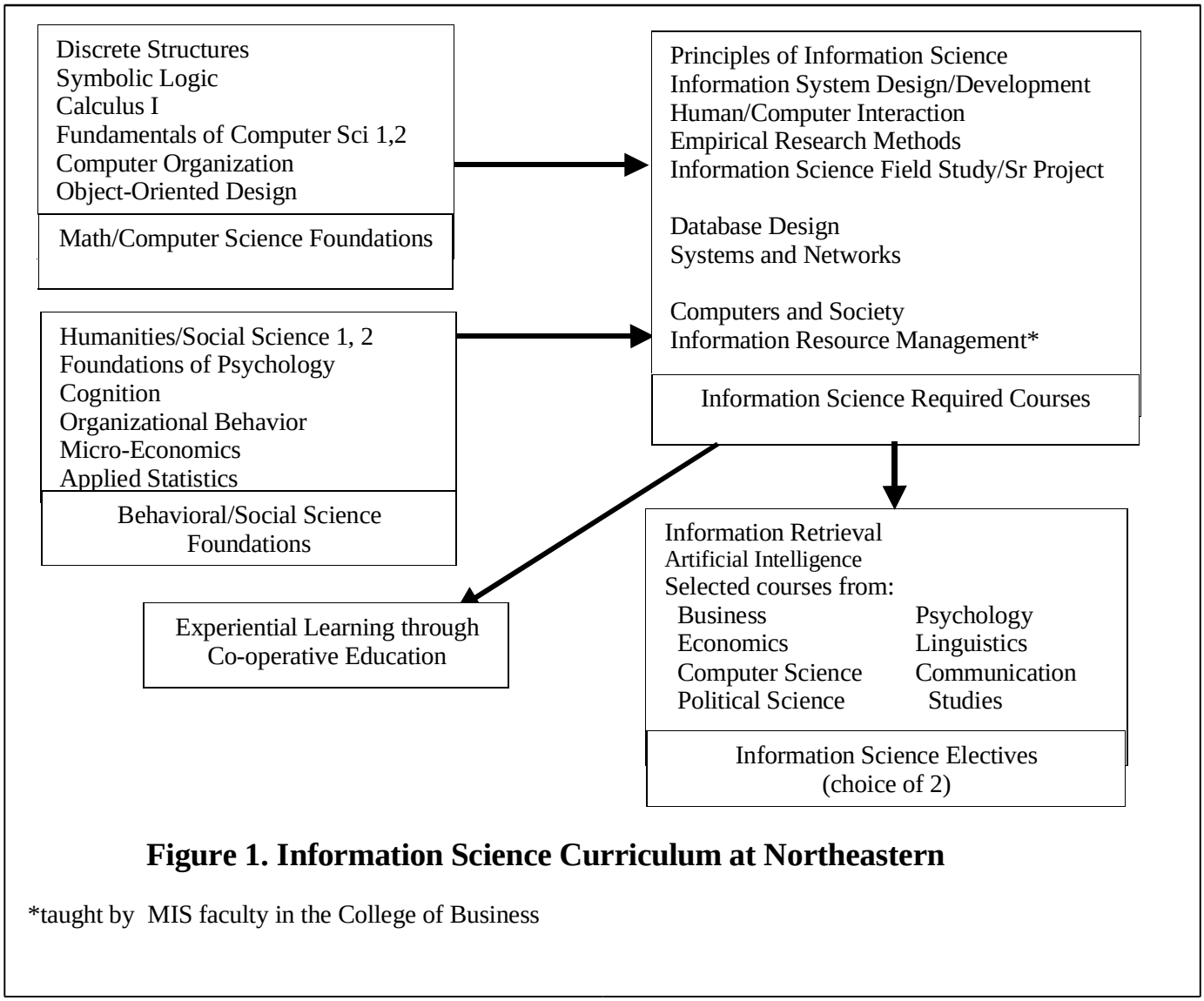


Figure 1. Information Science Curriculum at Northeastern

*taught by MIS faculty in the College of Business

II. The Emphasis on Balance

The field of information science takes a holistic view of information technology that includes the information contained in the system, the computers and networks that store and process the information, the users who interact with the system, and the clients or customers for whose benefit the system was created. From this perspective, there are three dimensions of information system performance that IT professionals must be concerned with: the *functional dimension*, the *technical dimension*, and the *human dimension*.

The *functional dimension* of an information system focuses on whether it achieves the objectives envisioned by the client or customer. A system that solves the wrong problem, provides the wrong information, requires information that is not available, or includes sub-systems that are not compatible, is not a success regardless of its other attributes. The *technical dimension* of a system includes its correctness (relative to its design specifications)

its reliability, and its efficiency in using computing resources (memory, processing power, etc.) The *human dimension* of an information system includes its usability and its compliance with the legal, ethical and policy requirements of the client or customer (and of society at large).

Figure 2 shows the percent of time devoted to each of the three dimensions in the information-technology related courses of a typical Computer Science curriculum, a typical MIS concentration, and the Information Science curriculum. Figure 3 shows the overall distribution of topic areas in a typical Computer Science curriculum, a typical MIS concentration, and the Information Science curriculum. The unique feature of the Information Science curriculum, clearly visible in Figure 3, is the balance achieved between the need for a high level of technical competence and the need for IT professionals to take account of the organizational goals and social environment that ultimately determines the success of their work.

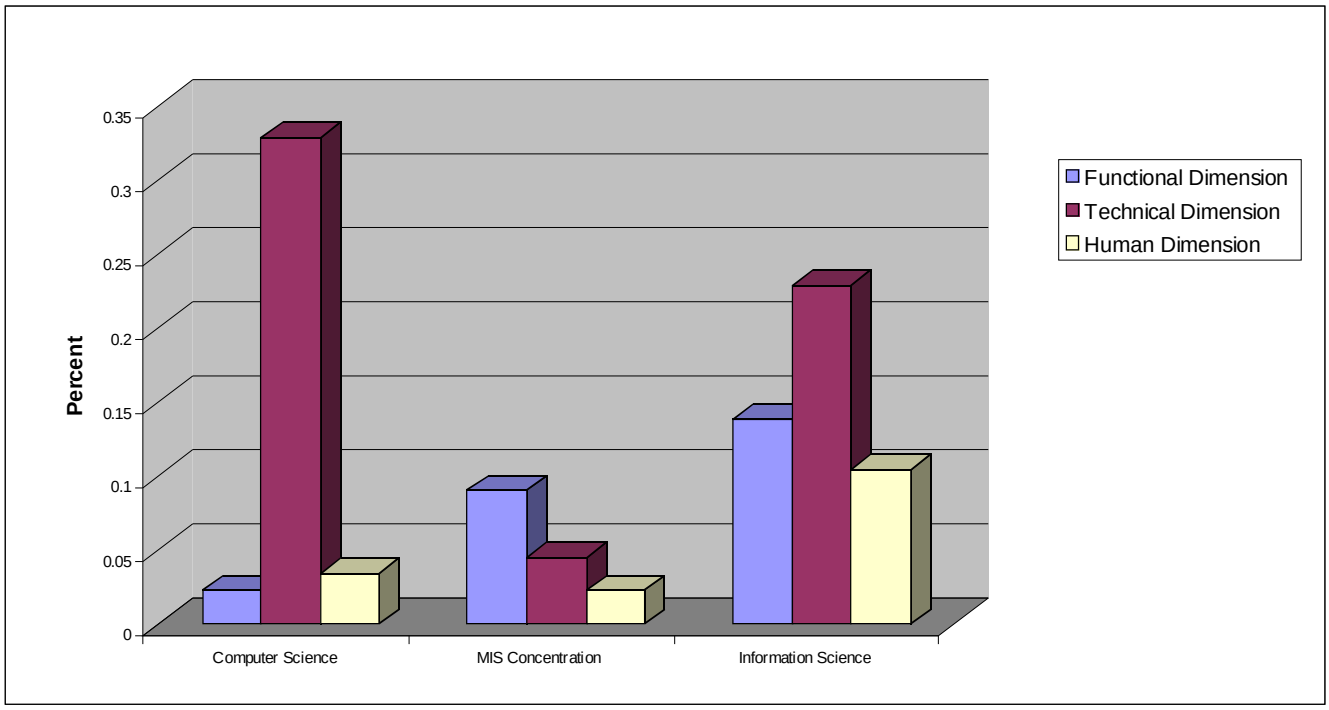
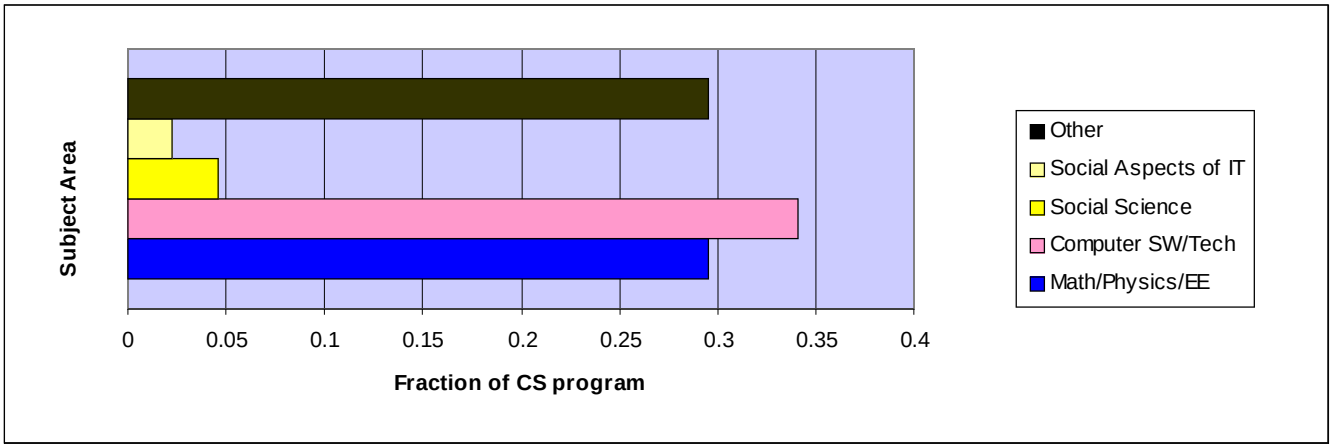
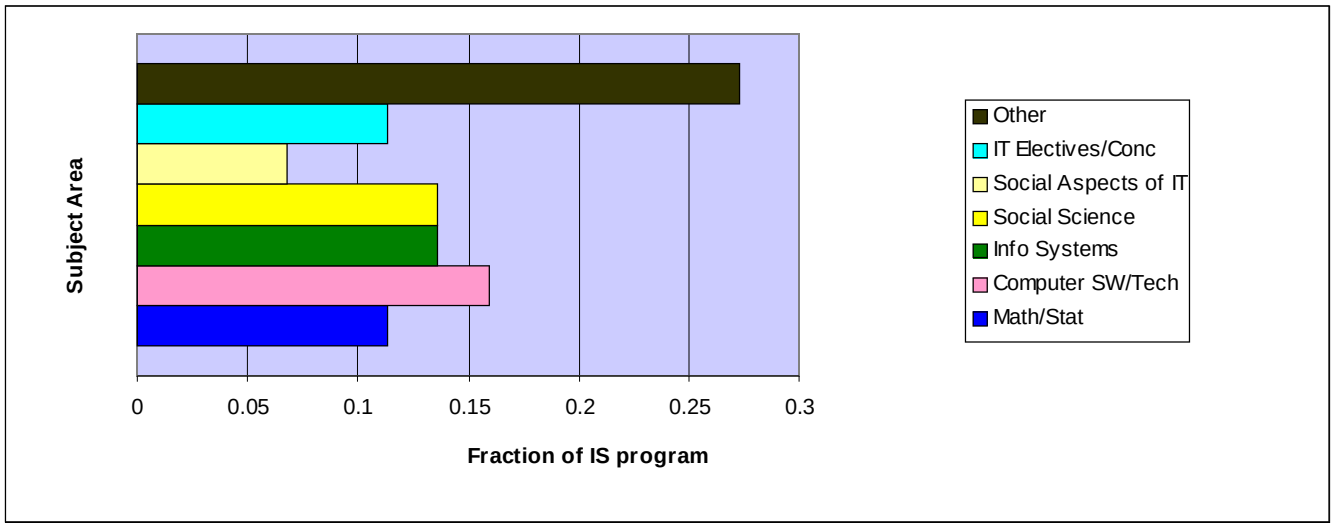


Figure 2. Comparison of typical Computer Science degree, MIS concentration, and Northeastern's Information Science degree. The percent of each program devoted to study of the three dimensions of IT performance is shown. The functional dimension of an information system focuses on whether it achieves the objectives envisioned by the client or customer. The technical dimension of a system includes its correctness, reliability, and efficiency. The human dimension includes its usability and its compliance with the legal, ethical and policy requirements of the client or customer and society at large.





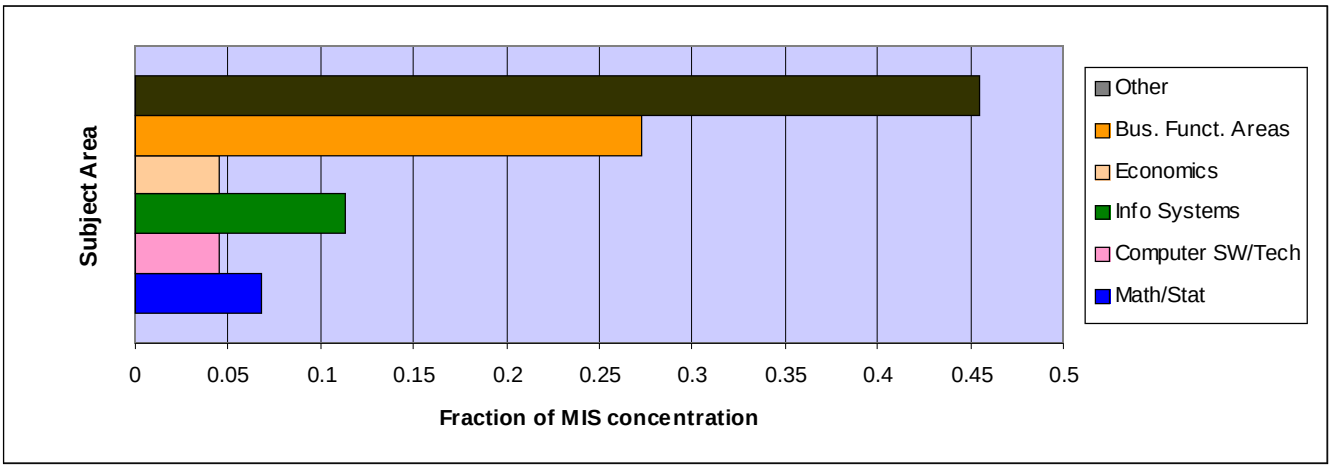


Figure 3. The emphasis on balance between technical and contextual aspects of IT is shown by this comparison of the distribution of subject matter in typical CS and MIS curricula and the Information Science curriculum.

III. Information Science Course Descriptions

ISU300 Principles of Information Science (4 SH)

Surveys the key theories, concepts, and themes of information science. Examines information and communication technologies from the perspective of the people and organizations that generate and use information to achieve their goals. Topics include: information and decision making; human information processing; definition and types of information systems; behavioral impact of information technologies such as office automation, e-mail, and the World Wide Web; legal and policy issues such as privacy, censorship, intellectual property and information security. A course project will explore the use and impact of information technology in a selected domain (such as e-commerce, education, medicine, government, law enforcement or electronic publishing), focusing on both technical and behavioral issues. Prerequisites: CSU200, CSU211.

ISU470 Information System Design & Development (4 SH)

Discusses the planning, analysis, design, and implementation of computer-based information systems, focusing on the methodologies and procedures used in organizational problem solving and systems development. Topics include: the systems development life cycle; project management; requirements analysis and specification; feasibility and cost-benefit analysis; logical and physical design; prototyping; system validation, deployment, and post-implementation review. Additional topics may include: platform and database selection and integration issues; CASE tools; end-user training; maintenance; and object-oriented analysis and design. Prerequisites: ISU300, CSU370 highly recommended.

ISU535 Information Retrieval (4 SH)

Discusses information retrieval including: document models, indexing, query techniques and results evaluation; text analysis for searching, indexing and compression; user interfaces for text and multimedia retrieval; digital libraries. Additional topics may include: parallel and distributed architectures; support for multimedia and image retrieval; specialized query strategies; advanced retrieval models. Coursework includes using and evaluating existing IR systems as well as implementing small-scale applications that illustrate indexing and retrieval strategies. Prerequisites: CSU213, Statistics.

ISU570 Human Computer Interaction (4 SH)

Studies the principles of human-computer interaction and the practice of user interface design. Discusses the major human information processing sub-systems (perception, memory, attention, and problem-solving), and how the properties of these systems influence the design of interactive systems. Reviews guidelines and specification languages for designing user interfaces, with an emphasis on toolkits of standard graphical-user-interface objects. Introduces usability metrics and evaluation methods. Additional topics may include: World Wide Web design principles and tools; wireless/mobile device interfaces; computer-supported cooperative-work; information visualization; virtual reality. Coursework includes designing user interfaces, creating working prototypes using a GUI toolkit, and evaluating existing interfaces using the methods studied. Prerequisites: CSU213. CSU370 highly recommended.

ISU580 Empirical Research Methods for Information Science (4 SH)

Students learn to critically evaluate and conduct empirical research, focusing on the use of empirical methods to study the effectiveness and organizational/social impact of information systems and technologies. Empirical research involves a number of broad steps including: identifying problems; developing specific hypotheses; collecting data relevant to the hypotheses; analyzing the data; and considering alternative explanations for the empirical findings. Some of the most commonly used research techniques including controlled experiments, surveys, and ethnographic methods are discussed. Additional topics include the ethics of data collection and experimentation in behavioral science. Although the course focuses primarily on the relationship between formulating research questions and implementing the appropriate methods to answer them, students can expect to apply the statistical techniques learned in the course prerequisites. Prerequisites: ISU300, Statistics.

ISU691 Information Science Field Study (1 SH)

Employs the student's cooperative education experience to observe and analyze the real-world interaction between information technology and its context of use. Students identify an aspect of their work environment to study, and make observations that will be the basis of an original Senior Research Paper. Course requirements include maintaining a journal of observations and experiences; participating in periodic electronic conferences with fellow students; and communicating regularly with the instructor to discuss the research project and the insights recorded in the journal. Prerequisites: ISU580. Restricted to majors in the Information Science degree program.

ISU692 Information Science Senior Project (4 SH)

This capstone course continues the work of Information Science Field Study to develop a sophisticated understanding of the interaction between technology and its context. Students write an in-depth Research Paper that reflects upon and analyzes the observations and experiences of the Field Study using the information science literature to interpret and better understand those experiences. Students then

participate in a seminar in which students present the results of their research. Prerequisites: ISU691. Restricted to majors in the Information Science degree program.

ISU700 Information Science Thesis (4 SH)

Under faculty supervision, a student will prepare an undergraduate thesis. Prerequisites: Junior standing, at least eight 4 SH courses in computer or information science, permission of the instructor, and permission of the Undergraduate Committee.

ISU701 Information Science Thesis Continuation (4 SH)

Under faculty supervision, a student will continue to prepare an undergraduate thesis. Prerequisites: ISU700, permission of the instructor, and permission of the Undergraduate Committee.

ISU900 Information Science Topics (4 SH)

A lecture course in information science on a topic not regularly taught in a formal course. Topics may vary from offering to offering. Prerequisites: ISU470 and permission of the instructor. May be taken up to three times for credit with different topics. Taking this course more than once requires the additional permission of the Undergraduate Committee.

ISU910 Information Science Project (4 SH)

Under faculty supervision, a student will work on a substantial project in information science. Prerequisites: Middle year standing, at least eight 4 SH courses in computer or information science, permission of the instructor, and permission of the Undergraduate Committee. May be taken up to three times for credit.

ISU921 Directed Study (1 SH)

Under faculty supervision, a student will examine standard information science material in fresh ways or new information science material that is not covered in formal courses. Prerequisites: ISU470 and permission of the instructor. The total amount of credit from courses CSU921-924 and ISU921-924 may not exceed 12 semester hours. Taking more than one of these courses requires the additional permission of the Undergraduate Committee.

ISU922 Directed Study (2 SH)

Under faculty supervision, a student will examine standard information science material in fresh ways or new information science material that is not covered in formal courses. Prerequisites: ISU470 and permission of the instructor. The total amount of credit from courses CSU921-924 and ISU921-924 may not exceed 12 semester hours. Taking more than one of these courses requires the additional permission of the Undergraduate Committee.

ISU923 Directed Study (3 SH)

Under faculty supervision, a student will examine standard information science material in fresh ways or new information science material that is not covered in formal courses. Prerequisites: ISU470 and permission of the instructor. The total amount of credit from courses CSU921-924 and ISU921-924 may not exceed 12 semester hours. Taking more than one of these courses requires the additional permission of the Undergraduate Committee.

ISU924 Directed Study (4 SH)

Under faculty supervision, a student will examine standard information science material in fresh ways or new information science material that is not covered in formal courses. Prerequisites: ISU470 and permission of the instructor. The total amount of credit from courses CSU921-924 and ISU921-924 may not exceed 12 semester hours. Taking more than one of these courses requires the additional permission of the Undergraduate Committee.

IS U 277, 278, 279, 477, 478, 479, 677, 678, 679 Information Science Honors Adjunct (1 SH)

Provides a structured mechanism for honors students to do additional honors work while taking one of the regular information science courses above the freshman year.

Interdisciplinary Courses in the IS Curriculum

Computer Science Courses:

CSU200 Discrete Structures (4 SH)

Introduces the mathematical structures and methods that form the foundation of computer science. Discusses structures such as sets, tuples, sequences, lists, trees, and graphs. Discusses functions, relations, ordering, and equivalence relations. Discusses inductive and recursive definitions of structures and functions. Discusses principles of proof such as truth tables, inductive proof, and basic logic. Finally, discusses the counting techniques and arguments needed to estimate the size of sets, the growth of functions, and the space-time complexity of algorithms. Prerequisites: A solid foundation in basic mathematical thinking.

CSU211 Fundamentals of Computer Science 1 (4 SH)

Introduces the fundamentals of computer science by describing the functional and object-oriented styles of programming, examining basic sequential and recursive algorithms, and studying linear data structures including arrays and linear collection classes such as vectors, stacks, queues, and lists. Discusses elementary programming patterns. Presents techniques for the creation of simple graphical user interfaces. Applies these ideas to sample applications that illustrate the breadth of computer science. Prerequisites: An interest in learning about computer science in depth and a solid foundation in basic mathematical thinking.

CSU212 Fundamentals of Computer Science 2 (4 SH)

Examines object-oriented programming and associated algorithms using more complex data structures as the focus. Discusses nested structures and non-linear structures including hash tables, trees, and graphs. Emphasizes abstraction, encapsulation, inheritance, polymorphism, recursion, and object-oriented design patterns. Applies these ideas to sample applications that illustrate the breadth of computer science. Prerequisites: CSU211. In addition, CSU200 should be taken prior to CSU212 or concurrently.

CSU370 Object- Oriented Design (4 SH)

Presents a comparative approach to object-oriented programming and design. Discusses the concepts of object, class, meta-class, message, method, inheritance, and genericity. Reviews forms of polymorphism in object-oriented languages. Contrasts the use of inheritance and composition as dual techniques for software reuse: forwarding versus delegation and sub-classing versus sub-typing. Fosters a deeper understanding of the principles of object-oriented programming and design including software components, object-oriented design patterns, and the use of graphical design notations such as UML. Basic concepts in object-oriented design are illustrated with case studies in application frameworks and by writing programs in one or more object-oriented languages. Prerequisites: CSU212.

CSU380 Computer Organization (4 SH)

Introduces the basic design of computing systems: CPU, memory, input and output. Provides a complete introduction to assembly language: the basics of an instruction set plus experience in assembly language programming using a RISC architecture. Uses system calls and interrupt-driven programming to show the interaction with the operating system. Covers machine representation of integers, characters, and floating point numbers. Describes caches and virtual memory. Prerequisites: CSU212.

CSU430 Database Design (4 SH)

Studies the design of a database for use in a relational database management system. The entity-relationship model and normalization will be used in example problems. Relational algebra and then the SQL language will be presented. Advanced topics include triggers, stored procedures, indexing, elementary query optimization, and fundamentals of concurrency and recovery. Students will implement a database schema and short application programs on one or more commercial relational database management systems. Prerequisites: CSU212.

CSU480 Systems & Networks (4 SH)

Introduces the basic concepts underlying computer operating systems and computer networks and provides hands-on experience with their implementation. Covers the basic structure of an operating system: application interfaces, processes, threads, synchronization, inter-process communication, processor allocation, deadlocks, memory management, file systems, and input/output control. Also introduces network architectures, network topologies, network protocols, layering concepts (i.e., ISO/OSI, TCP/IP reference models), communication paradigms (point-to-point vs. multicast/broadcast, connectionless vs. connection oriented), and networking API's (e.g., sockets). Uses examples from many real operating systems and networks (UNIX, MS-DOS, Windows, TCP/IP, Ethernet, ATM, token rings) to reinforce concepts. Prerequisites: CSU380.

CSU520 Artificial Intelligence (4 SH)

Introduces the fundamental problems, theories, and applications of the artificial intelligence field. Includes heuristic search; knowledge representation using predicate calculus; automated deduction and its applications; planning; machine learning. Additional topics may

include game playing; uncertain reasoning and expert systems; natural language processing; logics for common-sense reasoning; ontologies; multi-agent systems. Prerequisites: CSU212, PHLU215 (Symbolic Logic).

Other Courses:

PSY U101 Foundations of Psychology (4 SH)

Surveys the fundamental principles and issues of the major areas of contemporary scientific psychology. Approaches the study of psychology as a method of inquiry as well as a body of knowledge. Emphasizes biological bases of behavior, principles of learning and motivation, psychological testing, personality dynamics, psychopathology, and therapeutic approaches. Requires research participation in psychology experiments (or alternative).

PSY U466 Cognition (4 SH)

Provides a basic introduction to human cognition. Topics include pattern recognition, attention, memory, categorization and concept formation, problem solving, and aspects of cognitive development. Examines current theories of cognitive processing and related experimental findings. Prereq. Foundations of Psychology.

HRM U201 Organizational Behavior (4 SH)

Explores the effects of individual, interpersonal, group, and leadership factors on human behavior. Also explores managerial applications of behavioral and social science concepts, including job design, job satisfaction, performance appraisal, supervision, career dynamics, and organizational change. Emphasizes helping the student develop skills in dealing with the human side of enterprise. Prereq. Middler standing.

ECN U116 Micro- Economics (4 SH)

Focuses on development of basic theory of demand, supply, and market price. Explores applications to selected microeconomic problems, such as basic monopoly and competition, and other issues that relate to the role of the pricing system in resource allocation and income distribution.

MIS U305 Information Resource Management (4 SH)

Examines the major organizational and managerial issues associated with managing the information resource, focusing on three thematic components. Gives students an opportunity to assume a strategic viewpoint and consider using information to achieve competitive advantage, create new products or services, or to re-engineer the business; learn about using information technology to support the functional areas of the business such as finance, manufacturing, or human resources; consider issues related to managing information technology such as outsourcing IS applications, project management, and investing in new technology.

SOC U528 Computers and Society (4 SH)

Examines the impact of the computer revolution on the conditions of work and life in contemporary society including legal and theoretical issues. Discusses ethical and professional issues in computer use. Prereq: middler standing with ability to program.