Computer Science, BS

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.

Students may declare a major in computer science when they are admitted to the university or afterward. They may declare either a Bachelor of Arts or a Bachelor of Science, but if no preference is indicated by a student, the Bachelor of Arts is designated. Students may switch to the Bachelor of Science 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 30 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 Credit Policy on the Department of Computer Science website.

Learning Outcomes

- Students understand the mathematical, logical, 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, and various fields of artificial intelligence (AI).
- Students understand social, professional, and ethical issues related to computing.

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 grade-point average (GPA) of at least 2.00 in all courses for the major and in all UI courses for the major. A cumulative GPA 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.

Coursework 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.

Students who major in computer science may not also major or minor in computer science and engineering, data science, or informatics.

Departmental Residency Requirement

Students who earn a BS 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 or ECE:3350 Computer Architecture and Organization, CS:2820 Introduction to Software Development, CS:3330 Algorithms, and at least four computer science courses numbered CS:3620-CS:5899, but excluding CS:3910 Informatics Project, CS:3980 Topics in Computer Science I, and CS:4310 Design and Implementation of Algorithms; these courses are requirements for the BS in computer science as listed below.

Program Requirements

The BS with a major in computer science requires the following coursework. Many courses for the major require a minimum grade of C-minus in the prerequisite courses.

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Science Core Courses</td>
<td>27-28</td>
</tr>
<tr>
<td>Mathematics Core Courses</td>
<td>15-16</td>
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<tr>
<td>Computation Theory Course</td>
<td>3</td>
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<tr>
<td>Advanced Technical Electives</td>
<td>12</td>
</tr>
<tr>
<td>Natural Sciences Sequences Courses</td>
<td>6-8</td>
</tr>
</tbody>
</table>

Computer Science Core

<table>
<thead>
<tr>
<th>Course #</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>Introduction to 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:
CS:2630 Computer Organization 4
ECE:3350 Computer Architecture and Organization 3

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

Mathematics Core

Calculus I

Course # Title Hours
One of these:
MATH:1550 Engineering Mathematics I: Single Variable Calculus 4
MATH:1850 Calculus I 4

Calculus II

Course # Title Hours
One of these:
MATH:1560 Engineering Mathematics II: Multivariable Calculus 4
MATH:1860 Calculus II 4

Linear Algebra

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.

Course # Title Hours
This course:
MATH:2700 Introduction to Linear Algebra 4

Probability and Statistics

Course # Title Hours
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

Computation Theory

Course # Title Hours
One of these:
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.

Course # Title Hours
At least 6 s.h. from these:
A computer science course (prefix CS) numbered 3620-5899, except CS:3910, CS:3980, and CS:4310; a maximum of 3 s.h. in CS:3990 will count toward the requirement
A computer science course (prefix CS) numbered 5900 or above, with department approval

Remaining courses may be chosen from advanced technical elective courses in computer science (prefix CS) or in other disciplines with department approval; the following are preapproved technical electives.

Course # Title Hours
Biology
BIOL:2512 Fundamental Genetics 4
BIOL:3172 Evolution 4
Chemistry
CHEM:2210 Organic Chemistry I 3
CHEM:2220 Organic Chemistry II 3
CHEM:2230 Organic Chemistry I for Majors 3
CHEM:2240 Organic Chemistry II for Majors 3
CHEM:2410 Organic Chemistry Laboratory 3

Electrical and Computer Engineering
ECE:3600 Control Systems 3
ECE:5450 Machine Learning 3
ECE:5480 Digital Image Processing 3
ECE:5600 Control Theory 3

Geographical and Sustainability Sciences
GEOG:3520 GIS for Environmental Studies 3
GEOG:3540 Geographic Visualization 3

Earth and Environmental Sciences
EES:2410 Mineralogy 4
EES:3020 Earth Surface Processes 3
EES:3210 Principles of Paleontology 3
EES:3300 Sedimentary Geology 4
EES:3360 Soil Genesis and Geomorphology 3
EES:3380 Fluvial Geomorphology 3
EES:3390 Integrated Watershed Analysis 3
EES:3500 Igneous and Metamorphic Petrology 4
EES:3840 Structural Geology 4
EES:4800 Global Geophysics 3

Economics
ECON:4700 Topics in Analytical Economics 3

Mathematics
MATH:2560 Engineering Mathematics IV: Differential Equations 3
MATH:2850 Calculus III 4
MATH:3550 Engineering Mathematics V: Vector Calculus 3
MATH:3600 Introduction to Ordinary Differential Equations 2-3
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 understanding of the scientific method. Typically, it consists of a sequence of courses taken in the same science department. Students may choose courses that also fulfill the GE CLAS Core Natural Sciences requirement. Some possible choices are listed below; the director of undergraduate studies may approve others.

CLEP/AP 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 or more of the specific courses listed below.

Course #  Title                          Hours
Astronomy
ASTR:1771  Fundamental Astronomy I: The Solar System and Exoplanets  4

ASTR:1772  Fundamental Astronomy II: Evolution of Stars, Galaxies, and the Universe  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

or  EES:1050  Introduction to Geology  3-4

EES:1080  Introduction to Environmental Science  3-4

Geographical and Sustainability Sciences
GEOG:1020  The Global Environment  3

GEOG:2050  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

BS/MCS

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 BS/MCS program allows students to earn both degrees in five years. The program requires a total of 140 s.h. Students are granted a BS 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 BS and the MCS.

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 BS requirements.

Applicants to the combined program must:

• be enrolled as a BS 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 grade-point average (GPA) of at least 3.25 and a GPA of at least 3.25 in the computer science major (computed on math prerequisites and core computer science coursework taken at the University of Iowa).

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

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 Graduate Programs 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 grade-point average (GPA) of 3.33 and a minimum major GPA of 3.50; additionally, students complete 4–6 s.h. of CS:3990 Honors in Computer Science or Informatics and submit an acceptable honors thesis or project. At any time, students can communicate to the computer science professional advisor that they have an honors interest and can have that designation placed on their academic record.

A student is responsible for finding a faculty member willing to supervise the honors project. The student can register for CS:3990 Honors in Computer Science or Informatics under the project supervisor's name once the faculty member approves the proposed project and a timetable for the work. Once that is accomplished, the student must then communicate with the Department of Computer Science honors director, who changes the student’s status to denote the student is pursuing honors in the major. It is not necessary to have declared an honors interest before finding a thesis supervisor and beginning to pursue honors in the major, but the student must be coded as pursuing honors prior to completing the application for degree.

An honors project can be completed in one semester, but it usually takes two semesters to complete. In their final semester, a student must register for CS:3999 Computer Science or Informatics Honors Cohort. The honors thesis/project must be approved by the thesis supervisor and then submitted to the honors director who will give initial approval that the student can graduate with honors in the major. Final approval is given after final grades are submitted and all requirements are met. For more details regarding project requirements, see Honors in Computer Science on the department’s website.

Students who pursue honors in the major may count a maximum of 3 s.h. in CS:3990 Honors in Computer Science or Informatics toward the advanced technical elective requirement. Those in the combined BS/MCS program may register for 4–6 s.h. in CS:5990 Individualized Research or Programming Project instead of CS:3990; this registration allows 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 can pursue 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 coursework.

For more information, contact the Department of Computer Science honors director.

Career Advancement

Computer science graduates work primarily in two market sectors. One sector is the software and computer industry where the words computer science are being used—those in Silicon Valley, among other areas, that can range from startups to giants like Amazon, Google, Facebook, and Microsoft. The other sector allows computer science students to use their technical expertise in fields beyond computer science. Examples would be working as a user experience (UX) designer for a marketing agency or developing software for a financial group; there are computer science majors working in media, health care, the government, and even in law firms. Computer science skills are needed everywhere so students have ample opportunities to find an environment that fits their interests and strengths.

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's five-year BS/MCS program, or pursue other areas where computer science provides a strong foundation.

A recent job placement survey indicates that more than 97% of computer science graduates have a job, are continuing education, or are not seeking employment within six months of graduation.

View post-graduation data on the Pomerantz Career Center website that uses University of Iowa placement information to explore what recent computer science alumni are doing that includes median salaries, job titles, companies of employment, and other facts about UI graduates.

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

Academic Plans

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

Sample Plan of Study
Sample plans represent one way to complete a program of study. Actual course selection and sequence will vary and should be discussed with an academic advisor. For additional sample plans, see MyUI.

Computer Science, BS

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic Career</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any Semester</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Effective fall 2022, computer science majors enrolled full-time and with 60 s.h. or more overall earned hours reflected on the UI grade report will be assessed $500 per semester supplemental tuition; the amount is pro-rated for part-time students. For more information see: https://cs.uiowa.edu/supplemental-tuition-effective-fall-2022.

GE CLAS Core: Sustainability a

| Hours | 0 |
### First Year

#### Fall
- **CS:1210** Computer Science I: Fundamentals 4
- **MATH:1850** Calculus I 4
- **ENGL:1200** or **RHT:1030** The Interpretation of Literature 3 - 4
- **CS:1600** Success at Iowa 2

#### Hours 14-15

#### Spring
- **CS:2210** Discrete Structures 3
- **CS:2230** Computer Science II: Data Structures 4
- **MATH:1860** Calculus II 4
- **RHET:1030** or **ENGL:1200** The Interpretation of Literature 3 - 4

#### GE CLAS Core: Diversity and Inclusion 3

#### Hours 17-18

### Second Year

#### Fall
- **CS:2630** Computer Organization 4
- **CS:3330** Algorithms 3
- Major: mathematics elective 3 - 4
- **GE CLAS Core: World Languages First Level** Proficiency or elective course 4 - 5

#### Hours 15-17

#### Spring
- **CS:2820** Introduction to Software Development 3
- **CS:3820** Programming Language Concepts 3
- Major: mathematics elective 3 - 4
- **GE CLAS Core: Literary, Visual, and Performing Arts** 3
- **GE CLAS Core: World Languages Second Level** Proficiency or elective course 4 - 5

#### Hours 19-21

### Third Year

#### Fall
- **CS:3620** or **CS:3640** Operating Systems or Introduction to Networks and Their Applications 3
- Major: advanced computer science elective 3
- **GE CLAS Core: Natural Sciences without Lab** 3
- **GE CLAS Core: World Languages Third Level** Proficiency or elective course 4 - 5

#### Hours 13-14

#### Spring
- **CS:4330** or **CS:4350** Theory of Computation 4
- Major: advanced computer science elective 3
- **GE CLAS Core: Natural Sciences with Lab** 3
- **GE CLAS Core: World Languages Fourth Level** Proficiency or elective course 4 - 5

#### Hours 15-16

### Fourth Year

#### Fall
- Major: advanced computer science or technical elective 3
- **GE CLAS Core: Historical Perspectives** 3
- **GE CLAS Core: International and Global Issues** 3
- Elective course 3
- Elective course 3

#### Hours 15

#### Spring
- Major: advanced computer science or technical elective 3
- **GE CLAS Core: Social Sciences** 3
- **GE CLAS Core: Values and Culture** 3
- Elective course 3
- Elective course 3

#### Degree Application: apply on MyUI before deadline (typically in February for spring, September for fall)

#### Hours 15

### Total Hours 123-131

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a. Sustainability must be completed by choosing a course that has been approved for Sustainability AND for one of these General Education areas: Natural Sciences; Quantitative and Formal Reasoning; Social Sciences; Historical Perspectives; International and Global Issues; Literary, Visual, and Performing Arts; or Values and Culture.

b. Enrollment in this course requires completion of a placement exam.

c. Enrollment in math courses requires completion of a placement exam.

d. Students may use elective courses to earn credit towards the total s.h. required for graduation or to complete a double major, minors, or certificates.

e. GE CLAS Core courses may be completed in any order unless used as a prerequisite for another course. Students should consult with an advisor about the best sequencing of courses.


g. Required math electives include (1) MATH:2700 and (2) STAT:2020 or STAT:3120.

h. Students who have completed four years of a single language in high school have satisfied the GE CLAS Core World Languages requirement. Enrollment in world languages courses requires a placement exam, unless enrolling in a first-semester-level course.

i. Students may choose a computer science course (prefix CS) numbered 3620-5899, except CS:3910, CS:3980 and CS:4310, or a CS course numbered 5900 or above with department approval. A course used to complete a core requirement cannot also be used as a major elective.

j. The B.S. in computer science requires a 6-8 s.h., two-semester sequence science cognate. Select courses approved to meet the major requirement may also be used to meet the GE CLAS Core Natural Science requirement. See your academic advisor for additional information.

k. Students may choose a computer science course (prefix CS) numbered 3620-5899, except CS:3910, CS:3980 and CS:4310, or a CS course numbered 5900 or above with department approval. A course used to satisfy a core requirement cannot also be used as an advanced major elective. Alternatively, students may take a course in other...
disciplines with department approval. See academic advisor for additional information.

Please see Academic Calendar, Office of the Registrar website for current degree application deadlines. Students should apply for a degree for the session in which all requirements will be met. For any questions on appropriate timing, contact your academic advisor or Graduation Services.