Computer Science

Computer science is now a critical tool for pursuing an ever-broadening range of topics, from outer space to the workings of the human mind. In most areas of science and in many liberal arts fields, cutting-edge work depends increasingly on computational approaches. The undergraduate program at Brown is designed to combine breadth in practical and theoretical computer science with depth in specialized areas. These areas range from traditional topics, such as analysis of algorithms, artificial intelligence, databases, distributed systems, graphics, mobile computing, networks, operating systems, programming languages, robotics and security, to novel areas including games and scientific visualization.

Requirements for the Standard Track of the Sc.B. degree

Prerequisites (1 or 2 courses)
Two semesters of Calculus, for example:
- MATH 0090 and MATH 0100
or MATH 0170

Concentration Requirements (15 courses)

Core-Computer Science:
Select one of the following introductory course Series:

Series A
- CSCI 0150: Introduction to Object-Oriented Programming and Computer Science
- CSCI 0160: Introduction to Algorithms and Data Structures

Series B
- CSCI 0170: Computer Science: An Integrated Introduction
- CSCI 0180: Computer Science: An Integrated Introduction

Series C
- CSCI 0190: Accelerated Introduction to Computer Science

Select one computer science systems course:
- CSCI 0520: Computer Networks
- CSCI 1290: Introduction to Computer Systems

Select three of the following intermediate-level courses, one of which must be math-oriented and one systems-oriented:
- CSCI 0220: Introduction to Discrete Structures and Probability (math)
- CSCI 0320: Introduction to Software Engineering (systems)
- CSCI 0330: Introduction to Computer Systems (systems)
- CSCI 0310: Introduction to Computer Systems
- CSCI 0510: Models of Computation (math)
- CSCI 1450: Probability and Computing

Additional Computer Science Courses:
Select one theoretical computer science course:
- CSCI 1490: Introduction to Combinatorial Optimization
- CSCI 1510: Introduction to Cryptography and Computer Security
- CSCI 1550: Probability and Computing: Randomized Algorithms and Probabilistic Analysis
- CSCI 1570: Design and Analysis of Algorithms
- CSCI 1590: Introduction to Computational Complexity
- CSCI 1760: Multiprocessor Synchronization
- CSCI 1950H: Computational Topology
- CSCI 1950J: Introduction to Computational Geometry
- CSCI 1820: Algorithmic Foundations of Computational Biology

Select one artificial intelligence course:
- CSCI 1410: Applied Artificial Intelligence
- CSCI 1420: Machine Learning

Select one theoretical computer science course:
- CSCI 1430: Computer Vision
- CSCI 1450: Probability and Computing
- CSCI 1460: Computational Linguistics
- CSCI 1480: Building Intelligent Robots
- CSCI 1490: Introduction to Combinatorial Optimization
- CSCI 1580: Information Retrieval and Web Search

Select one computer science systems course:
- CSCI 1230: Introduction to Computer Graphics
- CSCI 1260: Compilers and Program Analysis
- CSCI 1270: Database Management Systems
- CSCI 1290: Computational Photography
- CSCI 1310: Fundamentals of Computer Systems
- CSCI 1320: Creating Modern Web Applications
- CSCI 1340: - Innovating Game Development
- CSCI 1380: Distributed Computer Systems
- CSCI 1600: Real-Time and Embedded Software
- CSCI 1610: Building High-Performance Servers
- CSCI 1660: Introduction to Computer Systems Security
- CSCI 1670: Operating Systems
- CSCI 1680: Computer Networks
- CSCI 1730: Design and Implementation of Programming Languages
- CSCI 1900: Software System Design

Four additional advanced computer science courses

A capstone course

Math: Two semesters of Mathematics or Applied Mathematics beyond MATH 0100/0170. One of these courses must be a linear algebra course

Math 0520: Linear Algebra
Math 0540: Honors Linear Algebra
CSCI 0530: Directions: The Matrix in Computer Science

Total Credits: 15

1. Normally these advanced courses must be at the 1000-level or higher, though an intermediate-level course not used to satisfy a core requirement may be used.
2. These courses must include two pairs of courses with each pair forming a coherent theme. A list of pre-approved pairs may be found at the approved-pairs web page (http://cs.brown.edu/ugrad/concentrations/approvedpairs.html). You are not restricted to pairs on this list, but any pair not on the list must be approved by the director of undergraduate studies.
3. Five of the eight courses must be computer science courses.
4. Among the eight courses may be approved 1000-level courses in Mathematics, Applied Mathematics, Biology, Engineering, Economics, Music, Cognitive, Linguistic, and Psychological Sciences, Neuroscience, and other departments that cover material relevant to the student’s concentration.
5. CSCI 1450 may be used either as a math-oriented intermediate course or an advanced course. CSCI 1450 was formerly known as CSCI 450; they are the same course and hence only one may be taken for credit. Applied Math 1650 may be used in place of CSCI 1450. However, concentration credit will be given for only one of Applied Math 1650 and CSCI 1450.
6. No course may be used to satisfy more than one area requirement.
7. Capstone: a one-semester course, normally taken in the student’s last undergraduate year, in which the student (or group of students) use a significant portion of their undergraduate education, broadly interpreted, in studying some current topic in depth, to produce a culminating artifact such as a paper or software project.

Requirements for the Professional Track of the Sc.B. degree

The requirements for the professional track include all those of the standard track, as well as the following:

Students must complete two to-four-month full-time professional experiences, doing work that is related to their concentration programs.
Such work is normally done within an industrial organization, but may also be at a university under the supervision of a faculty member.

On completion of each professional experience, the student must write and upload to ASK a reflective essay about the experience addressing the following prompts, to be approved by the student's concentration advisor:

- Which courses were put to use in your summer's work? Which topics, in particular, were important?
- In retrospect, which courses should you have taken before embarking on your summer experience? What are the topics from these courses that would have helped you over the summer if you had been more familiar with them?
- Are there topics you should have been familiar with in preparation for your summer experience, but are not taught at Brown? What are these topics?
- What did you learn from the experience that probably could not have been picked up from course work?
- Is the sort of work you did over the summer something you would like to continue doing once you graduate? Explain.
- Would you recommend your summer experience to other Brown students? Explain.

Requirements for the Standard Track of the A.B. degree

**Prerequisites**

Two semesters of Calculus, for example:

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 0090</td>
<td>Introductory Calculus, Part I</td>
</tr>
<tr>
<td>&amp; MATH 0100</td>
<td>and Introductory Calculus, Part II</td>
</tr>
<tr>
<td>MATH 0170</td>
<td>Advanced Placement Calculus</td>
</tr>
</tbody>
</table>

**Concentration Requirements (9 courses)**

Core Computer Science:

Select one of the following series:

<table>
<thead>
<tr>
<th>Series</th>
<th>Courses</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Series A</strong></td>
<td>CSCI 0150 &amp; CSCI 0160</td>
</tr>
<tr>
<td></td>
<td>Introduction to Object-Oriented Programming and Computer Science</td>
</tr>
<tr>
<td></td>
<td>and Introduction to Algorithms and Data Structures</td>
</tr>
<tr>
<td><strong>Series B</strong></td>
<td>CSCI 0170 &amp; CSCI 0180</td>
</tr>
<tr>
<td></td>
<td>Computer Science: An Integrated Introduction</td>
</tr>
<tr>
<td></td>
<td>and Computer Science: An Integrated Introduction</td>
</tr>
<tr>
<td><strong>Series C</strong></td>
<td>CSCI 0190</td>
</tr>
<tr>
<td></td>
<td>Accelerated Introduction to Computer Science</td>
</tr>
</tbody>
</table>

and an additional CSCI course not otherwise used to satisfy a concentration requirement: (this course may be CSCI 0180, an intermediate-level CSCI course, or a 1000 level course)

Three intermediate courses from the following, of which one must be math-oriented and one must be systems-oriented:

<table>
<thead>
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<th>Course</th>
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</tr>
</thead>
<tbody>
<tr>
<td>CSCI 0220</td>
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<td>CSCI 0510</td>
<td>Models of Computation (math)</td>
</tr>
<tr>
<td>CSCI 0530</td>
<td>Directions: The Matrix in Computer Science (math)</td>
</tr>
<tr>
<td>CSCI 1450</td>
<td>Probability and Computing</td>
</tr>
</tbody>
</table>

Four additional courses in computer science or related areas are required.

Total Credits 9

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1. Three must be advanced courses (at the 1000-level or higher), the fourth may be either an intermediate-level course not used to satisfy a core requirement or an advanced course. These three courses must include a pair of courses forming a coherent theme. A list of pre-approved pairs may be found at the approved-pairs web page (http://cs.brown.edu/ugrad/concentrations/approvedpairs.html). You are not restricted to pairs on this list, but any pair not on the list must be approved by the director of undergraduate studies.

2. CSCI 1450 may be used either as a math-oriented intermediate course or as an advanced course. CSCI 1450 was formerly known as CSCI 450: they are the same course and hence only one may be taken for credit. Applied Math 1650 may be used in place of CSCI 1450. However, concentration credit will be given for only one of Applied Math 1650 and CSCI 1450.

Requirements for the Professional Track of the A.B. degree

The requirements for the professional track include all those of the standard track, as well as the following:

Students must complete two two-to-four-month full-time professional experiences, doing work that is related to their concentration programs. Such work is normally done within an industrial organization, but may also be at a university under the supervision of a faculty member.

On completion of each professional experience, the student must write and upload to ASK a reflective essay about the experience addressing the following prompts, to be approved by the student's concentration advisor:

- Which courses were put to use in your summer's work? Which topics, in particular, were important?
- In retrospect, which courses should you have taken before embarking on your summer experience? What are the topics from these courses that would have helped you over the summer if you had been more familiar with them?
- Are there topics you should have been familiar with in preparation for your summer experience, but are not taught at Brown? What are these topics?
- What did you learn from the experience that probably could not have been picked up from course work?
- Is the sort of work you did over the summer something you would like to continue doing once you graduate? Explain.
- Would you recommend your summer experience to other Brown students? Explain.