COMPUTER SCIENCE, BACHELOR OF SCIENCE

Undergraduate Programs
(See also General Requirements for Departmental Majors (https://e-catalogue.jhu.edu/engineering/full-time-residential-programs/undergraduate-policies/academic-policies/requirements-bachelors-degree/))

The objectives of our bachelor degree programs are to train computer scientists who will be able to:

- Successfully engage in professional practice in the computing sciences or apply computer science tools and techniques to another field of interest.
- Pursue advanced study in the computing sciences.
- Work successfully in both independent and team environments.
- Lead teams and provide vision for innovation.
- Behave in a professional and ethical manner.

A successful major program of study leads to either the Bachelor of Science in Computer Science (B.S.) or the Bachelor of Arts in Computer Science (B.A.). Students should decide which degree program to complete by about their junior year. Both degree programs require specific courses and/or credits in several key areas: computer science, math, basic science, humanities and social sciences. However, there is much flexibility in how these requirements are fulfilled. Undergraduate majors may choose to pursue a broad selection of computer science and distributional courses, or to pursue a focus area within the field. Current foci primarily reflect departmental and school research strengths: big data, computational biology, fundamentals of computing, information security, natural language processing, robotics, systems and networking; and also include career paths for software engineering and entrepreneurship. Regardless of whether you pursue a particular focus or not, our bachelor programs provide excellent preparation for research within the department, summer internships, and post-graduation industry employment or graduate work.

All undergraduate students majoring or minoring in computer science must have a faculty advisor in the department. They will be assigned an advisor as entering freshmen or upon deciding on the major/minor. Every major must follow a program approved by their faculty advisor.

The department also offers a minor in computer science, and tangentially, a minor in computer integrated surgery and a minor in robotics. Some students majoring in computer science may be eligible for a combined bachelor’s/master’s degree program. Requirements for these programs are included here as well. Additional details regarding undergraduate programs can be found in the department's undergraduate advising manual (http://www.cs.jhu.edu/undergraduate-studies/academics/) or on the website at www.cs.jhu.edu (http://www.cs.jhu.edu).

Double Majors
It is possible for students to pursue a double major program in which one of the majors is computer science. The computer science requirements are flexible enough to allow for combination with most majors in the Whiting School of Engineering and the Krieger School of Arts and Sciences. Whether computer science is your primary or secondary major, you will be assigned a faculty advisor in the department. In order to declare a first or second major in computer science, students should initiate the process on-line, and then will need to see the Academic Program Coordinator or the Director of Undergraduate Studies.

Requirements for the B.S. Degree
The Bachelor of Science in Computer Science degree program is accredited by the Computing Accreditation Commission of ABET, www.abet.org (http://www.abet.org). It provides for the acquisition of the following knowledge base and skill set:

- Analyze a complex computing problem and 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.

To meet the course credit requirements for the B.S. in computer science, the student must complete a minimum of 120 credits. The basic requirements for the B.S. degree are as follows:

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Science</td>
<td></td>
<td>40</td>
</tr>
<tr>
<td>Mathematics</td>
<td></td>
<td>16</td>
</tr>
<tr>
<td>Basic Sciences</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Humanities/Social Sciences</td>
<td></td>
<td>18</td>
</tr>
<tr>
<td>Two Writing Intensive Courses</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electives</td>
<td></td>
<td>38</td>
</tr>
<tr>
<td>Total Credits</td>
<td></td>
<td>120</td>
</tr>
</tbody>
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Details and course recommendations for these distributional requirements are below. These requirements add up to 82 credits and fulfill general university and WSE requirements, leaving 38 pure elective credits. Except for electives and where noted below, courses should not be taken on an S/U basis. By university policy, no more than 18 D or D+ credits can be counted toward the total credit requirements for a degree. The Courses and Curriculum Planning section (https://www.cs.jhu.edu/course-info/) of the departmental Course Information webpage has lists of course area designations (Applications, Reasoning, Software, Systems, Theory) and courses approved as "CS other."

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
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<tbody>
<tr>
<td>EN.601.104</td>
<td>Computer Ethics (or Practical Ethics for Future Leaders which does not count towards CS credits)</td>
<td>1</td>
</tr>
<tr>
<td>EN.500.112</td>
<td>Gateway Computing: JAVA (or equivalent)</td>
<td>3</td>
</tr>
<tr>
<td>EN.601.220</td>
<td>Intermediate Programming</td>
<td>4</td>
</tr>
<tr>
<td>EN.601.226</td>
<td>Data Structures</td>
<td>4</td>
</tr>
<tr>
<td>EN.601.229</td>
<td>Computer System Fundamentals</td>
<td>3</td>
</tr>
</tbody>
</table>
Students are required to fulfill the university's requirement of two writing intensive courses, each at least 3 credits. Students must receive at least a C- grade or better in these writing courses. At least one course must be explicitly focused on writing skills in English (eg, courses in professional, fiction or expository writing). These courses may overlap other requirements.

### General Electives

Electives may be any credit bearing courses, to be chosen by the student with the guidance of their advisor as needed.

1. No more than 6 independent type credits (courses numbered 601.xxx) and no more than 3 credits of short courses (1-credit special topics courses) can be counted toward this requirement. However, B.S. students doing the Senior Honors Thesis (EN.601.519 Senior Honors Thesis or EN.601.520 Senior Honors Thesis) may use an additional three credits of independent work toward their CS requirements, for a total of 9 credits.

2. No courses with grades below C- or with S/U grades can be used to fulfill this requirement unless they are not offered for a grade. At most 4 S/U credits may be applied towards this requirement.

3. Note that course descriptions include old area designators which may have changed in 2019.

4. Up to 6 of the 40 required credits may be from an approved list of relevant courses in other departments, which includes some courses cross-listed in CS. These courses may only count as "CS other" credits, not upper level CS credits (regardless of course level in the other department). See department website for the list.

5. AP Statistics credits may not be used to satisfy these credit requirements; however, they do meet the need for coverage of statistics (not probability).

See the Distribution tab in the Requirements for a Bachelor's Degree (https://e-catalogue.jhu.edu/engineering/full-time-residential-programs/undergraduate-policies/academic-policies/requirements-bachelors-degree/) section for two exceptions to the rule that each H/S distribution course be at least 3 credits. Note that at most two H/S courses may be taken S/U (if not counted toward the writing requirement); the other four must be taken for a grade.

### Writing Requirement

Students must take at least one of the following courses to satisfy the team requirement. The course satisfying this requirement may overlap other requirements.

- EN.601.290 User Interfaces and Mobile Applications 3
- EN.601.295 Developing Health IT Applications 3
- EN.601.310 Software for Resilient Communities 3
- EN.601.411 Computer Science Innovation & Entrepreneurship II 3
- EN.601.421 Object Oriented Software Engineering 3
- EN.601.447 Computational Genomics: Sequences 3
- EN.601.452 Computational Biomedical Research 3
- EN.601.340 Introduction to Human-Computer Interaction 3
- EN.601.496 Computer Integrated Surgery II - Teams 3
- EN.580.437 Neuro Data Design I (counts as “CS other”) 4
- EN.580.438 Neuro Data Design II (counts as “CS other”) 4

### Mathematics

The following courses or equivalent substitutes such as AP credit must be included:

- AS.110.108 Calculus I (Physical Sciences & Engineering) 4
- AS.110.109 Calculus II (For Physical Sciences and Engineering) 4

The remaining courses must be 200-level or above, chosen from Mathematics (AS.110.xxx) or Applied Math and Statistics (EN.553.xxx), and must include coverage of both probability and statistics. Some highly recommended math electives are:

- AS.110.201 Linear Algebra 4
- EN.553.420 Introduction to Probability 4
- EN.553.430 Introduction to Statistics 4

### Basic Sciences

Students must take two semesters of core science courses (any combination of Physics, Chemistry, Biology), with their associated labs, totaling at least 8 credits. These courses should be taken for a grade. However, AP credit is an acceptable substitute for these courses and labs.

### Humanities/Social Sciences

As per WSE requirements, six courses in the Humanities and Social and Behavioral Sciences must be taken, with each course at least 3 credits. These courses must have either Humanities (‘H’) or Social and Behavioral Sciences (‘S’) area (or both) designators on them. Foreign language courses (without an ‘H’ or ‘S’) may also be used to satisfy this requirement.

### Computer Science, Bachelor of Science