Computer Science Major (B.S.)

https://ceps.unh.edu/computer-science/program/bs/computer-science

Description

Computer science focuses on problem solving with a particular emphasis on the design of computer-efficient solutions. Within a few years of obtaining a bachelor's degree alumni will have:

1. Engaged in successful careers in diverse areas of software development and will be pursuing advanced education in computer science or related fields;
2. Applied the full range of core computer science concepts and techniques to fill software development needs of an organization;
3. Adapted to changing directions of computing technology and used state-of-the-art techniques to confront new problems effectively;
4. Navigated the complex interconnections between software and the goals and constraints of the organization served;
5. Participated responsibly in the pervasive and changing role of computing technology in global society as both software engineers and citizens;
6. Operated collaboratively in a team environment and assumed leadership roles.

The B.S. in computer science program is accredited by the Computing Accreditation Commission of ABET.

Requirements

Computer science majors must complete the following coursework in computer science, mathematics, computer engineering, and science. (all courses are 4 credits unless indicated otherwise):

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 400</td>
<td>Introduction to Computing</td>
<td>1</td>
</tr>
<tr>
<td>CS 415 &amp; CS 416</td>
<td>Introduction to Computer Science I &amp; II</td>
<td>8</td>
</tr>
<tr>
<td>or CS 414</td>
<td>From Problems to Algorithms to Programs</td>
<td></td>
</tr>
<tr>
<td>&amp; CS 417</td>
<td>and From Programs to Computer Science</td>
<td></td>
</tr>
<tr>
<td>or CS 410P &amp; CS 417</td>
<td>Introduction to Scientific Programming/Python &amp; C</td>
<td></td>
</tr>
<tr>
<td>or CS 410C &amp; CS 417</td>
<td>Introduction to Scientific Programming/C &amp; From Programs to Computer Science</td>
<td></td>
</tr>
<tr>
<td>CS 420 &amp; CS 543</td>
<td>Foundations of Programming for Digital Systems &amp; Introduction to Digital Systems</td>
<td>4</td>
</tr>
<tr>
<td>IT 403</td>
<td>Introduction to Internet Technologies</td>
<td>4</td>
</tr>
<tr>
<td>CS 501</td>
<td>Professional Ethics and Communication in Technology-related Fields</td>
<td>4</td>
</tr>
<tr>
<td>CS 515</td>
<td>Data Structures and Introduction to Algorithms</td>
<td>4</td>
</tr>
<tr>
<td>CS 518</td>
<td>Introduction to Software Engineering</td>
<td>4</td>
</tr>
<tr>
<td>CS 520</td>
<td>Assembly Language Programming and Machine Organization</td>
<td>4</td>
</tr>
<tr>
<td>CS 527</td>
<td>Fundamentals of Cybersecurity</td>
<td>4</td>
</tr>
<tr>
<td>CS 619</td>
<td>Introduction to Object-Oriented Design and Development</td>
<td>4</td>
</tr>
<tr>
<td>CS 620</td>
<td>Operating System Fundamentals</td>
<td>4</td>
</tr>
<tr>
<td>CS 659</td>
<td>Introduction to the Theory of Computation</td>
<td>4</td>
</tr>
<tr>
<td>CS 758</td>
<td>Algorithms</td>
<td>4</td>
</tr>
<tr>
<td>CS 761</td>
<td>Programming Language Concepts and Features</td>
<td>4</td>
</tr>
<tr>
<td>CS 791 &amp; CS 792</td>
<td>Senior Project I &amp; II</td>
<td>4</td>
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</table>

or CS 799 Thesis

Computer Science Electives:
Select one course from the following implementation electives:

- CS 712: Compiler Design
- CS 720: Systems Programming
- CS 730: Introduction to Artificial Intelligence
- CS 735: Introduction to Parallel and Distributed Programming
- CS 770: Computer Graphics

Select one course from the following theory electives:

- CS 723: Performance Evaluation of Computer Systems
- CS 745: Formal Specifications and Verification of Software Systems
- CS 750: Machine Learning
- CS 755: Computer Vision
- CS 757: Mathematical Optimization for Applications

Select two additional CS courses numbered 690-799 as general electives

Professional Electives

Select one course from the following:

- CS 700-level course

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>IT 502</td>
<td>Intermediate Web Design</td>
<td>4</td>
</tr>
<tr>
<td>IT 604</td>
<td>Server-side Web Development</td>
<td>4</td>
</tr>
<tr>
<td>IT 605</td>
<td>Client-side Web Development</td>
<td>4</td>
</tr>
<tr>
<td>IT 612</td>
<td>Scripting Languages</td>
<td>4</td>
</tr>
<tr>
<td>IT 630</td>
<td>Data Science and Analytics</td>
<td>4</td>
</tr>
<tr>
<td>IT 666</td>
<td>Cybersecurity Practices</td>
<td>4</td>
</tr>
<tr>
<td>IT 705</td>
<td>Project Management for Information Technology</td>
<td>4</td>
</tr>
<tr>
<td>IT 780</td>
<td>Topics in Information Technology</td>
<td>4</td>
</tr>
<tr>
<td>MATH 525</td>
<td>Linear Algebra I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 526</td>
<td>Linear Algebra II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 527</td>
<td>Differential Equations with Linear Algebra</td>
<td>4</td>
</tr>
<tr>
<td>MATH 528</td>
<td>Multidimensional Calculus</td>
<td>4</td>
</tr>
<tr>
<td>MATH 545</td>
<td>Introduction to Linear Algebra</td>
<td>4</td>
</tr>
<tr>
<td>MATH 546</td>
<td>Linear Algebra for Applications</td>
<td>4</td>
</tr>
<tr>
<td>MATH 547</td>
<td>Complex Analysis for Applications</td>
<td>4</td>
</tr>
<tr>
<td>MATH 736</td>
<td>Advanced Statistical Methods for Research</td>
<td>4</td>
</tr>
<tr>
<td>MATH 737</td>
<td>Statistical Methods for Quality Improvement and Design</td>
<td>4</td>
</tr>
<tr>
<td>MATH 739</td>
<td>Applied Regression Analysis</td>
<td>4</td>
</tr>
<tr>
<td>MATH 740</td>
<td>Design of Experiments I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 741</td>
<td>Survival Analysis</td>
<td>4</td>
</tr>
<tr>
<td>MATH 743</td>
<td>Time Series Analysis</td>
<td>4</td>
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<tr>
<td>MATH 744</td>
<td>Design of Experiments II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 745</td>
<td>Foundations of Applied Mathematics I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 746</td>
<td>Foundations of Applied Mathematics II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 747</td>
<td>Introduction to Nonlinear Dynamics and Chaos</td>
<td>4</td>
</tr>
<tr>
<td>MATH 753</td>
<td>Introduction to Numerical Methods I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 755</td>
<td>Probability with Applications</td>
<td>4</td>
</tr>
<tr>
<td>MATH 756</td>
<td>Principles of Statistical Inference</td>
<td>4</td>
</tr>
<tr>
<td>MATH 760</td>
<td>Geometry</td>
<td>4</td>
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<tr>
<td>MATH 761</td>
<td>Abstract Algebra</td>
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<tr>
<td>MATH 767</td>
<td>One-Dimensional Real Analysis</td>
<td>4</td>
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<tr>
<td>MATH 776</td>
<td>Logic</td>
<td>4</td>
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<tr>
<td>MATH 783</td>
<td>Set Theory</td>
<td>4</td>
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<tr>
<td>MATH 784</td>
<td>Topology</td>
<td>4</td>
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<tr>
<td>MATH 788</td>
<td>Complex Analysis</td>
<td>4</td>
</tr>
<tr>
<td>ECE 562</td>
<td>Computer Organization</td>
<td>4</td>
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<tr>
<td>ECE 649</td>
<td>Embedded Microcomputer Based Design</td>
<td>4</td>
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<tr>
<td>ECE 700-level course</td>
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<tr>
<td>ENGL 502</td>
<td>Professional and Technical Writing</td>
<td>4</td>
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<tr>
<td>GEN 604</td>
<td>Principles of Genetics</td>
<td>4</td>
</tr>
<tr>
<td>GEN 711</td>
<td>Genomics and Bioinformatics</td>
<td>4</td>
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</tbody>
</table>

Mathematics Courses

- MATH 405: Calculus I
- MATH 426: Calculus II
- MATH 631: Mathematical Proof
- MATH 639: Introduction to Statistical Analysis
- MATH 644: Statistics for Engineers and Scientists
- MATH 545: Introduction to Linear Algebra
- MATH 546: Linear Algebra for Applications
- MATH 547: Complex Analysis for Applications
- MATH 736: Advanced Statistical Methods for Research
- MATH 737: Statistical Methods for Quality Improvement and Design
- MATH 739: Applied Regression Analysis
- MATH 740: Design of Experiments I
- MATH 741: Survival Analysis
- MATH 743: Time Series Analysis
- MATH 744: Design of Experiments II
- MATH 745: Foundations of Applied Mathematics I
- MATH 746: Foundations of Applied Mathematics II
- MATH 747: Introduction to Nonlinear Dynamics and Chaos
- MATH 753: Introduction to Numerical Methods I
- MATH 755: Probability with Applications
- MATH 756: Principles of Statistical Inference
- MATH 760: Geometry
- MATH 761: Abstract Algebra
- MATH 767: One-Dimensional Real Analysis
- MATH 776: Logic
- MATH 783: Set Theory
- MATH 784: Topology
- MATH 788: Complex Analysis
- ECE 562: Computer Organization
- ECE 649: Embedded Microcomputer Based Design
- ECE 700-level course
- ENGL 502: Professional and Technical Writing
- GEN 604: Principles of Genetics
- GEN 711: Genomics and Bioinformatics

Science courses

- One Discovery Biological Science (BS) with Discovery Lab
- One Discovery Physical Science (PS) with Discovery Lab

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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<tr>
<td>&amp;&amp;</td>
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</tbody>
</table>
**Computer Science Major (B.S.)**

### Other Courses

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Discovery requirements not already covered by required courses</td>
<td>3</td>
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</table>

**Total Credits** 128-129

1. Professional electives must either be chosen from the list of approved courses or another non-introductory CEPS course with significant science and/or engineering focus approved on a per-course basis by the undergraduate studies committee.

2. Courses must carry the Discovery attributes of Biological Science or Physical Science and include Discovery lab (DLAB).

3. One of these courses must be writing intensive.

Computer science majors must maintain an overall grade-point average of 2.0 or better in all required computer science, mathematics, and computer engineering courses in order to graduate. If at the end of any semester, including the first, a student’s cumulative grade-point average in these courses falls below 2.0, the student may not be allowed to continue as a CS major.

In order to meet the CS major requirements, the following courses must be passed with a grade of C- or better: CS 400, CS 415, IT 403, MATH 425, Discovery I, CS 416, CS 420, CS 515, CS 501.

If a student wishing to transfer into the computer science major has any coursework that is applicable to the major, the grades in those courses must satisfy the minimum grade requirements for the B.S. degree in computer science. The student must have an overall grade-point average of 2.0 or better in all courses taken at the university.

### Degree Plan

#### Recommended Plan of Study

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First Year</strong></td>
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<tr>
<td><strong>Fall</strong></td>
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</tr>
<tr>
<td>CS 400</td>
<td>Introduction to Computing</td>
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<tr>
<td>CS 415</td>
<td>Introduction to Computer Science I</td>
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<td>IT 403</td>
<td>Introduction to Internet Technologies</td>
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<tr>
<td>MATH 425</td>
<td>Calculus I</td>
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<tr>
<td>Discovery I</td>
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<tr>
<td><strong>Spring</strong></td>
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<tr>
<td>CS 416</td>
<td>Introduction to Computer Science II</td>
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<tr>
<td>CS 420</td>
<td>Foundations of Programming for Digital</td>
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<tr>
<td></td>
<td>Systems</td>
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<tr>
<td>MATH 426</td>
<td>Calculus II</td>
<td>4</td>
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<tr>
<td>ENGL 401</td>
<td>First-Year Writing</td>
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<td><strong>Second Year</strong></td>
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<td><strong>Fall</strong></td>
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<tr>
<td>CS 515</td>
<td>Data Structures and Introduction to</td>
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<td></td>
<td>Algorithms</td>
<td></td>
</tr>
<tr>
<td>CS 518</td>
<td>Introduction to Software Engineering</td>
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<tr>
<td>or CS 527</td>
<td>or Fundamentals of Cybersecurity</td>
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<tr>
<td><strong>Fourth Year</strong></td>
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<tr>
<td><strong>Fall</strong></td>
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<tr>
<td>CS 791</td>
<td>Senior Project I</td>
<td>2</td>
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<tr>
<td>CS 700-level Implementation or Theory Elective</td>
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<tr>
<td>CS 700-level General Elective (or Discovery V)</td>
<td>4</td>
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<tr>
<td>Discovery V (or CS 758)</td>
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<tr>
<td><strong>Discovery VI</strong></td>
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<tr>
<td><strong>Spring</strong></td>
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</tr>
<tr>
<td>CS 792</td>
<td>Senior Project II</td>
<td>2</td>
</tr>
<tr>
<td>CS 700-level Implementation or Theory Elective</td>
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<tr>
<td>CS 700-level General Elective (or CS 758)</td>
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<tr>
<td>Discovery VII</td>
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<tr>
<td><strong>Credits</strong></td>
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</tr>
<tr>
<td><strong>Total Credits</strong></td>
<td>129</td>
<td></td>
</tr>
</tbody>
</table>

**Discovery (7):** Historical Perspectives, Humanities, Fine and Performing Arts, Social Science, World Cultures, Physical Science Discovery Lab, Biological Science Discovery Lab with ONE mandatory course with Writing Intensive (WI) attribute.
Student Learning Outcomes

Graduates of the UNH BS CS program will have an ability 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.
- Learn independently about new technologies, and develop the skills needed to understand them.