

COMPUTER SCIENCE

Pamela Pierce (Mathematics), Chair

Denise Byrnes

Samer Khasawneh

Sofia Visa

Computer Science is more than just programming. It is the study of computer programs, abstract models of computers, and the many applications of computing. Computer Science combines elements of mathematics, philosophy, languages, and natural science. Although computing technology is continuously changing, the core skills required to practice Computer Science remain the same: problem solving, abstract thinking, and independent learning.

The mission of the Computer Science program is to educate students in the theoretical foundation of the discipline and its creative application to the solution of complex problems, and to prepare students to learn independently in a discipline that is constantly changing. Supported by a liberal arts education, the program seeks to develop students who are sensitive to the wide range of social concerns influenced by the discipline and are articulate in expression of their ideas and actions. Students successfully completing the Computer Science major should have the computer science background and the mathematical maturity needed to enter a graduate program in Computer Science or to take an entry-level position in a computing-related field.

As computing is increasingly applied to other fields, students in the natural sciences, business and economics, and other majors may benefit from a minor or double major in Computer Science.

Major in Computer Science

Consists of thirteen courses:

- CSCI 15100
- CSCI 15200
- One of the following courses: MATH 10800 or 11100
- One of the following courses: MATH 12300 or 22300
- CSCI 25100
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- One of the following courses: MATH 21100 or 24100
- CSCI 35100
- Two elective full-credit Computer Science courses numbered above 35100
- Junior Independent Study: See note below
- Senior Independent Study: CSCI 45100
- Senior Independent Study: CSCI 45200

Minor in Computer Science

Consists of eight courses:

- CSCI 15100
- CSCI 15200
- One of the following courses: MATH 10800 or 11100
- One of the following courses: MATH 12300 or 22300
- CSCI 25100
- Three elective full-credit Computer Science courses at the 200-level or above

Special Notes

- **Junior Independent Study:** The College requirement of a third unit of Independent Study is satisfied through the independent work done as part of the courses numbered above 20000, which are taken to fulfill the requirements of the major.
- **Advanced Placement:** At most two courses of advanced placement may be counted toward a major or minor. Advanced placement of one or two courses in Computer Science is available to students who have taken the Advanced Placement Examination or an equivalent furnished by the Department of Mathematics and Computer Science. Students are urged to take the AP Examination for this purpose when possible. The decision about granting such placement and its amount is made by the Department of Mathematics and Computer Science after the student has consulted with the chairperson. Normally a minimum score of 4 on the examination is necessary, but such a score alone does not guarantee advanced placement. A student placed in CSCI 15200 will receive one course credit; two course credits will be granted if the student is placed in a course above the level of CSCI 15200. The advanced placement policy of the College is explained in the section on *Admission*.
- Students are given a recommended placement in Computer Science based upon their high school record, their performance on the SAT and/or ACT, and their performance on a mathematics placement exam administered by the department during Summer registration.
- Majors are encouraged to take related courses in physics, mathematics, economics, and philosophy.
- The laboratory and classroom components are closely integrated in Computer Science courses with a laboratory and must therefore be taken concurrently. The course grade and the laboratory grade are identical and are based on performance in both components; the relative weight of the two components is stated in each course syllabus.
- *Connecting Art and Computer Science*, CSCI 19900, is designed specifically for students wanting a course in Computer Science to partially fulfill the College's Learning Across the Disciplines requirements. CSCI 15100 is not recommended for these requirements.
- Those students who are oriented toward the application of the computer to a specific professional objective, such as industrial or business management, medicine, engineering, computational natural science, or law, should consider a Computer Science minor or double major in consultation with the adviser for those programs.
- Combined programs of liberal arts and engineering are available. (See *Pre-Professional and Dual Degree Programs: Pre-Engineering*.)
- Only grades of C- or better are acceptable in courses for the major or minor.

COMPUTER SCIENCE COURSES

CSCI 11000. INTRODUCTION TO COMPUTER SCIENCE

This course examines the fundamental differences between problem solving in computer science and problem solving in other disciplines. How has computing evolved since its inception? How do computers store information? How do computers communicate? What is artificial intelligence? How do computing and society interact? This course also introduces problem solving with computer programming. *Annually. Not offered 2012-2013.*
[MNS]

CSCI 15100. COMPUTER PROGRAMMING I

The Java programming language is introduced in this course. Java language constructs such as variables,

sequential statements, if-else, loops, classes/objects and methods are examined in relation to general problem solving strategies. Algorithmic techniques such as searching and sorting are covered. Upon completion of the course, students should be able to design, code, test, and debug at a beginning level. *Prerequisite: Departmental approval, as determined by performance on mathematics placement exam. Annually. Fall and Spring. [MNS]*

CSCI 15200. COMPUTER PROGRAMMING II

Building on the basic programming skills developed in CS 151, this course adds tools to the programmer's repertoire to solve more complex problems using the C++ programming language. It introduces classic data structures used to store collections of data efficiently. It further develops software-engineering practices—including testing, documentation, and object-oriented programming—that aid in the construction of large programs. *Prerequisite: CSCI 15100. Annually. Fall and Spring. [MNS]*

CSCI 19901. CONNECTING ART AND COMPUTER SCIENCE – ANIMATIONS, GAMING AND 3-D VIRTUAL WORLDS

Fundamentally, Computer Science is about the application of computation to the solution of problems. Often these problems span multiple disciplines, requiring teams that bring diverse perspectives to the problem and its solution. This course explores some of the connections between two quite different disciplines, art and computer science, in the context of animation, computer games, and three-dimensional virtual worlds. In the process the student will gain insights into the basics of computing and software design, the importance of being able to communicate ideas clearly, and how to work collaboratively. *Fall 2012. [MNS]*

CSCI 25100. PRINCIPLES OF COMPUTER ORGANIZATION

This course provides an overview of computer systems design and architecture, and machine language. Topics include: instruction set design, register transfers, data-path design, pipelining, controller design, memory systems, addressing techniques, microprogramming, computer arithmetic. A survey of popular computer systems and microprocessors reinforce how real computer systems are designed. *Prerequisite: CSCI 15200. Annually. Fall 2012.*

CSCI 25200. ALGORITHMS

This course covers standard and advanced algorithms for problem solving in computer science. Brute force, recursion, greedy strategies and dynamic programming techniques are applied to real world problems. Time-space analysis is performed for various algorithm and data structure pairings. The limitations of algorithms are also studied in the context of NP-completeness. *Prerequisite: CSCI 15200 and MATH 12300, 21100, or 22300. Annually. Spring 2013.*

CSCI 25300. THEORY OF COMPUTATION

The theory of abstract machines and formal languages is introduced in this course. Computability by finite automata, pushdown automata and Turing machines is examined and related to pattern matching, lexical analysis, compilation and programming for digital computer systems. Proofs by induction, construction, contradiction and reduction are used to formalize computability theory and the limitations of computing. *Prerequisite: CSCI 15200 and MATH 12300 or 22300. Alternate years. Spring 2013.*

CSCI 27900. PROBLEM SEMINAR

This course provides the opportunity for students to practice solving challenging computer science problems. Typically, this is for those students intending to prepare for the ACM programming contest in which the College participates. The ACM contest is the culmination of this course. (.25 course credit) *S/NC course. May be taken more than once. Prerequisite: CSCI 15100. Annually. Fall 2012.*

CSCI 30900-30905. SPECIAL TOPICS

The content and prerequisites of this course vary according to the topic chosen. The course is available at irregular intervals when there is a need for a special topic. Past topics include Software Quality, Parallel and Distributed Computing, and Web Programming. (*Variable course credit*) *Prerequisite: Permission of the instructor. Not offered 2012-2013.*

CSCI 35100. PROGRAMMING LANGUAGE THEORY AND COMPILER CONSTRUCTION

This course examines programming languages and the use of compilers to translate from high-level languages to machine languages. We use formalisms to describe the syntax and semantics of imperative languages. We explore alternative language paradigms. We examine the algorithms and data structures used in compiler implementation. CSCI 25200 is recommended. *Prerequisite: CSCI 25100. Annually. Not offered 2012-2013.*

CSCI 35300. OPERATING SYSTEMS

An Operating System acts as an interface between the application and hardware layer of a computer system. In this course we examine how operating systems manage computing resources such as the memory hierarchy, file

system, program runtime environment and peripheral devices. Several popular operating systems are examined as case studies. *Prerequisite: CSCI 25100. Alternate years. Spring. Not offered 2012-2013.*

CSCI 35400. FILE AND DATABASE SYSTEMS

This course provides an overview of general database topics that are relevant to any database management system. These topics include: database design (data modeling, entity-relationship modeling, relational data models, normal forms), the use of database management systems for application development (SQL query language and relational algebra), transaction processing and storage, and indexing principles. The students practice on modern database systems such as Oracle, MySQL or SQL Server. In addition, students develop a web database application. At the end of this course students will be able to design and implement a database, to query a database using SQL, and to write stored procedures to access and interact with databases. *Prerequisite: CSCI 25200. Alternate years. Fall 2012.*

CSCI 35600. COMPUTER GRAPHICS

This course explores the theory and application of computer graphics through the evolution of graphics algorithms and rendering hardware. Topics include 2-D and 3-D transformations and projections, illumination models, texture mapping, animation techniques, user interfaces, and rendering algorithms. Group projects, lab assignments and in class activities expose students to the practical problems inherent in computer graphics programming. *Prerequisite: CSCI 15200 and MATH 21100. Alternate years. Not offered 2012-2013.*

CSCI 35700. MACHINE INTELLIGENCE

This course is a hands-on introduction to machine learning and artificial intelligence. The main question addressed is: How can we design good computer algorithms that improve automatically through experience (e.g. similar to the way humans learn)? Multiple machine learning models are examined. The goal of the course is that students begin to understand some of the issues and challenges facing machine learning while being exposed to the pragmatics of implementing machine learning systems in Matlab. *Prerequisites: CSCI 15200 and MATH 21100. Alternate years. Spring 2013.*

CSCI 40000. TUTORIAL

This course is given for topics not normally covered in regular courses. *Prerequisite: CSCI 25200; the approval of both the supervising faculty member and the chairperson is required prior to registration.*

CSCI 45100. SENIOR INDEPENDENT STUDY – SEMESTER ONE

The first semester of the Senior Independent Study project, in which each student engages in creative and independent research guided by a faculty mentor and which culminates in a thesis and an oral examination in the second semester. *Prerequisite: CSCI 25200.*

CSCI 45200. SENIOR INDEPENDENT STUDY – SEMESTER TWO

The second semester of the Senior Independent Study project, which culminates in the thesis and an oral examination. *Prerequisite: CSCI 45100.*