

School of Arts and Sciences

# COMPUTER SCIENCE

[www.cs.pitt.edu](http://www.cs.pitt.edu)

Twenty years ago, the computer was primarily used to carry out data processing tasks or perform mathematical calculations for scientific research. Today, computers are integrated into everyone's lives in both personal and remote ways, ranging anywhere from automated banking, to assisting physicians in medical diagnosis and treatment, to helping scientists predict global warming trends and earthquake scenarios. Developments and applications in computer technology are so numerous and evolve so quickly that listing them is nearly impossible. We can only imagine where technology such as the Internet and artificial intelligence will take us in the not-so-distant future.

The University of Pittsburgh's Department of Computer Science was established in 1966, making it one of the oldest departments of its kind in the country. The undergraduate major in computer science is a challenging program that teaches you the fundamental areas and basic concepts of the discipline, including problem-solving techniques used for a variety of computation problems. The program lets you explore your interests and strengthen your skills in advanced courses in computer science theory, programming languages, artificial intelligence, systems programming, and software engineering. You can also expand your academic experience by conducting an internship with a local company, working part time at the University's Computing and Information Services, and assisting faculty with teaching or research projects.

You will be studying in a city with the resources and reputation of a thriving center of high technology, and one of the nation's leading cities for the number of people employed in the computer industry. Pittsburgh is home to the Pittsburgh Supercomputing Center, one of five supercomputing centers in the country created to provide advanced scientific computing to the scientific and engineering research communities. Some recent projects conducted at the center involved collaborating with the Center for Analysis and Prediction of Storms to develop and test models for the prediction of severe storms, and running simulations for the U.S. Department of Energy's relativistic heavy ion collider. Being exposed to real-world computer technology such as this during the course of your studies can also help prepare you for graduate study or employment in an increasingly computer-oriented world.

The University of Pittsburgh offers top-notch computer equipment and facilities for student use, including seven computing labs with hundreds of Macintosh, Intel, and UNIX workstations and printers, color scanners, and graphic-generating equipment. The standard Pitt computer stations provide access to the University-wide data network, as well as VMS timesharing applications and a variety of software programs that allow you to work on databases, desktop publishing, editors, file transfer, programming languages, spreadsheets, and statistical and utility application. The technology evaluation and consulting lab is a unique facility where students and faculty can evaluate new hardware and software and use high-end equipment for tasks such as image manipulation, multimedia program authoring, file transfer, and specialty printing.

Computing "access" is defined as widely as possible at the University of Pittsburgh. All student residence halls allow students to use their own computers to access the University network and the Internet, and consultants are available in the residence halls to assist with your computing needs. The majority of University computer labs are equipped with wheelchair-accessible workstations, and some offer access to special equipment such as voice synthesis software, large-print operating system software, text scanning, and Braille printing. Special computing technology for students with physical and/or learning disabilities is available in the University's adaptive computing training lab.



## Required Core Courses

### Computer Science (13 credits)

These courses provide an introduction to the fundamental areas of computer science including programming languages, problem-solving techniques, and data structures.

#### CS 0401 Introduction to Computer Science (4 credits)

As the first course for computer science majors, CS 0401 introduces fundamental topics in computer science and the programming language Java. Students should be familiar with basic programming and high-school level Pascal, including arrays, records, and functions with parameters.

#### CS 0441 Discrete Structures for Computer Science (3 credits)

Discrete structures are the backbone of computer science, and this course helps you understand and use them. In particular, you learn about logic, proofs, sets, relations, functions, counting, and probability, with an emphasis on applications in computer science.

#### CS 0445 Introduction to Data Structures (3 credits)

This course emphasizes basic data structures of computer science (stacks, queues, trees, lists, graphs) and their implementation using Java language. You learn programming techniques that use recursion and pointer variables, as well as various searching and sorting methods. As a result, you also develop an intuitive understanding of the complexity of these algorithms. CS 0401 is a prerequisite for this course.

#### CS 0447 Computer Organization and Assembly Language (3 credits)

Through exercises, programming projects, and exams, this course teaches you the components of computing systems common to most computer architectures. In particular, you learn about data representation, types of processors (e.g., RISC V. CISC), memory types and hierarchy, assembly language, linking and loading, and processor implementation. CS 0401 and CS 0445 are prerequisites for this course, although CS 0445 can be taken concurrently.

#### CS 0449 Introduction to Systems Software (3 credits)

This course will introduce the students to the important systems language, C, and to several topics related to the hardware and software environment. These are issues related to device interfaces and hardware synchronization at the lowest level of the operating system, the linkage of operating system services to application software, and the fundamental mechanisms for computer communications. CS 0441, CS 0445, and CS 0447 are prerequisites for this course, although CS 0447 may be taken concurrently.

### Mathematics (11–12 credits)

These courses are required to teach students the level of mathematical expertise essential for the study of computer science. It is highly recommended that you complete these courses early, starting with MATH 0220 in your freshman or sophomore year.

Note: If 12 credits are completed in mathematics/statistics, this can be used as your related area.

MATH 0220 Analytical Geometry and Calculus 1 (4 credits)

MATH 0230 Analytical Geometry and Calculus 2 (4 credits)

Choose *one* of the following courses:

STAT 1000 Applied Statistical Methods (4 credits)

STAT 1100 Stat. and Probability for Bus. Mgt. (4 credits)

STAT 1151 Introduction to Probability (3 credits)

### Typical Freshman Course Sequence

#### First Term

CS 0401 Introduction to Computer Science

CS 0441 Discrete Structure for Computer Science

MATH 0220 Analytical Geometry and Calculus 1

General Writing course

#### Second Term

CS 0445 Introduction to Information Structures

CS 0447 Computer Organizations and Assembly Language

MATH 0230 Analytical Geometry and Calculus 2

STAT 1000 Applied Statistical Methods

English Writing course

**Upper-Level Courses** allow you to explore the major areas of computer science (theory, programming languages, systems programming, artificial intelligence, and software engineering) in more depth than core courses. Please see the Department of Computer Science Web page for complete course descriptions and prerequisites.

## Required Courses (9 credits)

It is advisable to take these three courses before any other upper-level computer science courses:

### CS 1501 Algorithm Implementation (3 credits)

All problem-solving methods of computer science involve the manipulation of data. Data structures, including lists and trees, are some of the tools used to store and manipulate data. In this course, you learn about data structures and problem-solving methods such as divide-and-conquer techniques, greedy methods, and dynamic programming. You also study various sorting and searching methods and receive an introduction to methods of analyzing the efficiency of an algorithm.

### CS 1502 Formal Methods in Computer Science (3 credits)

This course aims to develop your skills in modeling problems using discrete mathematics, and to introduce you to new discrete structures. In addition, you further develop your mathematical and algorithmic reasoning skills and learn about the theoretical study of information and computation as a physical phenomenon.

### CS 1550 Introduction to Operating Systems (3 credits)

The purpose of this course is to instruct you to use and understand the basic concepts of operating systems, the mechanisms that allow the machines to interface with the programmers. In particular, you learn about concepts such as the processing unit, process management, concurrency, communication, memory management and protection, and file systems.

## Elective Courses (15 credits)

At least five upper-level course electives must be taken from the list below:

### Foundations

CS 1510 Design and Analysis of Algorithms  
CS 1511 Intro to the Theory of Computations

### Languages

CS 1520 Programming Languages for Web Apps.  
CS 1621 Structure of Programming Languages  
CS 1622 Introduction to Compiler Design

### Systems

CS 1541 Introduction to Computer Architecture  
CS 1645 Intro to High-Performance Computing  
CS 1651 Advanced Systems Software  
CS 1652 Data Communication and Networks

### Applications

CS 1515 Scientific Computation  
CS 1530 Software Engineering  
CS 1538 Introduction to Simulation  
CS 1555 Database Management Systems  
CS 1566 Introduction to Computer Graphics  
CS 1571 Introduction to Artificial Intelligence  
CS 1573 Artificial Intelligence Programming  
CS 1590 Social Implications of Computing Tech.  
CS 1631 Software Design Methodology

## Job Opportunities

Because of the widespread use of computers and networks, employment opportunities for computer science majors exist in virtually every area of society (e.g., technology, banking, government, medicine, and education). Generally speaking, BS-level computer science majors are employed as either applications programmers or systems programmers. Individuals in the former classification are concerned with the design and implementation of programs to handle specific applications such as payroll, inventory, numerical analysis, or patient monitoring. Systems programmers, on the other hand, are concerned primarily with the computing system itself (independent of a particular application), and they design, implement, and maintain programs whose purpose is to support the execution of applications programs.

### For more information on the computer science major, please contact:

University of Pittsburgh  
Department of Computer Science  
John C. Ramirez  
Director of Undergraduate Studies  
6141 Sennott Square,  
Pittsburgh, PA 15260  
412-624-8492  
[www.cs.pitt.edu](http://www.cs.pitt.edu)

### For information on other majors, please contact:

University of Pittsburgh  
Office of Admissions and Financial Aid  
Alumni Hall, 4227 Fifth Avenue  
Pittsburgh, PA 15260-6601  
412-624-PITT  
E-mail: [oafa@pitt.edu](mailto:oafa@pitt.edu)  
[www.oafa.pitt.edu](http://www.oafa.pitt.edu)

## Special Programs/Extracurricular Activities

### Internships

Pittsburgh and Western Pennsylvania have experienced rapid development of small high-technology firms in recent years. As a student, you have many opportunities to gain valuable work experience at these and other firms while completing your undergraduate degree. The Department of Computer Science is actively involved in placing students in internships locally and in other cities. Students have conducted internships at places such as the Pittsburgh Supercomputing Center, University of Pittsburgh School of Medicine, USX, Alcoa, Microsoft, Mellon National Bank, Eli Lilly, Blue Cross Blue Shield, and Aristech.

### Computer Science Co-op Program

Through the assistance of the School of Engineering's Office of Cooperative Education, computer science majors can enter the co-op program after the completion of their sophomore year, and rotate between academic terms and paid work assignments. Co-op students complete at least three work periods lasting four months with a local, national, or international employer and take on increasingly challenging work assignments that complement their academic progression. Credit for work assignment does not count toward the 40 credits needed for completion of the computer science major, but can be used as elective credit for the general degree requirements in the School of Arts and Sciences.

### Double Majors

Students majoring in computer science may consider completing a second major in another field. One option is the Arts and Sciences/Business **Dual Major**, a challenging four-year program that enables you to complete the requirements for any Arts and Sciences major (in this case, computer science) while completing a major in business. After successfully completing the program, you are awarded a BS degree in computer science and business. Pitt's undergraduate business program is accredited by the American Assembly of Collegiate Schools of Business, a distinction held by only 25 percent of business schools in the country.

### BS/MS Dual Degree Program (Bachelor of Science in Computer Science/Master's degree in Computer Science)

Exceptional computer science students may consider the **BS/MS Dual Degree Program**. This challenging program allows students to complete both a BS and an MS degree in computer science in a period of five years, rather than the normal six years that the two degrees in sequence would require.

### Undergraduate Teaching and Tutoring

The Department of Computer Science hires qualified undergraduate students on a selective basis to help teach undergraduate courses. At the CS Help Room, computer science majors also provide tutoring services to undergraduates who are taking computer science courses at Pitt.

### Undergraduate Research

Faculty in the Department of Computer Science occasionally hire undergraduates, particularly students who have performed well in upper-level computer science classes, to assist them on research projects. Areas of faculty research include natural language processing, artificial intelligence and intelligent computer programming, image processing and pictorial information systems, computer architecture, parallel compilers, and optical memory in systems that require large memories, such as map databases for air navigation and medical databases for emergency treatment.

**University of Pittsburgh Special Interest Group for Networks (UPSIGN)** is a campus organization devoted to encouraging communication between network administrators, users, and campus support organizations to increase efficiency, technical knowledge, and quality of service regarding the University's network system. UPSIGN provides a forum for discussing network-related issues on campus through meetings and an electronic discussion board.

### Association for Computing Machinery at Pitt

This national organization promotes the research, discussion, and exchange of information on current topics in computer science and machinery. Members hold meetings, organize social activities, and sponsor lectures and seminars.

### Study Abroad

Study abroad programs let you earn credits toward your degree while strengthening your credentials as a graduate and enhancing your appreciation and understanding of other cultures. Credits earned are Pitt credits, scholarships are available, and financial aid is applicable. Study abroad programs that offer a strong curriculum in computer science include:

An exchange program with the **University of Sussex in Brighton, England** allows students to take courses at the School of Cognitive and Computing Sciences for one academic year and pay Pitt tuition and housing fees. Brighton, located on the southeastern coast of England, is known as "London-by-the-sea" because of its cultural offerings, shops, and student population.

The **Program for North American Mobility in Higher Education**, a student exchange program between Pitt and a number of well-regarded universities in Canada and Mexico, offers courses for computer science majors. Students attend for one semester or the entire academic year for the approximate cost of attending Pitt.

*The information printed in this document was accurate to the best of our knowledge at time of printing and is subject to change at any time at the University's sole discretion.*

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