Computer science involves the application of theoretical concepts in the context of software development to the solution of problems that arise in almost every human endeavor. Computer science as a discipline draws its inspiration from mathematics, logic, science, and engineering. From these roots, computer science has fashioned paradigms for program structures, algorithms, data representations, efficient use of computational resources, robustness and security, and communication within computers and across networks. The ability to frame problems, select computational models, design program structures, and develop efficient algorithms is as important in computer science as software implementation skill. Computer science is concerned with bringing together all of the intellectual resources needed to enable the rapid and effective development of software to meet the needs of business, research, and end users.

The goal of the undergraduate program in computer science is to teach students the conceptual and practical skills that will enable them to contribute to the development of computational principles and to play a productive role in the software community. To that end, the undergraduate program focuses on the fundamentals of program design including object-oriented design, software development, computer organization, systems and networks, theory of computation, principles of languages, and advanced algorithms and data. The program also offers a variety of electives at the upper undergraduate and beginning graduate levels ranging from more theoretical courses to those that focus on important applications.

BSCS—Bachelor of Science in Computer Science

COMPUTER SCIENCE MAJOR REQUIREMENTS

Computer Science Overview
Freshmen or freshmen transfers complete the following two courses:

CS 1200 Computer/Information Science Overview 1 1 SH
CS 1210 Computer/Information Science Overview 2 1 SH

Upper-level transfer students complete the following course:
CS 1220 Computer/Information Science Co-op Preparation 1 SH

Computer Science Fundamental Courses
Complete the following four courses with corresponding labs, as indicated. A grade of C– or higher is required in each course:

CS 1800 Discrete Structures 4 SH
CS 2500 Fundamentals of Computer Science 1 4 SH
with CS 2501 Lab for CS 2500 1 SH
CS 2510 Fundamentals of Computer Science 2 4 SH
with CS 2511 Lab for CS 2510 1 SH
CS 2800 Logic and Computation 4 SH
with CS 2801 Lab for CS 2800 1 SH

Computer Science Required Courses
Complete the following seven courses:

CS 2600 Computer Organization 4 SH
CS 3500 Object-Oriented Design 4 SH
CS 3600 Systems and Networks 4 SH
CS 3800 Theory of Computation 4 SH
CS 4400 Programming Languages 4 SH
CS 4500 Software Development 4 SH
CS 4800 Algorithms and Data 4 SH

Computer Science Senior Seminar
Complete the following course:
CS 4000 Senior Seminar 1 SH

Computer Science Capstone
Complete one of the following courses (thus satisfying the NU Core capstone requirement):

CS 4100 Artificial Intelligence 4 SH
CS 4300 Computer Graphics 4 SH
CS 4550 Web Development 4 SH
CS 4900 Honors Senior Seminar 4 SH

Computer Science Upper-Division Electives
Complete two upper-division computer science courses. With advisor approval, directed study, project study, and appropriate graduate-level courses may also be taken as upper-division electives.

CS 2990 to CS 4993
IS 4200 Information Retrieval 4 SH
IS 4300 Human Computer Interaction 4 SH

ADDITIONAL COURSES FOR BS

Mathematics Courses
Complete the following four courses. A grade of C– or higher is required in MATH 1341 and MATH 1342:

MATH 1341 Calculus 1 for Science and Engineering 4 SH
MATH 1342 Calculus 2 for Science and Engineering 4 SH
MATH 2331 Linear Algebra 4 SH
MATH 3081 Probability and Statistics 4 SH

Computers and Society
Complete the following course:
SOCL 4528 Computers and Society 4 SH

Science Requirement
Complete two courses with corresponding labs and recitations for one of the following sciences:

BIOLOGY
Complete the following course with corresponding lab:
BIOL 1111 General Biology 1 4 SH
with BIOL 1112 Lab for BIOL 1111 1 SH
and complete a second course with corresponding lab from the following list:
<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>SH</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOL 1113</td>
<td>General Biology 2</td>
<td>4</td>
</tr>
<tr>
<td>with BIOL 1114</td>
<td>Lab for BIOL 1113</td>
<td>1</td>
</tr>
<tr>
<td>BIOL 2301</td>
<td>Genetics and Molecular Biology</td>
<td>4</td>
</tr>
<tr>
<td>with BIOL 2302</td>
<td>Lab for BIOL 2301</td>
<td>1</td>
</tr>
</tbody>
</table>

**CHEMISTRY**

Complete the following two courses with corresponding labs:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>SH</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 1211</td>
<td>General Chemistry 1</td>
<td>4</td>
</tr>
<tr>
<td>with CHEM 1212</td>
<td>Lab for CHEM 1211</td>
<td>1</td>
</tr>
<tr>
<td>CHEM 1214</td>
<td>General Chemistry 2</td>
<td>4</td>
</tr>
<tr>
<td>with CHEM 1215</td>
<td>Lab for CHEM 1214</td>
<td>1</td>
</tr>
</tbody>
</table>

**GEOLOGY/ENVIRONMENTAL SCIENCE (OPTION 1)**

Complete the following two courses with corresponding labs:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>SH</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENVR 1200</td>
<td>Dynamic Earth</td>
<td>4</td>
</tr>
<tr>
<td>with ENVR 1201</td>
<td>Lab for ENVR 1200</td>
<td>1</td>
</tr>
<tr>
<td>ENVR 1202</td>
<td>History of Earth and Life</td>
<td>4</td>
</tr>
<tr>
<td>with ENVR 1203</td>
<td>Lab for Interpreting Earth History</td>
<td>1</td>
</tr>
</tbody>
</table>

**GEOLOGY/ENVIRONMENTAL SCIENCE (OPTION 2)**

Complete the following course with corresponding lab:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>SH</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENVR 1200</td>
<td>Dynamic Earth</td>
<td>4</td>
</tr>
<tr>
<td>with ENVR 1201</td>
<td>Lab for ENVR 1200</td>
<td>1</td>
</tr>
</tbody>
</table>

and complete an additional course with corresponding lab from the following list:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>SH</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENVR 2310</td>
<td>Earth Materials</td>
<td>4</td>
</tr>
<tr>
<td>with ENVR 2311</td>
<td>Lab for ENVR 2310</td>
<td>1</td>
</tr>
<tr>
<td>ENVR 2340</td>
<td>Earth Landforms and Processes</td>
<td>4</td>
</tr>
<tr>
<td>with ENVR 2341</td>
<td>Lab for ENVR 2340</td>
<td>1</td>
</tr>
<tr>
<td>ENVR 4106</td>
<td>Coastal Processes</td>
<td>4</td>
</tr>
<tr>
<td>with ENVR 4107</td>
<td>Lab for ENVR 4106</td>
<td>1</td>
</tr>
<tr>
<td>ENVR 4500</td>
<td>Applied Hydrogeology</td>
<td>4</td>
</tr>
<tr>
<td>with ENVR 4501</td>
<td>Lab for ENVR 4500</td>
<td>1</td>
</tr>
<tr>
<td>ENVR 5244</td>
<td>Sedimentation</td>
<td>4</td>
</tr>
<tr>
<td>with ENVR 5245</td>
<td>Lab for ENVR 5244</td>
<td>1</td>
</tr>
<tr>
<td>ENVR 5260</td>
<td>Geographical Information Systems</td>
<td>4</td>
</tr>
<tr>
<td>with ENVR 3301</td>
<td>Lab for ENVR 3300</td>
<td>1</td>
</tr>
</tbody>
</table>

**GEOLOGY/ENVIRONMENTAL SCIENCE (OPTION 3)**

Complete the following two courses with corresponding labs:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>SH</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENVR 1202</td>
<td>History of Earth and Life</td>
<td>4</td>
</tr>
<tr>
<td>with ENVR 1203</td>
<td>Lab for Interpreting Earth History</td>
<td>1</td>
</tr>
<tr>
<td>ENVR 5242</td>
<td>Ancient Marine Life</td>
<td>4</td>
</tr>
<tr>
<td>with ENVR 5243</td>
<td>Lab for ENVR 5242</td>
<td>1</td>
</tr>
</tbody>
</table>

**PHYSICS**

Complete one of the following sequences of courses:

<table>
<thead>
<tr>
<th>Sequence</th>
<th>Course Code</th>
<th>Course Title</th>
<th>SH</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>PHYS 1161</td>
<td>Physics 1</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>PHYS 1162</td>
<td>Lab for PHYS 1161</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 1165</td>
<td>Physics 2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>with PHYS 1166</td>
<td>Lab for PHYS 1165</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>PHYS 1145</td>
<td>Physics for Life Sciences 1</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>PHYS 1146</td>
<td>Lab for PHYS 1145</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 1147</td>
<td>Physics for Life Sciences 2</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>with PHYS 1148</td>
<td>Lab for PHYS 1147</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

**SEQUENCE C**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>SH</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 1151</td>
<td>Physics for Engineering 1</td>
<td>4</td>
</tr>
<tr>
<td>with PHYS 1152</td>
<td>Lab for PHYS 1151</td>
<td>1</td>
</tr>
<tr>
<td>PHYS 1155</td>
<td>Physics for Engineering 2</td>
<td>4</td>
</tr>
<tr>
<td>with PHYS 1156</td>
<td>Lab for PHYS 1155</td>
<td>1</td>
</tr>
</tbody>
</table>

**Electrical Engineering**

Complete the following course:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>SH</th>
</tr>
</thead>
<tbody>
<tr>
<td>EECE 3230</td>
<td>Computer Architecture for Computer Scientists</td>
<td>4</td>
</tr>
</tbody>
</table>

**ELECTIVES OUTSIDE COMPUTER AND INFORMATION SCIENCE**

**Depth or Breadth Elective Requirement**

Complete three courses from either the depth option or the breadth option.

**DEPTH**

Complete three courses in one department outside computer science and information science. Note: For the purposes of this requirement, all business courses are considered to be in a single department.

**BREADTH**

Complete three courses in arts, humanities, or social sciences.

**Remaining Electives**

Complete 20 semester hours of elective course work. Two of these electives must be used to satisfy the NU Core arts/humanities level 1 requirement and the NU Core social science level 1 requirement. If the NU Core comparative study of cultures requirement is to be satisfied by taking a course, then it must also be one of the general electives.

**MAJOR GPA REQUIREMENT**

Minimum 2.000 GPA required in all CS and IS courses

**COMPUTER SCIENCE CREDIT REQUIREMENT**

Complete 60 semester hours in the major. Acceptable courses for this requirement include all CS courses and any courses from the following list:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>SH</th>
</tr>
</thead>
<tbody>
<tr>
<td>IS 4200</td>
<td>Information Retrieval</td>
<td>4</td>
</tr>
<tr>
<td>IS 4300</td>
<td>Human Computer Interaction</td>
<td>4</td>
</tr>
<tr>
<td>MATH 2310</td>
<td>Discrete Mathematics</td>
<td>4</td>
</tr>
</tbody>
</table>

**NU CORE REQUIREMENTS**

See page 26 for requirement list.

**GENERAL ELECTIVES**

Additional courses taken beyond college and major course requirements to satisfy graduation credit requirements.

**COORDERATIVE EDUCATION**

**UNIVERSITY-WIDE REQUIREMENTS**

135 total semester hours required

Minimum 2.000 GPA required
BACS—Bachelor of Arts in Computer Science

COMPUTER SCIENCE MAJOR REQUIREMENTS

Computer Science Overview
Freshmen or freshmen transfers complete the following two courses:

- CS 1200 Computer/Information Science Overview 1 1 SH
- CS 1210 Computer/Information Science Overview 2 1 SH

Upper-level transfer students complete the following course:
- CS 1220 Computer/Information Science Co-op Preparation 1 SH

Computer Science Fundamental Courses
Complete the following four courses, with corresponding labs, as indicated. A grade of C– or higher is required in each course:

- CS 1800 Discrete Structures 4 SH
- CS 2500 Fundamentals of Computer Science 1 with CS 2501 Lab for CS 2500 1 SH
- CS 2510 Fundamentals of Computer Science 2 with CS 2511 Lab for CS 2510 1 SH
- CS 2800 Logic and Computation with CS 2801 Lab for CS 2800 1 SH

Computer Science Required Courses
Complete the following six courses:

- CS 2600 Computer Organization 4 SH
- CS 3500 Object-Oriented Design 4 SH
- CS 3600 Systems and Networks 4 SH
- CS 3800 Theory of Computation 4 SH
- CS 4500 Software Development 4 SH
- CS 4800 Algorithms and Data 4 SH

Computer Science Senior Seminar
Complete the following course:
- CS 4000 Senior Seminar 1 SH

Computer Science Capstone
Complete one of the following courses (thus satisfying the NU Core capstone requirement):

- CS 4100 Artificial Intelligence 4 SH
- CS 4300 Computer Graphics 4 SH
- CS 4550 Web Development 4 SH
- CS 4900 Honors Senior Seminar 4 SH

ADDITIONAL COURSES FOR BA

Mathematics Courses
Complete the following courses. A grade of C– or higher is required in MATH 1341:

- MATH 1341 Calculus 1 for Science and Engineering 4 SH
- MATH 1342 Calculus 2 for Science and Engineering 4 SH
- MATH 3081 Probability and Statistics 4 SH

Science Courses
Complete one course with corresponding lab and recitation for one of the following groups:

- BIOLOGY
  - BIOL 1111 General Biology 1 4 SH
  - with BIOL 1112 Lab for BIOL 1111 1 SH

- CHEMISTRY
  - CHEM 1101 General Chemistry for Health Sciences 4 SH
  - with CHEM 1102 Lab for CHEM 1101 1 SH
  - CHEM 1151 General Chemistry for Engineers 4 SH
  - with CHEM 1152 Lab for CHEM 1151 1 SH

- GEOLOGY/ENVIRONMENTAL SCIENCE
  - ENVR 1200 Dynamic Earth 4 SH
  - with ENVR 1201 Lab for ENVR 1200 1 SH
  - ENVR 1202 History of Earth and Life 4 SH
  - with ENVR 1203 Interpreting Earth History 1 SH

- PHYSICS
  - PHYS 1145 Physics for Life Sciences 1 4 SH
  - with PHYS 1146 Lab for PHYS 1145 1 SH
  - PHYS 1151 Physics for Engineering 1 4 SH
  - with PHYS 1152 Lab for PHYS 1151 1 SH
  - PHYS 1161 Physics 1 4 SH
  - with PHYS 1162 Lab for PHYS 1161 1 SH

Computers and Society
Complete the following course:
- SOCL 4528 Computers and Society 4 SH

UPPER-DIVISION ELECTIVE

Computer Science or Mathematics Upper-Division Elective
Complete one upper-division course in computer science, information science, or mathematics. With advisor approval, a directed study, project study, or an appropriate graduate-level course may also be taken as a computer science elective.

- CS 2990 to CS 4993
- IS 4200 Information Retrieval 4 SH
- IS 4300 Human Computer Interaction 4 SH

REQUIRED GENERAL ELECTIVES

Complete ten general electives. One of these electives must be used to satisfy the NU Core social science level 1 requirement. One of the electives must be an arts course from the NU Core arts/humanities level 1 domain, and one must be a humanities course from the NU Core arts/humanities level 1 domain. If the NU Core comparative study of cultures requirement is to be satisfied by taking a course, then it must also be one of the general electives. Note: For this requirement, an arts course is defined to be any course in the NU Core arts/humanities level 1 domain with one of the following subject codes: ARCH, ARTD, ARTE, ARTF, ARTG, ARTH, ARTS, MUSC, MUSI, MUST, or THTR. A humanities course is defined to be any course in the NU Core arts/humanities level 1 domain that is not an arts course.
MAJOR GPA REQUIREMENT
Minimum 2.000 GPA required in all CS and IS courses

NU CORE REQUIREMENTS
See page 26 for requirement list.

COLLEGE REQUIREMENTS FOR BA
Complete the College of Arts and Sciences college requirements for the BA degree, including the three required foreign language courses. See page 41 for requirement list.

GENERAL ELECTIVES
Additional courses taken beyond college and major course requirements to satisfy graduation credit requirements.

COOPERATIVE EDUCATION

UNIVERSITY-WIDE REQUIREMENTS
134 total semester hours required
Minimum 2.000 GPA required

BS/MS in Computer Science
Undergraduate students apply to the combined program through the graduate school. Once admitted, students may count a limited amount of graduate credit toward the undergraduate degree. Consult the department for information on this program.

Minor in Computer Science
The requirements for the minor in computer science are shown below. Students who wish to take a particular course must have taken its prerequisites listed in the catalog. Note: Electrical and computer engineering students should contact the College of Computer and Information Science about course substitutions that ease completion of the minor in computer science.

REQUIRED COURSES
Complete the following two courses with corresponding labs. A grade of C– or higher is required:

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>SH</th>
</tr>
</thead>
<tbody>
<tr>
<td>CS 2500</td>
<td>Fundamentals of Computer Science 1</td>
<td>4</td>
</tr>
<tr>
<td>with CS 2501</td>
<td>Lab for CS 2500</td>
<td>1</td>
</tr>
<tr>
<td>CS 2510</td>
<td>Fundamentals of Computer Science 2</td>
<td>4</td>
</tr>
<tr>
<td>with CS 2511</td>
<td>Lab for CS 2510</td>
<td>1</td>
</tr>
</tbody>
</table>

COMPUTER SCIENCE ELECTIVES
Complete three courses from the following list:

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
<th>SH</th>
</tr>
</thead>
<tbody>
<tr>
<td>IS 4200</td>
<td>Information Retrieval</td>
<td>4</td>
</tr>
<tr>
<td>IS 4300</td>
<td>Human Computer Interaction</td>
<td>4</td>
</tr>
</tbody>
</table>

GPA REQUIREMENT
2.000 GPA required in the minor