COMPUTER SCIENCE

The undergraduate program in computer science is designed to serve: (1) computer science majors, (2) students majoring in other areas (primarily the sciences, mathematics, engineering and business) who are interested in securing a working knowledge of computer problem solving and (3) students (mainly in the social sciences and humanities) interested in a general introduction to computers, their range of application, and their impact on society.

In an effort to better serve this variety of objectives, the program in computer science has been modified from that of previous years. This has been accomplished by a change in numbering of some of the courses, such that courses which belong to a common area of computer science have a common second digit. As before, odd numbers indicate courses normally given in the Fall, and even numbers indicate courses normally given in the Spring.

Programs for Computer Science Majors

A computer science major must complete 14 courses in the department. At present, 9 of these are required courses and the remaining 5 are to be selected within a plan of study in an area of concentration chosen by the student. Eleven out of the 14 courses were required in previous years. (Students having successfully taken these 11 courses automatically satisfy the present requirements.)

Majors are prepared for professional work in the design and implementation of computer hardware and software systems, for the use of computers to solve problems in science, engineering and business, for teaching computer science at the high school and college levels, and for graduate work in computer science.

The most obvious feature of computer science is rapid change. Therefore, all majors are required to take a core of 9 courses which stresses fundamental principles and theories which are the basis of computer science. These courses are:

02:198:105-106 Computer Oriented Calculus and Linear Algebra
02:193:111 Introduction to Computing
02:193:205 Introduction to Discrete Structures
02:193:206 Discrete Probability Theory and Combinatorial Analysis
02:198:215-216 Computers and Programming
02:198:241 Non-numerical Problems and Computer Programming
02:198:323 Numerical Problems and Computer Programming B

Four of these required courses (02:198:105, 02:198:106, 02:198:205, 02:198:206) provide the necessary mathematical concepts and methods for work in computer science; students in need of additional mathematical preparation are required to take introductory courses among 02:050:118, 02:050:119, 02:050:120, 02:050:124 before taking any of these four courses. They may also take the introductory course 02:198:101 that provides experience in elementary problem solving using computers. Three of the required courses 02:198:111, 02:198:242, 02:198:323 are concerned with the fundamentals of computer problem solving and with programming in high level languages (BASIC, FORTRAN, P/L/I, SNOBOL, LISP). The last two 02:198:215 and 02:198:218 provide the basic concepts and techniques in computer organization, machine level programming and systems software.

Beyond these nine required courses, a major, in consultation with his or her advisor, must develop a plan of study in a selected area of concentration. Majors interested in computer systems and programming should include 02:198:315, 316 and the 02:198:411, 412 in their plan of study. Those interested in numerical and scientific applications should include 02:198:324 and 02:198:424; those interested in business and data processing applications should include 02:198:231 and 02:198:332; and those interested in non-numerical applications of computers should include 02:198:244 and 02:198:442 in their respective plan of study. Plans of study in other areas of concentration may be proposed for the department's approval by students in consultation with their advisor.

Majors are strongly encouraged to enroll in extra-departmental courses which contribute (a) to general knowledge in their area of concentration and (b) to the general background in humanities which is an essential part of a college education.

Programs for Non-Computer Science Majors

Students majoring in physics, mathematics, engineering, biological or environmental sciences will gain a good grasp of computer concepts and a competence in the use of computers in their respective fields by the courses 02:198:111 followed by 02:198:315, 02:198:323, 02:198:231, and 02:198:442. These courses, taken in order, provide a comprehensive introduction to computer science for students in these disciplines.

The course 02:198:221 possibly followed by 02:198:324 offers a less demanding alternative. The course 02:198:424 should be of particular interest to many students in general areas of sciences and engineering.

For students interested in business application of computers, the course 02:193:111, followed by the introductory course in data processing 02:198:231 and an advanced course in Information Processing Methods 02:198:332 is the recommended sequence.

Students in the social and behavioral sciences or in the humanities may receive preparation in the use of computers and in non-numerical problem solving by taking 02:198:111, followed by the sequence of two courses 02:198:242 (non-numerical problems and computer programming) and 02:198:442 (seminar in non-numerical applications). Students interested in a general acquaintance with computers, and their uses will find the introductory course 02:198:111 of interest.

Those interested in studying the broad impact of computers in various aspects of scientific, economic and social life, should participate in the seminar course 02:198:405 "Computers and Society." This seminar course aims at least one computer science course (such as 02:198:111 or 02:198:221). Even though the introductory mathematical courses (101, 105, 106, 205, 206) are specifically designed for computer science majors, their emphasis on applied problems, on constructive processes, and their articulation with courses in computer problem solving make them well suited for students majoring in certain areas of biology, psychology, anthropology, economics, and urban planning.
New Courses

ELEMENTARY PROBLEM-SOLVING USING COMPUTERS (Cr. 4) Fall, Spring 02:168:101
Kaplan
This course is for students interested in developing problem-solving skills and attitudes. Through student-computer interaction, various problems in word manipulation, numbers and geometry will be solved. Students will be encouraged to generalize their experience and to try problems of their own design.

COMPUTER ORIENTED CALCULUS AND LINEAR ALGEBRA (Cr. 4, 4) Fall, Spring 02:168:105, 106
Faculty
Prerequisite: satisfactory high school mathematical preparation or 02:090:119, 124.
Majors are required to take this sequence or, alternatively, the calculus sequence and the course in linear algebra offered by the mathematics department (MC). Also recommended for students in other sciences and in urban planning who are interested in a computer mathematical orientation. Selected topics in calculus and linear algebra that provide useful mathematical foundations for work in computer science; computers are used as an aid for teaching concepts in calculus. Sequence of topics includes numbers and functions, graphs and curves, derivatives, integration, series, Taylor's formula, linear equations, vectors, matrices, determinants, functions of several variables, partial derivatives.

INTRODUCTION TO COMPUTING (Cr. 4) Fall, Spring 02:198:111
Goel, Ostrander
Prerequisite: at least one year of high school mathematics.
This course is required for computer science majors and is also suitable for other students who are interested in learning fundamentals of computing. Algorithms, interactive programming using the BASIC or FORTRAN language, use of the computer in the batch-processing mode, and programming numerical problems are studied. Another programming non-numerical problems (e.g., sorting), block diagram of a computer, computer simulation, other programming languages.

INDEPENDENT STUDY A (Variable credit) Fall, Spring 02:198:201, 202
Faculty
Students should obtain and complete an application form at the departmental office prior to registration for independent study.
This course is intended for computer science majors who are interested in going deeper into a subject which is not covered comprehensively in a formal course. This course also provides a vehicle by which computer science majors may gain experience in software design and implementation under the supervision of a faculty member. This project may be related to a specific area of numerical or non-numerical application.

INTRODUCTION TO DISCRETE STRUCTURES (Cr. 4) Fall 02:168:205
Orgas
Prerequisite: advanced high school mathematical preparation or 02:168:105, 106.
Required for majors in computer science. Also recommended for students in the biological, behavioral and social sciences as well as in urban planning, who have a theoretical orientation and are interested in computer methods. Fundamental algebraic and logical concepts that are needed for theoretical work in computer science and applications of these concepts in problems in the field. Topics include: set theory, propositional calculus, boolean algebra, and algebraic structures including semigroups and groups. Relationships between these structures will be presented and applications in the study of computer networks and algorithms will be discussed.

DISCRETE PROBABILITY THEORY AND COMBINATORIAL ANALYSIS (Cr. 4) Spring 02:106:206
Srinivasan
Prerequisites: 02:198:205 or equivalent, and 02:198:105-106 or equivalent.
Required for majors in computer science. Also recommended for students in other sciences and in urban planning who have a theoretical orientation and are interested in computer methods. Topics include: permutations and combinations, discrete probability theory, generating functions, recurrence relations, the principle of inclusion and exclusion, theory of graphs and combinatorial problems that are relevant to computer theory.

COMPUTERS AND PROGRAMMING (Cr. 4, 4) Fall, Spring 02:198:215, 216
Ostrander and Faculty
Prerequisites: a course in computer problem solving (preferably 02:198:111 or 02:198:221).
Required for majors in computer science. Also recommended for students majoring in mathematics and engineering who are strongly interested in programming and in computer structures, structure of computers, logical design, and machine architecture. Programming in machine language and assembly language. Data structures. Programming and storage management techniques. Introduction to systems software, data management, and job control language. Laboratory work in software design and programming.

NUMERICAL PROBLEMS AND COMPUTER PROGRAMMING A (Cr. 4) Fall, Spring 02:156:221
Fonder and Faculty
Prerequisite: a working knowledge of calculus and linear algebra such as 02:198:105, 106. Students with programming knowledge should take 02:198:323 instead of this course.
The course concentrates on the study of high level programming languages and their use in the formulation of algorithms for the solution of numerical problems. Recommended for students majoring in the sciences, mathematics and engineering who are seriously interested in computer programming and numerical methods. The elements of FORTRAN IV with illustrations from numerical processes, subroutines, array, input-output, data types. Numerical processing, roots of equations, simultaneous equations, elements of matrix analysis, iterative programming processes. Interpolation, curve fitting, approximation of functions. Numerical integration and differentiation. Errors and propagation of errors. Random number generation, basic notions of PL/I.

DATA PROCESSING AND COMPUTER PROGRAMMING (Cr. 4) Fall 02:168:231
Baxendale
Prerequisite: 02:198:111 or equivalent or permission of instructor.
The course will start with an in-depth study of COBOL programming, in main data representation, magnetic tape systems, direct access storage devices, peripheral input-output devices and introduction to software. Description of a data base and its structure. Computer programming of practical applications from the business and institutional record-keeping area.

NUMERICAL PROBLEMS AND COMPUTER PROGRAMMING A (Cr. 4) Fall, Spring 02:198:244
Paul and Faculty
Prerequisites: 02:198:111 or 02:198:221 or equivalent. 02:198:205 is recommended.
To explore the formulation and comparison of algorithms for the solution of non-numerical problems. Algorithms to solve problems of enumeration and optimization with examples from languages, graphs, and games are considered. Evaluation of these as well as sorting algorithms. Problems will be solved using a language such as SNOBOL or APL. This course is required for computer science majors.
LANGUAGE SOFTWARE (Cr. 4) Fall 02:198:315
Easton
Assemblers, loaders, and macro processors. Introduction to formal properties of programming languages. Schemes of compiling. Structure of compilers. Laboratory work in the design and Implementation of software.

OPERATING SYSTEMS SOFTWARE (Cr. 4) Spring 02:198:316
Falk
Prerequisites: 02:198:215-216 and 02:198:206. While not a prerequisite, it is strongly recommended that 02:198:315 be taken before this course.
Organization of input/output, buffering, interrupt handling, channels, batch processing systems, multiprogramming, multiprocessing, and time sharing. Processes, memory management, name management, resource allocation, protection. Studies of particular system configurations.

NUMERICAL PROBLEMS AND COMPUTER PROGRAMMING B (Cr. 4) Fall 02:198:323
Vichnevetsky and Yaglou
Prerequisites: two semesters of calculus and familiarity with a high level language such as FORTRAN or BASIC.
This course concentrates on the numerical solution of quantitative problems: solutions of equations, numerical approximation of functions; solution of differential equations, Extensive use of the computer with high level languages illustrates the theoretical development of algorithms. Required for computer science majors, but also recommended for majors in other disciplines with adequate programming preparation.

NUMERICAL METHODS (Cr. 4) Spring 02:198:324
Kaplan
Prerequisite: 02:198:221 or 02:198:323.
Some of the following topics will be introduced in concept, followed by an analysis in depth of their properties in terms of accuracy, computer time, etc. (a) numerical methods for systems of linear equations, matrix inversion, eigen values; (b) numerical methods for differential equations, preceded by a short computer oriented introduction to differential equations; (c) approximation of functions, interpolation, differentiation and quadrature. Extensive use of computer to illustrate the theory.

INFORMATION PROCESSING METHODS (Cr. 4) Spring 02:198:332
Boxenfalen
Prerequisite: 02:198:231 or permission of instructor.
Recommended for majors in computer science, as well as for students in social sciences, humanities and business who are interested in applications of computer in data processing and information systems. Description of a data base and the structure. Concepts of functions, arrays, records, files, trees, lists and loop structures. Updating and addition to records, Modes of referencing and accessing records. Hierarchies of storage. Sorting, searching and retrieval of files; the role of programs in the data base, the relocation and allocation of storage. Business record-keeping, study in inventory control, Management information systems, inquiry and interactive systems. Automatic indexing and information retrieval. System simulation and control. Properties of languages in description of simulation models. Design and testing of models; queuing flow in networks, storage and priority systems, feedback systems.

INDEPENDENT STUDY B (Cr. 4) Fall, Spring 02:198:403-404
Faculty
Intended mainly for students in computer science. Subject and requirements to be determined individually with the supervising instructor. Design studies and work on computer projects of a realistic nature in areas of systems software, computer hardware, computer mathematics, theory of computation and in new computer applications. Students should obtain and complete an application form at the departmental office prior to registration for independent study.

SEMINAR IN COMPUTERS AND SOCIETY (Cr. 3) Fall 02:198:405
Yaglou
Prerequisite: at least one computer science course and permission of instructor, and at least one course in sociology, political science, anthropology, or philosophy is recommended in addition.
The course will center around the ways in which technology, particularly computers, may affect blue and white collar workers, the privacy of individuals, and the relations between the citizen and the government. The relationship between computers and brains will be studied as well as how man's view of himself may be affected by widespread use of computers. Guest speakers will be invited for certain special topics such as computers in law and computers in medicine.

Techniques and principles of large-scale software projects. Structured programming, choice of language, transportability and machine-independence, interfacing, scheduling. The laboratory work of the course consists of the student (as a team) designing and implementing a large project.

MODELLING AND SIMULATION OF CONTINUOUS SYSTEMS (Cr. 4) Spring 02:198:424
Vichnevetsky
Prerequisites: 02:198:221 or 02:198:323 or equivalent and at least two semesters of calculus or permission of the instructor.
The course concentrates on the formulation of mathematical models of continuous dynamical systems, and their simulation through the use of analog and digital computers. Applications in biological, environmental, and industrial dynamics are emphasized.

SEMINAR IN NON-NUMERICAL COMPUTER APPLICATIONS (Cr. 3) Spring 02:198:442
Bruce, Falk
Prerequisite: 02:198:242 and permission of the instructor.
This senior-level seminar is recommended for majors in computer science as well as for students in social sciences and humanities, who are interested in advanced applications of computers in non-numerical problems. Text processing systems, Computer applications in literature, linguistics, history and the arts. Formula manipulation, proof finding and heuristic problem solving. Question answering and dialogue systems.

TOPICS IN COMPUTER THEORY (Cr. 3) Spring 02:198:452
Orga
Prerequisites: 02:198:215-216 and 02:198:205-206 or equivalent; a desirable preparation would be a course in logic such as the course 02:730:322.
Recommended for majors in computer science, especially for those intending to go into graduate work. Introduction to topics in switching and automata theory, the theory of computation and the theory of formal languages.