COMPUTER SCIENCE DEGREE

Students must also complete the Undergraduate Registration Requirement (https://catalogs.northwestern.edu/undergraduate/requirements-policies/undergraduate-registration-requirement/) and the degree requirements of their home school.

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirements (48 units)</td>
<td></td>
</tr>
</tbody>
</table>

**Core Courses (32 units)**

4 mathematics courses:

- COMP_SCI 212-0 Mathematical Foundations of Comp Science
- MATH 220-1 Single-Variable Differential Calculus
- MATH 220-2 Single-Variable Integral Calculus
- MATH 228-1 Multivariable Differential Calculus for Engineering

4 engineering analysis and computer proficiency courses:

- GEN_ENG 205-1 Engineering Analysis I
- & GEN_ENG 205-2 and Engineering Analysis II
- & GEN_ENG 205-3 and Engineering Analysis III
- or GEN_ENG 206-1 Honor Engineering Analysis
- & GEN_ENG 206-2 and Honors Engineering Analysis
- & GEN_ENG 206-3 and Honors Engineering Analysis

- COMP_SCI 111-0 Fundamentals of Computer Programming

4 units of basic science chosen according to McCormick basic science guidelines (https://catalogs.northwestern.edu/undergraduate/engineering-applied-science/#requirementstext)

3 design and communications courses (https://catalogs.northwestern.edu/undergraduate/engineering-applied-science/#requirementstext)

5 basic engineering courses: (https://catalogs.northwestern.edu/undergraduate/engineering-applied-science/#requirementstext)

- COMP_SCI 211-0 Fundamentals of Computer Programming II
- IEMS 201-0 Introduction to Statistics
- or IEMS 303-0 Statistics
- or ELEC_ENG 302-0 Probabilistic Systems

3 courses from at least two of the remaining basic engineering areas: computer architecture and numerical methods, electrical science, fluids and solids, materials science and engineering, systems engineering and analysis, and thermodynamics

7 social sciences/humanities courses (https://catalogs.northwestern.edu/undergraduate/engineering-applied-science/#requirementstext)

5 unrestricted electives (https://catalogs.northwestern.edu/undergraduate/engineering-applied-science/#requirementstext)

**Major Program (16 units)**

3 required courses:

- COMP_SCI 150-0 Fundamentals of Computer Programming 1.5
- COMP_SCI 213-0 Introduction to Computer Systems
- COMP_SCI 214-0 Data Structures & Algorithms

5 breadth courses (see below)

6 technical electives (see below)

2 project courses (see below)

See general requirements (https://catalogs.northwestern.edu/undergraduate/engineering-applied-science/#requirementstext) for details.

COMP_SCI 110-0 Introduction to Computer Programming may be used as an unrestricted elective if taken before COMP_SCI 111-0 Fundamentals of Computer Programming. It may not, however, be applied to the computer science major requirements.

**Breadth Courses**

Majors must take one course from each area. Minors must take one course from each of any three areas.

**Theory**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMP_SCI 335-0</td>
<td>Introduction to the Theory of Computation</td>
</tr>
<tr>
<td>COMP_SCI 336-0</td>
<td>Design &amp; Analysis of Algorithms</td>
</tr>
</tbody>
</table>

**Systems**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMP_SCI 322-0</td>
<td>Compiler Construction</td>
</tr>
<tr>
<td>COMP_SCI 339-0</td>
<td>Introduction to Database Systems</td>
</tr>
<tr>
<td>COMP_SCI 340-0</td>
<td>Introduction to Networking</td>
</tr>
<tr>
<td>COMP_SCI 343-0</td>
<td>Operating Systems</td>
</tr>
<tr>
<td>COMP_SCI 345-0</td>
<td>Distributed Systems</td>
</tr>
<tr>
<td>COMP_SCI 350-0</td>
<td>Introduction to Computer Security</td>
</tr>
<tr>
<td>COMP_SCI 354-0</td>
<td>Computer System Security</td>
</tr>
<tr>
<td>COMP_SCI 440-0</td>
<td>Advanced Networking</td>
</tr>
<tr>
<td>COMP_SCI 441-0</td>
<td>Resource Virtualization</td>
</tr>
<tr>
<td>COMP_SCI 443-0</td>
<td>Advanced Operating Systems</td>
</tr>
<tr>
<td>COMP_SCI 446-0</td>
<td>Kernel and Other Low-level Software Development</td>
</tr>
<tr>
<td>COMP_SCI 450-0</td>
<td>Internet Security</td>
</tr>
<tr>
<td>COMP_SCI 346-0</td>
<td>Microprocessor System Design</td>
</tr>
<tr>
<td>COMP_SCI 349-0</td>
<td>Introduction to Parallel Computing</td>
</tr>
<tr>
<td>COMP_SCI 359-0</td>
<td>Computer Architecture I</td>
</tr>
</tbody>
</table>

**Artificial Intelligence**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMP_SCI 325-1</td>
<td>Artificial Intelligence Programming</td>
</tr>
<tr>
<td>COMP_SCI 337-0</td>
<td>Natural Language Processing</td>
</tr>
<tr>
<td>COMP_SCI 344-0</td>
<td>Design of Computer Problem Solvers</td>
</tr>
<tr>
<td>COMP_SCI 348-0</td>
<td>Introduction to Artificial Intelligence</td>
</tr>
<tr>
<td>COMP_SCI 349-0</td>
<td>Machine Learning</td>
</tr>
<tr>
<td>COMP_SCI 371-0</td>
<td>Knowledge Representation and Reasoning</td>
</tr>
<tr>
<td>COMP_SCI 372-0</td>
<td>Designing &amp; Constructing Models with Multi-Agent Language</td>
</tr>
</tbody>
</table>

**Interfaces**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMP_SCI 313-0</td>
<td>Tangible Interaction Design and Learning</td>
</tr>
<tr>
<td>COMP_SCI 315-0</td>
<td>Design, Technology, and Research</td>
</tr>
<tr>
<td>COMP_SCI 330-0</td>
<td>Human Computer Interaction</td>
</tr>
<tr>
<td>COMP_SCI 331-0</td>
<td>Introduction to Computational Photography</td>
</tr>
<tr>
<td>COMP_SCI 351-0</td>
<td>Introduction to Computer Graphics</td>
</tr>
<tr>
<td>COMP_SCI 352-0</td>
<td>Machine Perception of Music &amp; Audio</td>
</tr>
<tr>
<td>COMP_SCI 370-0</td>
<td>Computer Game Design</td>
</tr>
<tr>
<td>COMP_SCI 376-0</td>
<td>Computer Game Design and Development</td>
</tr>
<tr>
<td>COMP_SCI 377-0</td>
<td>Game Design Studio</td>
</tr>
<tr>
<td>ELEC_ENG 332-0</td>
<td>Introduction to Computer Vision</td>
</tr>
</tbody>
</table>

**Software Development and Programming Languages**

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMP_SCI 310-0</td>
<td>Scalable Software Architectures</td>
</tr>
<tr>
<td>COMP_SCI 321-0</td>
<td>Programming Languages</td>
</tr>
<tr>
<td>COMP_SCI 338-0</td>
<td>Practicum in Intelligent Information Systems</td>
</tr>
</tbody>
</table>
Project Courses

Majors must take two courses from this list.

Project course list

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMP_SCI 315-0</td>
<td>Design, Technology, and Research</td>
</tr>
<tr>
<td>COMP_SCI 322-0</td>
<td>Compiler Construction</td>
</tr>
<tr>
<td>COMP_SCI 330-0</td>
<td>Human Computer Interaction</td>
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<tr>
<td>COMP_SCI 331-0</td>
<td>Introduction to Computational Photography</td>
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<tr>
<td>COMP_SCI 337-0</td>
<td>Natural Language Processing</td>
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<tr>
<td>COMP_SCI 338-0</td>
<td>Practicum in Intelligent Information Systems</td>
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<tr>
<td>COMP_SCI 339-0</td>
<td>Introduction to Database Systems</td>
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<td>COMP_SCI 340-0</td>
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<td>COMP_SCI 343-0</td>
<td>Operating Systems</td>
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<tr>
<td>COMP_SCI 344-0</td>
<td>Design of Computer Problem Solvers</td>
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<tr>
<td>COMP_SCI 345-0</td>
<td>Distributed Systems</td>
</tr>
<tr>
<td>COMP_SCI 351-0</td>
<td>Introduction to Computer Graphics</td>
</tr>
<tr>
<td>COMP_SCI 351-2</td>
<td>Intermediate Computer Graphics</td>
</tr>
<tr>
<td>COMP_SCI 354-0</td>
<td>Computer System Security</td>
</tr>
<tr>
<td>COMP_SCI 355-0</td>
<td>Digital Forensics and Incident Response</td>
</tr>
<tr>
<td>COMP_SCI 367-0</td>
<td>Wireless and Mobile Health: Passive Sensing Data Analytics</td>
</tr>
<tr>
<td>COMP_SCI 370-0</td>
<td>Computer Game Design</td>
</tr>
<tr>
<td>COMP_SCI 371-0</td>
<td>Knowledge Representation and Reasoning</td>
</tr>
<tr>
<td>COMP_SCI 377-0</td>
<td>Game Design Studio</td>
</tr>
<tr>
<td>COMP_SCI 393-0</td>
<td>Software Construction</td>
</tr>
<tr>
<td>COMP_SCI 394-0</td>
<td>Agile Software Development</td>
</tr>
<tr>
<td>COMP_SCI 397-0</td>
<td>Special Projects in Computer Science</td>
</tr>
<tr>
<td>COMP_SCI 441-0</td>
<td>Resource Virtualization</td>
</tr>
<tr>
<td>COMP_SCI 446-0</td>
<td>Kernel and Other Low-level Software Development</td>
</tr>
<tr>
<td>COMP_SCI 450-0</td>
<td>Internet Security</td>
</tr>
<tr>
<td>COMP_SCI 473-2</td>
<td>NUIvention: Web - Part 2</td>
</tr>
<tr>
<td>COMP_SCI 497-0</td>
<td>Special Projects in Computer Science</td>
</tr>
<tr>
<td>COMP_ENG 366-0</td>
<td>Embedded Systems</td>
</tr>
<tr>
<td>COMP_ENG 466-0</td>
<td>Embedded Systems</td>
</tr>
<tr>
<td>ELEC_ENG 332-0</td>
<td>Introduction to Computer Vision</td>
</tr>
<tr>
<td>ELEC_ENG 375-0</td>
<td>Machine Learning: Foundations, Applications, and Algorithms</td>
</tr>
<tr>
<td>ELEC_ENG 433-0</td>
<td>Statistical Pattern Recognition</td>
</tr>
</tbody>
</table>

Note

Courses that fulfill the breadth and project courses also fulfill the technical elective requirement. However, a given course may only be applied to a single requirement for the major. In such cases where a single course applied to multiple requirements, a student must choose which requirement to apply a given course to. A course may not be counted toward multiple requirements at once.

Technical electives

Majors must take six technical electives. Any 300- or 400-level COMP_SCI course may be taken as a technical elective. In addition the following courses may also be taken as technical electives:

Additional technical electives

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMP_ENG 303-0</td>
<td>Advanced Digital Design</td>
</tr>
<tr>
<td>COMP_ENG 329-0</td>
<td>The Art of Multicore Concurrent Programming</td>
</tr>
<tr>
<td>COMP_ENG 346-0</td>
<td>Microprocessor System Design</td>
</tr>
<tr>
<td>COMP_ENG 355-0</td>
<td>ASIC and FPGA Design</td>
</tr>
<tr>
<td>COMP_ENG 356-0</td>
<td>Introduction to Formal Specification &amp; Verification</td>
</tr>
<tr>
<td>COMP_ENG 357-0</td>
<td>Design Automation in VLSI</td>
</tr>
<tr>
<td>COMP_ENG 358-0</td>
<td>Introduction to Parallel Computing</td>
</tr>
</tbody>
</table>