Computer Science - Bachelor of Arts (BA)

Computer science is an exciting and challenging field that has impact on many parts of our lives. Computer scientists craft the technologies that enable the digital devices we use every day. They develop the large-scale software that powers business and industry, and they advance the computational techniques and write the software that supports scientists in their study of the world around us. They create the software that social scientists use to identify and analyze patterns in the behavior of social groups and human behavior in social networks and the applications that humanists and linguists use to research language development. Many new applications of computing technology remain to be discovered. Indeed, computing will be at the heart of future revolutions in business, science and society. Students who study computer science now will be at the forefront of those important advances.

Computer science offers study in the fields of computer systems, cyber security, robotics, algorithm design, artificial intelligence, software and web engineering, programming languages, database design, human-computer interaction, machine learning, data science, numerical and parallel computing, speech and language processing and theoretical computer science.

Computer science is concerned with how computers are constructed, how they store and process data, how they are used in problem solving and how the quality of those solutions is assessed. It is about the science of creating software for a variety of users. It is about understanding how that software interacts with the hardware on which it is run. Computer science goes well beyond the machine to the study of how people interact with the technologies around them. Applications of computer science reach far and wide.

For more information, visit the department’s BA Degree (https://www.colorado.edu/cs/current-students/undergraduate-students/ba-degree/) webpage.

A student may not earn both the BS and BA in computer science. A student may not earn both a bachelor’s degree in computer science and the minor in computer science from CU Boulder.

Requirements

The degree provides considerable freedom in the selection of specific courses to fulfill major requirements, allowing students to tailor the degree to their individual needs and interests.

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Students earning a BA in Computer Science from the College of Engineering and Applied Science must earn a CU cumulative GPA of at least 2.250, and Major GPA of at least 2.250, to be eligible to graduate. The degree is nominally 120 credit hours but may require more credits depending on the Additional Field of Study chosen by and approved for the student.

*Note: Prior to the 2020–2021 academic year, this program was offered by the College of Arts & Sciences. Students who enrolled in this program prior to the 2020–2021 academic year should refer to the requirements as defined during their year of entry (see the University Catalog archive (catalog.colorado.edu/archive/)).*

**Required Courses and Credits**

Students must complete the General Education requirements, which includes approximately 46 credit hours, and the required courses listed below. Through the required coursework for the major, students will fulfill the QRMS component of the General Education Skills Requirement.

Students are required to pursue an Additional Area of Study as part of earning the BA in computer science. The additional area can be any available minor or certificate from any of CU Boulder’s colleges and schools (Arts & Sciences, Business, EAS, CMCI, Education, Music). Students completing a dual degree (by pursuing another major) fulfill the requirement with those plans.

Any Additional Area of Study that is not part of a dual degree must be at least 15 credit hours. Programs that do not meet this requirement will be considered by petition and students will be required to add additional coursework.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSCI 1300</td>
<td>Computer Science 1: Starting Computing</td>
<td>4</td>
</tr>
<tr>
<td>CSCI 2270</td>
<td>Computer Science 2: Data Structures</td>
<td>4</td>
</tr>
<tr>
<td>CSCI 2400</td>
<td>Computer Systems</td>
<td>4</td>
</tr>
<tr>
<td>CSCI 3104</td>
<td>Algorithms</td>
<td>4</td>
</tr>
<tr>
<td>CSCI 3155</td>
<td>Principles of Programming Languages</td>
<td>4</td>
</tr>
<tr>
<td>CSCI 3308</td>
<td>Software Development Methods and Tools</td>
<td>3</td>
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</tbody>
</table>

Choose four Courses

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<tbody>
<tr>
<td>CSCI 3002</td>
<td>Fundamentals of Human Computer Interaction</td>
<td>4</td>
</tr>
<tr>
<td>CSCI 3202</td>
<td>Introduction to Artificial Intelligence</td>
<td>4</td>
</tr>
<tr>
<td>CSCI 3287</td>
<td>Design and Analysis of Database Systems</td>
<td>4</td>
</tr>
<tr>
<td>CSCI 3302</td>
<td>Introduction to Robotics</td>
<td>4</td>
</tr>
<tr>
<td>CSCI 3403</td>
<td>Introduction to CyberSecurity for a Converged World</td>
<td>4</td>
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<tr>
<td>CSCI 3434</td>
<td>Theory of Computation</td>
<td>4</td>
</tr>
<tr>
<td>CSCI 3656</td>
<td>Numerical Computation</td>
<td>4</td>
</tr>
<tr>
<td>CSCI 3753</td>
<td>Design and Analysis of Operating Systems</td>
<td>4</td>
</tr>
<tr>
<td>CSCI 4022</td>
<td>Advanced Data Science</td>
<td>4</td>
</tr>
<tr>
<td>CSCI 4273</td>
<td>Network Systems</td>
<td>4</td>
</tr>
<tr>
<td>CSCI 4448</td>
<td>Object-Oriented Analysis and Design</td>
<td>4</td>
</tr>
</tbody>
</table>

**CSCI Upper-Division Electives**

Choose two to four additional upper-division CSCI courses or approved courses from outside CSCI.

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<tr>
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**Required Ancillary Coursework**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1300</td>
<td>Calculus 1</td>
<td>8</td>
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or APPM 1350 Calculus 1 for Engineers
or APPM 1345 Calculus 1 with Algebra, Part B
MATH 2300 Calculus 2
or APPM 1360 Calculus 2 for Engineers

**Discrete Mathematics**
Choose one: 3

- CSCI 2824 Discrete Structures
- or ECEN 2703 Discrete Mathematics for Computer Engineers
- or APPM 3170 Discrete Applied Mathematics
- or MATH 2001 Introduction to Discrete Mathematics

**Linear Algebra or Probability/Statistics**
Choose one: 3-4

- Linear Algebra
  - CSCI 2820 Linear Algebra with Computer Science Applications
- MATH 2130 Introduction to Linear Algebra for Non-Mathematics Majors
- MATH 2135 Introduction to Linear Algebra for Mathematics Majors
- APPM 3310 Matrix Methods and Applications
- Probability/Statistics
  - CSCI 3022 Introduction to Data Science with Probability and Statistics
  - MATH 3510 Introduction to Probability and Statistics
- MATH 4510 Introduction to Probability Theory
- APPM 3570 Applied Probability
- STAT 3100 Applied Probability
- ECON 3818 Introduction to Statistics with Computer Applications
- STAT 4000 Statistical Methods and Application I

**Logic & Ethics**

**Logic**
Choose one: 3

- PHIL 1440 Critical Thinking
- PHIL 2440 Symbolic Logic

**Ethics**
Choose one: 3

- PHIL 1100 Ethics
- PHIL 1200 Contemporary Social Problems
- PHIL 2160 Ethics and Information Technology
- PHIL 3100 Ethical Theory
- EHON 1151 Critical Encounters
- ENES 2020 The Meaning of Information Technology
- ENLP 2000 Leadership, Fame and Failure
- INFO 4601 Ethical and Policy Dimensions of Information and Technology
- CSCI 2750 Computing, Ethics and Society

**Outside Area of Study**
Approved minor, certificate or dual degree program at CU Boulder 12-15

**Graduating in Four Years**
Consult the four-year guarantee requirements for information on eligibility. The concept of "adequate progress" as it is used here only refers to maintaining eligibility for the four-year guarantee; it is not a requirement for the major. To maintain adequate progress toward a BA in computer science, students should meet the following requirements:

- Declare the computer science BA major and have taken Calculus 1 and CSCI 1300 by the end of their second semester.
- Consult with a major advisor to determine adequate progress toward completion of the major and general education requirements.

**Recommended Four-Year Plan of Study**
This four-year plan of study is based on students starting at the Calculus 1 level. This plan is flexible and CSCI course substitutions in year two based on starting MATH or other requirements should be discussed with an academic advisor.

General Education Distribution and Diversity requirements (https://www.colorado.edu/artsandsciences/undergraduate/degree-requirements/general-education-requirements/) can be met with courses for the Additional Area of Study. Some additional areas of study may exceed 120 total credit hours.

For more information on required courses including all options for Calculus, additional MATH, PHIL and CSCI-BA Core and Upper Division electives, see the Requirements tab. Detailed information is also available on the BA Degree Requirements (https://www.colorado.edu/cs/current-students/undergraduate-students/ba-degree/ba-degree-requirements/) webpage.

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<tr>
<td><strong>Year One</strong></td>
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<tr>
<td><strong>Fall Semester</strong></td>
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<tr>
<td>CSCI 1300</td>
<td>Computer Science 1: Starting Computing</td>
<td>4</td>
</tr>
<tr>
<td>MATH 1300</td>
<td>Calculus 1</td>
<td>5</td>
</tr>
<tr>
<td>General Education Skills course (example: Lower-division Written Communication)</td>
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<td>3</td>
</tr>
<tr>
<td>General Education Distribution Course (example: Social Science) or Additional Area of Study Course</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td><strong>Spring Semester</strong></td>
<td></td>
<td>Credit Hours 15</td>
</tr>
<tr>
<td>CSCI 2270</td>
<td>Computer Science 2: Data Structures</td>
<td>4</td>
</tr>
<tr>
<td>MATH 2300</td>
<td>Calculus 2</td>
<td>5</td>
</tr>
<tr>
<td>General Education Distribution course (example: Natural Sciences with Lab)</td>
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<td>5</td>
</tr>
<tr>
<td>Logic or Ethics course</td>
<td></td>
<td>3</td>
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<tr>
<td><strong>Year Two</strong></td>
<td></td>
<td>Credit Hours 17</td>
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<tr>
<td><strong>Fall Semester</strong></td>
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<td>Logic or Ethics Course</td>
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<td>Additional Area of Study Course</td>
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</tr>
<tr>
<td>General Education Distribution course (example: Arts &amp; Humanities)</td>
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<td>3</td>
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<tr>
<td><strong>Spring Semester</strong></td>
<td></td>
<td>Credit Hours 16</td>
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<tr>
<td>CSCI 3104</td>
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</table>
CSCI 3308  Software Development Methods and Tools  3
Linear Algebra, Probability or Statistics course  3-4
Additional Area of Study  3
Additional Area of Study  3
Credit Hours  16-17

Year Three
Fall Semester
CSCI 3155  Principles of Programming Languages  4
CSCI core course or CSCI Upper-division Elective  3-4
Additional Area of Study  3
Upper-division General Education Skills course (example: Upper-division Written Communication)  3
General Education Distribution course (example: Natural Sciences)  3
Credit Hours  16-17

Spring Semester
CSCI core course or CSCI Upper-division Elective  3-4
CSCI core course or CSCI Upper-division Elective  3-4
Additional Area of Study  3
General Education Distribution/Diversity course (example: Social Sciences/Global Perspective)  3
Free Elective  1
Credit Hours  13-15

Year Four
Fall Semester
CSCI core course or CSCI Upper-division Elective  3-4
CSCI Upper-division Elective or Capstone-1  3-4
Additional Area of Study or General Education Distribution course  3
Additional Area of Study or General Education Distribution course  3
General Education Distribution course  3
Credit Hours  15-17

Spring Semester
CSCI Upper-division Elective  3-4
CSCI Upper-division Elective or Capstone-2  3-4
Additional Area of Study or General Education Distribution course  3
Additional Area of Study or General Education Distribution course  3
Credit Hours  12-14
Total Credit Hours  120-128

Learning Outcomes
Upon graduation, students are expected to be able to:

- Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.
- Design, implement, and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program’s discipline.
- Communicate effectively in a variety of professional contexts.

- Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
- Function effectively as a member or leader of a team engaged in activities appropriate to the program’s discipline.
- Apply computer science theory and software development fundamentals to produce computing-based solutions.

Program Educational Objectives
Within 3–5 years after graduating with a Bachelor of Arts degree in computer science, our graduates will be:

- **Broadly educated and versatile.** Able to draw upon foundational knowledge, learn, adapt and successfully bring to bear analytical and computational approaches on changing societal and technological challenges.

- **Inspiring and collaborative.** Is a leader and a responsible citizen whose strengths come from an ability to draw on and contribute to diverse teams, expertise and experiences.

- **Innovative.** Drives scientific and societal advancement through technological innovation and entrepreneurship.

- **Engaged.** Is and remains engaged with the University of Colorado, the state of Colorado and technical and scientific professional communities.