Computer Science, B.S.

Learning Outcomes

- Students understand the mathematical, logical, statistical, and theoretical foundations of computing.
- Students can analyze and compare the relative merits of alternative software designs and develop high-quality software systems.
- Students understand the fundamental principles of computer organization, system software, networks, and security.
- Students can apply computer science principles to a variety of problems, such as databases, data mining, graphics, and various fields of artificial intelligence (AI).
- Students understand social, professional, and ethical issues related to computing.

Overview

The major in computer science provides students with the necessary training for employment in careers such as software development and information management. It provides good preparation for graduate study in a variety of disciplines.

The department encourages students majoring in computer science to consider earning a second major, certificate, or minor.

Students may declare a major in computer science when they are admitted to the University or afterward. All students begin as Bachelor of Arts majors but may switch to the Bachelor of Science programs at any time.

Undergraduates majoring in computer science develop competence in programming principles and methodologies, problem-solving techniques, mathematics, and computer systems. Computer science training is critical for many careers in science, engineering, business, and health care.

Computer science majors are advised at the Academic Advising Center until they have completed 24 s.h., at which point they are assigned a departmental advisor. Students being advised at the Academic Advising Center also can consult with a computer science faculty advisor.

Transfer students who have taken a course approved as equivalent to a required computer science or informatics course are exempt from that course. Transfer course grades are included in the computer science grade-point average.

Students should consult the Department of Computer Science website or visit the department's office for information about general policies, elective areas, and internships, scholarships, and student groups, such as the University's chapter of the Association for Computing Machinery (ACM) and Women in Computing Sciences (WiCS).

Advanced Placement

The Computer Science Advanced Placement Program test may be used to satisfy requirements. See "Advanced Placement" under Undergraduate Programs on the Department of Computer Science website.

Requirements

The Bachelor of Science with a major in computer science requires a minimum of 120 s.h., including at least 63 s.h. of work for the major. Students must maintain a g.p.a. of at least 2.00 in all courses for the major and in all UI courses for the major. A cumulative g.p.a. of at least 2.00 is required for graduation. Students also must complete the College of Liberal Arts and Sciences GE CLAS Core.

The Bachelor of Science program is more rigorous than that of the Bachelor of Arts program; it is designed to provide in-depth training for students who would like to acquire strength in math and science in order to enhance their skills and job prospects. It also is appropriate for those who plan to pursue graduate work in computer science, although it is not required for graduate study at most universities.

Course work for the major includes computer science courses as well as courses in mathematics, statistics, and other supporting disciplines. Work for the major may not be taken pass/nonpass.

Bachelor of Science students with a computer science major should choose their GE CLAS Core Natural Sciences courses carefully since they may be able to use the same courses to satisfy the computer science major natural science sequences requirement; see "Natural Science Sequences" below.

The departmental residency requirement requires that students who earn a B.S. in computer science must complete at least seven courses (minimum of 21 s.h.) at the University of Iowa from the following: CS:2630 Computer Organization and ECE:3350 Computer Architecture and Organization, CS:2820 Object-Oriented Software Development, CS:3330 Algorithms, and at least four computer science course numbered CS:3620-CS:5899, but excluding CS:3910 and CS:3980.

The B.S. with a major in computer science requires the following course work.

Computer Science Core Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS:1210</td>
<td>Computer Science I: Fundamentals</td>
<td>4</td>
</tr>
<tr>
<td>CS:2210</td>
<td>Discrete Structures</td>
<td>3</td>
</tr>
<tr>
<td>CS:2230</td>
<td>Computer Science II: Data Structures</td>
<td>4</td>
</tr>
<tr>
<td>CS:2820</td>
<td>Object-Oriented Software Development</td>
<td>4</td>
</tr>
<tr>
<td>CS:3330</td>
<td>Algorithms</td>
<td>3</td>
</tr>
<tr>
<td>CS:3820</td>
<td>Programming Language Concepts</td>
<td>3</td>
</tr>
</tbody>
</table>

One of these:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS:2630</td>
<td>Computer Organization</td>
<td>3</td>
</tr>
<tr>
<td>ECE:3350</td>
<td>Computer Architecture and Organization</td>
<td>3</td>
</tr>
</tbody>
</table>

Natural Science Sequences Courses

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS:1210</td>
<td>Computer Science I: Fundamentals</td>
<td>4</td>
</tr>
<tr>
<td>CS:2210</td>
<td>Discrete Structures</td>
<td>3</td>
</tr>
<tr>
<td>CS:2230</td>
<td>Computer Science II: Data Structures</td>
<td>4</td>
</tr>
<tr>
<td>CS:2820</td>
<td>Object-Oriented Software Development</td>
<td>4</td>
</tr>
<tr>
<td>CS:3330</td>
<td>Algorithms</td>
<td>3</td>
</tr>
<tr>
<td>CS:3820</td>
<td>Programming Language Concepts</td>
<td>3</td>
</tr>
</tbody>
</table>

One of these:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS:2630</td>
<td>Computer Organization</td>
<td>3</td>
</tr>
<tr>
<td>ECE:3350</td>
<td>Computer Architecture and Organization</td>
<td>3</td>
</tr>
</tbody>
</table>
Computer Science, B.S.

One of these:
- CS:3620 Operating Systems 3
- CS:3640 Introduction to Networks and Their Applications 3
- CS:4640 Computer Security 3

Mathematics Core

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
</table>
| Calculus I
One of these:
- MATH:1550 Engineering Mathematics I: Single Variable Calculus 4
- MATH:1850 Calculus I 4

Calculus II
One of these:
- MATH:1560 Engineering Mathematics II: Multivariable Calculus 4
- MATH:1860 Calculus II 4

Linear Algebra
This course:
- MATH:2700 Introduction to Linear Algebra 4

Probability and Statistics
One of these:
- STAT:2020 Probability and Statistics for the Engineering and Physical Sciences 3
- STAT:3120 Probability and Statistics 4

Other probability and statistics courses (prefix STAT) with a calculus prerequisite approved by the department

Students who take MATH:2550 Engineering Mathematics III: Matrix Algebra and MATH:2560 Engineering Mathematics IV: Differential Equations can use these courses together to satisfy the linear algebra requirement.

Computation Theory
Students must complete one of the following.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
</table>
- CS:4330 Theory of Computation 3
- CS:4350 Logic in Computer Science 3

Advanced Technical Electives
Students must earn at least 12 s.h. (four courses) in advanced technical electives, as follows.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
</table>
- At least 6 s.h. from these:
  - A computer science course (prefix CS) numbered 3620-5899, except CS:3910 and CS:3980
  - A computer science course (prefix CS) numbered 5900 or above, with department approval
And:
- Remaining courses may be chosen from advanced technical elective courses in computer science (prefix CS) or in other disciplines with department approval

An approved list of courses in other departments that satisfy this requirement can be found on the Department of Computer Science website; see "Major Requirements" on the Undergraduate Programs page.

Students may count a maximum of 3 s.h. earned in CS:3990 Honors in Computer Science or Informatics toward the advanced technical elective requirement.

Natural Science Sequences
Students take two or more courses in a sequence (totaling at least 6 s.h.) in a cognate area of natural science. The natural science sequence is intended to enhance a student's perspective by providing a deeper understanding of the scientific method. Typically, it consists of a sequence of courses taken in the same science department. Students often choose courses that also fulfill the GE CLAS Core Natural Sciences requirement. Some possible choices are listed below; the department chair may approve others.

CLEP/APP credit may be used to satisfy part or all of the natural science requirement only if the appropriate science department at the University of Iowa accepts the credit as equivalent to one to more of the specific courses listed below.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
</table>
- Astronomy
  - ASTR:1771 General Astronomy I 4
  - ASTR:1772 General Astronomy II 4
- Biology
  - BIOL:1411 Foundations of Biology 4
  - BIOL:1412 Diversity of Form and Function 4
- Chemistry
  - CHEM:1110 Principles of Chemistry I 4
  - CHEM:1120 Principles of Chemistry II 4
- Earth and Environmental Sciences
  - EES:1030 Introduction to Earth Science 3-4
  - EES:1050 Introduction to Geology 3-4
- Geographical and Sustainability Sciences
  - GEOG:1020 The Global Environment 3
  - GEOG:1050 Foundations of GIS 4
- Physics
  - One of these sequences:
    - PHYS:1611-1612 Introductory Physics I-II 8
    - PHYS:1701-1702 Physics I-II 8

Early Admission to the Graduate College
Undergraduate computer science students who have 6 s.h. or less to earn toward graduation may apply for early admission to the Graduate College. Early admission allows students in their final undergraduate semester to take courses for graduate credit in addition to the courses they need to complete their bachelor's degrees.

Combined Programs

B.S./M.C.S.

Qualified computer science undergraduate students who plan to earn the Master of Computer Science degree may apply
for the combined Bachelor of Science/Master of Computer Science program. The combined B.S./M.C.S. program allow students to earn both degrees in five years. The program requires a total of 140 s.h. Students are granted a B.S. when they complete all requirements for the undergraduate degree.

Students in the combined program must complete all requirements for each degree, but may count a maximum of 12 s.h. (four courses) toward both degrees. The four courses must be taken during the fourth year of undergraduate study, after admission to the combined program, and must satisfy degree requirements of both the B.S. and the M.C.S.

If students withdraw from the combined program before completing their bachelor's degree, credit earned in the four courses is counted only toward the undergraduate degree.

Students apply for admission to the combined program during their third year as an undergraduate and enter the program at the beginning of their fourth year. They typically complete the combined program comfortably in one year after completing the B.S. requirements.

Applicants to the combined program must:

- be enrolled as a B.S. student majoring in computer science at the University of Iowa;
- have completed a minimum of 80 s.h. at the time of admission to the combined program, with at least 30 s.h. earned at the University of Iowa; and
- have a cumulative University of Iowa g.p.a. of at least 3.25 and a g.p.a. of at least 3.25 in the computer science major (computed on math prerequisites and core computer science course work taken at the University of Iowa).

Applicants must meet the admission requirements of the Graduate College; see the Manual of Rules and Regulations of the Graduate College.

Students must submit an application for admission to the program, a statement of purpose, three letters of recommendation, and transcripts from all colleges attended; they also must apply to the Graduate College. Graduate Record Examination (GRE) scores are not required. For more detailed information, see Prospective Students on the Department of Computer Science website.

Honors

Honors in the Major

Students majoring in computer science have the opportunity to graduate with honors in the major. They must maintain a minimum UI cumulative g.p.a. of 3.33 and complete 4-6 s.h. of CS:3990 Honors in Computer Science or Informatics which requires the submission of an acceptable honors thesis. Students are responsible for finding a faculty member willing to supervise their honors project. They can register for CS:3990 with the project supervisor's name once the faculty member approves the proposed project and a timetable for the work. For more details, see Honors on the Department of Computer Science website.

Honors students may count a maximum of 3 s.h. of CS:3990 Honors in Computer Science or Informatics toward the B.S. degree's advanced technical elective requirement. Students in the combined B.S./M.C.S. program may register for 4-6 s.h. of CS:5990 Individualized Research or Programming Project instead of CS:3990; this will allow them to receive graduate credit for the course while satisfying the course requirements to graduate with honors.

University of Iowa Honors Program

In addition to honors in the major, students have opportunities for honors study and activities through membership in the University of Iowa Honors Program. Visit Honors at Iowa to learn about the University's honors program.

Membership in the UI Honors Program is not required to earn honors in the computer science major. However, the semester hours earned in CS:3990 Honors in Computer Science or Informatics or CS:5990 Individualized Research or Programming Project can be used to partially satisfy the UI Honors requirement of 12 s.h. of experiential learning course work.

Academic Plans

Four-Year Graduation Plan

The Four-Year Graduation Plan is not available to B.S. students majoring in computer science. Students work with their advisors on individual graduation plans.

Career Advancement

Computer science graduates work primarily in two market sectors. One includes the software and computer industry, from small start-ups to giants such as Amazon, Google, Intel, Yahoo, and Microsoft. These offer job opportunities in software design, including UI/UX, mobile, and web development. Another sector is made up of organizations whose primary business is not computing, such as banks, insurance, and other financial groups; health care organizations; consulting, media and legal firms; entertainment companies; and the military.

As many as one-third of computer science graduates go into research or elect to pursue graduate studies in computer science, including the University of Iowa B.S./M.C.S. program, or pursue other areas where computer science provides a strong foundation.

A recent job placement survey indicates that more than 97 percent of computer science graduates were placed or no longer seeking employment within six months of graduation.

The Pomerantz Career Center offers multiple resources to help students find internships and jobs.