Computer science, one of the youngest and most exciting scientific disciplines, addresses two fundamental questions: What computational tasks is a computer capable of doing? How can we design, analyze, and implement efficient algorithms (computational processes) to solve large, complex problems? The discipline requires thinking in both abstract terms—computer scientists need analytical skills to design efficient algorithms; and concrete terms—computer scientists must have the practical skills necessary for the implementation of those algorithms. The range of problems that can be attacked using the techniques of computer science spans many disciplines, and computer scientists often become proficient in other areas.

The Department of Computer Science at Bowdoin offers major and minor programs, as well as an interdisciplinary major with mathematics. These programs support the fundamental liberal arts philosophy that emphasizes breadth and depth of study, critical analysis of ideas, exposure to different modes of inquiry, a mature style of writing and other forms of discourse, and multicultural awareness through off-campus study. In this liberal arts setting, students have a unique opportunity to investigate the many strong connections between computer science and related fields, such as mathematics, philosophy, biochemistry, psychology, economics, art, and languages. At the same time, the computer science major provides a solid foundation for graduate study in computer science, as well as careers in teaching, research, and industry (such as financial services and Internet-related businesses).

In the first two years, computer science majors develop foundational knowledge of the field. Later, they focus on advanced topics and applications in more depth. Computer science faculty members at Bowdoin actively pursue research in a variety of subjects, including artificial intelligence (especially robotics and swarm intelligence), cognitive science, algorithms engineering and processing large data, and computational game theory and social and economic networks. Students are encouraged to take independent study courses that will engage them in research projects with faculty members.

The department also enjoys a strong sense of community among students and faculty fostered by small class sizes, department lunches, outside speakers, and informal talks and discussions throughout the year. During the summer, some of our majors remain at Bowdoin to work on research projects (supported by Bowdoin fellowships or outside grants) or in a technical capacity in Information Technology.

The Curriculum

Students pursuing a major or minor in computer science take Introduction to Computer Science, providing a basic introduction to problem solving and programming. Majors and minors also take Data Structures, a continuation of the introductory course, as well as Algorithms, concentrating on analyzing programs and learning how to make them more efficient. The curriculum then divides intermediate and advanced courses into three major topic areas: Systems and Software, Theory, and

Facilities

To support computer science coursework and research, four laboratories are available. Two labs contain networks of Apple workstations and are used primarily to support courses and student work. The other two labs are run by faculty and support student research. One of these labs focuses on robotics and the other is devoted to issues surrounding computer security.

The first two laboratories provide access to a wide range of programming languages and software that gives computer science students experience with the modern technologies and software environments that they will encounter in graduate school or industry.

The HPC (high performance computing) and algorithms lab provides access to a grid of Linux servers. Students have the opportunity to work on research that focuses on efficient algorithms for processing large data.

The robotics lab contains a variety of state-of-the-art robots, including Pioneer AT-DXs, Sony Aibos, and Aldebaran Naos. Students have the opportunity to work on independent projects using the robots and to participate in robot-related faculty research. Robotic soccer, for example, is a major ongoing research project in the department. The Northern Bites, Bowdoin's student-led robotic soccer team, won the 2007 RoboCup Standard Platform League World Championship and took second place in the Standard Platform League World Championship in 2009. The team took second place at the 2010 RoboCup Standard Platform League US Open, which was held at Bowdoin.

Computer Science

Artificial Intelligence. The department strives to offer courses in each of the major areas every semester. Many students also pursue independent studies on various topics as determined by faculty interest.

The Major and Minor Programs

Any student may elect a major in computer science, a minor in computer science, or an interdisciplinary major in computer science and mathematics. Introduction to Computer Science and Data Structures (the two courses in the introductory sequence) are required in all cases and are normally taken first. However, Algorithms, which is required for both majors, can also serve as an entry point and should be taken as early as possible. Students who have taken an Advanced Placement course in secondary school may be able to skip the requirement to take the introductory class.

The computer science major consists of ten courses: Introduction to Computer Science, Data Structures, Algorithms, and seven additional courses that meet the following requirements: at least one course in each of the major areas, at least one course designated as a "Projects" course, and at least four courses at the advanced level. Independent studies at the intermediate and advanced levels may be used to fulfill one of these elective requirements.

The computer science minor consists of Introduction to Computer Science, Data Structures, and any three other intermediate or advanced computer science courses.

Completion of the interdisciplinary major in computer science and mathematics requires eleven courses, six from computer science and five from mathematics. For more details about this interdisciplinary major, consult the College Catalogue online.

Bowdoin

Honors Projects

Recent honors theses completed by majors in the department include:

- **FleetDB: A Main Memory Functional Database**
- **Using Pheromones in a Swarm-Based Music Improvisation System**
- **Robot Localization in the RoboCup Standard Platform League**
- **Dynamically Balanced Omnidirectional Humanoid Robot Locomotion**
- **Map Overlay: Simple, Practical, and Scalable Approaches**
- **I/O-Efficient Shortest Paths on Grid-Based Terrains**
- **BD-SSAT: Combining Systematic and Local Search to Solve Stochastic Boolean Satisfiability Problems**
- **Recognizing Useful Advice and Using It Efficiently in a Reinforcement Learning Framework**

Independent Study, Honors, and Student/Faculty Research

Students are encouraged to collaborate with faculty on research projects through independent studies, honors projects (graduation with honors in computer science requires a one-year project that includes a thesis), and fellowship-funded summer research. Participation in faculty research provides experience that is invaluable both for graduate study and in industry. Such collaborations can lead to co-authorship of a paper and the opportunity to attend a national or international conference.

Faculty

Eric L. Chown, professor of computer science, B.A., M.S. (Northwestern), Ph.D. (Michigan), specializes in artificial intelligence and cognitive science. He is also the faculty advisor for Bowdoin's internationally competitive RoboCup team.

Mohammad Irfan, visiting assistant professor of computer science and fellow in digital and computational studies, B.S., M.S. (Bangladesh University), Ph.D. (Stony Brook), specializes in computational game theory with a focus on social and economic networks.

Stephen M. Majercik, associate professor of computer science, A.B. (Harvard), M.F.A., M.B.A. (Yale), M.S. (Southern Maine), Ph.D. (Duke), specializes in artificial intelligence, especially swarm intelligence and artificial intelligence in the arts.

Laura I. Toma, associate professor of computer science, B.S., M.S. (Universitatea Politechnica Bucuresti), M.S., Ph.D. (Duke), specializes in algorithm engineering and algorithms for large data. She is chair of the department.

Allen B. Tucker Jr., Anne T. and Robert M. Bass Professor of Natural Sciences Emeritus, A.B. (Wesleyan), M.S., Ph.D. (Northwestern), specializes in programming languages and natural language processing. He is the author or co-author of books and publications in the areas of programming languages, natural language processing, and computer science education.

After Bowdoin

Bowdoin's curricular offerings in computer science prepare graduates well for further study or professional careers in teaching, industry, and financial services. Recent computer science majors have entered graduate programs at Brown, Carnegie Mellon, Dartmouth, Georgia Tech, Indiana, Michigan, Northwestern, Penn, Princeton, Stanford, Tufts, UCLA, Utah, and Washington.

Many computer science graduates have taken positions at firms such as Google, Amazon, Twitter, American Management Systems, Chase Manhattan, Goldman Sachs, ITA Software, Meditech, Coopers and Lybrand, Liberty Mutual, Sun Microsystems, and a variety of others inside and outside the technology industry. Recent graduates have also secured positions with Bay Area start-up firms including Okta and Heroku.

Other graduates have followed different short- and long- term career paths, such as the Peace Corps, medicine, law, neuroscience, physics, and music composition.

For more information, go to:
bowdoin.edu/computer-science/