Department of Computer Science

Website: www.iup.edu/compsci

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The programs in computer science at IUP lead to the BS or BA degree and are designed primarily to prepare graduates for productive work in highly computer-dependent areas of business, government, and industry. In recent years, majors graduating from the program have attained their first jobs in business applications, programming and systems analysis, computer software development, scientific and applied mathematical programming, and other computer-related areas and have gone to graduate school.

In a rapidly developing field such as computer science, it is important that the graduate’s education be broad and fundamental so that new trends can more readily be followed. The goal is to balance fundamentality and breadth with sufficient supervised practice so that the graduates are productive at the time they graduate but ready and willing to change with the field.

The Computer Science Department, working with its Corporate Advisory Board, has identified objectives of a computer science professional over the length of his/her career (Program Educational Objectives). These Program Educational Objectives can be found on the departmental website, www.iup.edu/compsci.

The department encourages computer science majors to take a strong minor (or area concentration) in a second area of interest. Some students may wish to double major. Majors in other disciplines at IUP are also welcome to take computer science courses for which they are qualified or to complete a Computer Science minor or Cyber Security minor.

Students in a Computer Science Track should set their goals beyond simple programming and should be preparing to:
1. apply computer science knowledge to application areas from science and industry;
2. apply appropriate data structures and algorithms to analyze and solve new problems;
3. apply software engineering techniques to designing, implementing, documenting, testing, and maintaining software systems;
4. contribute to improving the design and implementation of databases;
5. use more than one programming language and choose an appropriate one for the project;
6. work with and communicate effectively with professionals in various fields;
7. continue a lifelong professional development in computing;
8. act ethically and professionally.

There are additional goals for students dependent on the track they choose.

Bachelor of Arts—Computer Science

A graduate of this track will be prepared to:
1. apply knowledge of computing to an area not usually associated with computer science,
2. be particularly effective in communicating with others of different cultural and educational background regarding computing issues,
3. be employed in entry-level positions in business.

Bachelor of Science—Computer Science/Software Engineering Track

A graduate of this track will be prepared to:
1. develop Web-based applications and interfaces,
2. work with all types of computer systems—legacy, current, and future;
3. apply knowledge of computing to an area of secondary interest (dependent on the minor taken),
4. work with a variety of software tools in designing and implementing computer-based systems,
5. manage activities that are strongly computer-system dependent,
6. be employed at entry-level through project-leader positions.

Bachelor of Science—Computer Science/Languages and Systems Track

A graduate of this track will be prepared to:
1. improve (a) the software tools that programmers and analysts use, (b) operating systems, (c) Web-based applications and interfaces, and (d) networks and system security,
2. develop (a) better languages for communicating with computers and (b) software that takes computer organization into account, and enter graduate studies.

Bachelor of Science—Computer Science/Cyber Security Track

A graduate of this track will be prepared to:
1. work with business personnel to implement information security policy, manage security in network systems,
2. work with law enforcement personnel at all levels to prevent information security violations and prosecute those who attack computer systems,
3. manage security in network systems,
4. increase the public’s knowledge of cyber security issues,
5. establish procedures that provide information assurance in computer systems for which he/she is responsible, contribute to improving secure data communications, strengthen the security of application programs.

Bachelor of Arts—Computer Science

Liberal Studies: As outlined in Liberal Studies section with the following specifications:
Mathematics: 3cr, MATH 125 (1)
Liberal Studies Electives: 3cr, MATH 216, no courses with COSC prefix
Major: 39
Core Courses:
- COSC 105 Fundamentals of Computer Science 3cr
- COSC 110 Problem Solving and Structured Programming 3cr
- COSC 210 Object-Oriented and GUI Programming 3cr
- COSC 220 Applied Computer Programming 4cr
- COSC 300 Computer Organization and Assembly Language 3cr
- COSC 310 Data Structures and Algorithms 3cr
- COSC 341 Introduction to Database Management Systems 3cr
- COSC 380 Seminar on the Computing Profession and Ethics 2cr
- COSC 480 Seminar on Technical Topics 1cr
Controlled Electives: 8cr from the following: (2)
- COSC/MATH 250, COSC 316 (3), 319, 345, 355, 356, 362, 365, 473 (4), 481 (only sections approved for majors), 482, 493 (4), COSC/IFMG 354, IFMG 455
Upper-Level Electives by Categories: 6cr (5)
- Artificial Intelligence: COSC 405
- Computer Architecture: COSC 410
- Database Management: COSC 444
- Distributed Systems: COSC 465
- Numerical Methods: COSC 427, 451
- Systems Programming: COSC 430, 432
- Theory of Languages: COSC 420, 424, 460
Other Requirements: 3
Additional Mathematics:
- MATH 309 Discrete Mathematics 3cr
Free Electives: 34-35
Total Degree Requirements: 120

Bachelor of Science—Computer Science/Software Engineering Track

Liberal Studies: As outlined in Liberal Studies section with the following specifications:
Mathematics: 3cr, MATH 125 (1)
Natural Science: Must choose option 1 with two labs
Liberal Studies Elective: 3cr, MATH 216, no courses with COSC prefix
Major: 46
Required Courses:
- COSC 105 Fundamentals of Computer Science 3cr
- COSC 110 Problem Solving and Structured Programming 3cr
- COSC 210 Object-Oriented and GUI Programming 3cr
- COSC 220 Applied Computer Programming 4cr
- COSC 300 Computer Organization and Assembly Language 3cr
- COSC 310 Data Structures and Algorithms 3cr
- COSC 319 Software Engineering Concepts 3cr
- COSC 341 Introduction to Database Management Systems 3cr
- COSC 365 Web Architecture and Application Development 3cr
- COSC 380 Seminar on the Computing Profession and Ethics 2cr
- COSC 480 Seminar on Technical Topics 1cr
- COSC 473 Software Engineering Practice or 493 Internship in Computer Science (2)
Controlled Electives: 9cr from the following: (3, 5)
- COSC/MATH 250, COSC 316, 345, 355, 356, 362, 481 (only sections approved for majors), 482, COSC/IFMG 354, IFMG 455
Upper-Level Electives by Categories: 3cr from the following: (5) 3cr
- Artificial Intelligence: COSC 405
- Computer Architecture: COSC 410
- Database Management: COSC 444
- Distributed Systems: COSC 465
- Numerical Methods: COSC 427, 451
- Systems Programming: COSC 430, 432
- Theory of Languages: COSC 420, 424, 460
Other Requirements: 3
Additional Mathematics:
- MATH 309 Discrete Mathematics 3cr
Minor: Complete a minor from one of the following areas:
- Cyber Security 12-18cr
- Any department in the College of Natural Sciences and Mathematics 9-20cr
- Designated business courses 18cr
- Designated economics courses 18cr
- Designated communications media courses 18cr
Free Electives: 7-18
Total Degree Requirements: 120

(1) MATH 125 can be substituted by MATH 121.
(2) Upper-level electives may be counted as controlled electives. 3cr of Intermediate Level foreign language may be applied toward controlled electives.
(3) COSC 316 cannot be counted for major credit if a student does a Cyber Security minor.
(4) Credit for both COSC 320 and 493 may be counted toward the degree, but only one will be counted toward the major requirements. Note: Only 3cr of first 6cr of COSC 493 or 6cr of a total 12cr of COSC 493 can be counted toward major. COSC 493 may be selected after completion of sophomore year.
(5) Select at least two additional courses, from at least two different categories, from the list of upper-level electives.
Bachelor of Science—Computer Science/Languages and Systems Track

**Liberal Studies**: As outlined in Liberal Studies section with the following specifications:
- **Mathematics**: 3cr, MATH 125 (1)
- **Natural Science**: Must choose Option I
- **Liberal Studies Elective**: 3cr, MATH 126 (1), no course with COSC prefix

**Major**: 48 cr

- **Core Courses**:
  - COSC 105 Fundamentals of Computer Science 3cr
  - COSC 110 Problem Solving and Structured Programming 3cr
  - COSC 210 Object-Oriented and GUI Programming 3cr
  - COSC 300 Computer Organization and Assembly Language 3cr
  - COSC 310 Data Structures and Algorithms 3cr
  - COSC 319 Software Engineering Concepts 3cr
  - COSC 341 Introduction to Database Management Systems 3cr
  - COSC 380 Seminar on the Computing Profession and Ethics 2cr
  - COSC 480 Seminar on Technical Topics 1cr

- **Languages and Systems Required Courses**:
  - COSC 345 Computer Networks 3cr
  - COSC 432 Introduction to Operating Systems 3cr
  - COSC 460 Theory of Computation 3cr

- **Controlled Electives**: Select 9-10cr from the following: (5, 6)
  - COSC 220, 316, 355, 362, 365, COSC/MATH 250 (4)

- **Upper-Level Electives**: Select 6cr from the following: (6)
  - COSC 405, 410, 420 or 424, 430, 465, 473 or 493 (2), 481 (as approved for majors)

**Other Requirements**: 12 cr

- **Mathematics**: A minor in mathematics including the following: (3)
  - MATH 171 Introduction to Linear Algebra
  - MATH 216 Probability and Statistics for Natural Sciences
  - MATH 225 Calculus III for Physics, Chemistry, and or 250 Mathematics or Introduction to Numerical Methods (4)
  - MATH 309 Discrete Mathematics

**Free Electives**: 15-16 cr

**Total Degree Requirements**: 120 cr

(1) MATH 125 and 126 can be substituted by MATH 121 and 122.
(2) COSC 493 may be selected after completion of sophomore year.
(3) MATH 125 and 126 (taken as Liberal Studies requirements) are also counted toward the minor.
(4) COSC/MATH 250 may be counted as a Computer Science elective or as a part of the Mathematics minor, but not both.
(5) Upper-level electives may be counted as controlled electives. 3cr of Intermediate Level foreign language may be applied toward controlled electives.
(6) Controlled and upper-level electives may not be applied toward more than one track in computer science.

Bachelor of Science—Computer Science/Cyber Security Track

**Liberal Studies**: As outlined in Liberal Studies section with the following specifications:
- **Mathematics**: 3cr, MATH 125 (1)
- **Social Science**: CRIM 101 (2)

**Liberal Studies Elective**: 3cr, MATH 216, no courses with COSC prefix

**Major**: 49 cr

- **Core Courses**:
  - COSC 105 Fundamentals of Computer Science 3cr
  - COSC 110 Problem Solving and Structured Programming 3cr
  - COSC 210 Object-Oriented and GUI Programming 3cr
  - COSC 220 Applied Computer Programming 4cr
  - COSC 300 Computer Organization and Assembly Language 3cr
  - COSC 310 Data Structures and Algorithms 3cr
  - COSC 319 Software Engineering Concepts 3cr
  - COSC 341 Introduction to Database Management Systems 3cr
  - COSC 380 Seminar on the Computing Profession and Ethics 2cr
  - COSC 480 Seminar on Technical Topics 1cr

- **Cyber Security Required Courses**:
  - COSC 316 Host Computer Security (3, 4, 5) 3cr
  - COSC 345 Computer Networks 3cr
  - COSC 356 Network Security (3, 4, 5) 3cr
  - COSC 473 Software Engineering Practice or 3cr or 493 Internship in Computer Science (6)

- **Controlled Electives**: 6cr from the following: (7, 8)
  - COSC/IFMG 354 Testing and Controlling LANs, COSC 362, 365, IFMG 382

- **Upper-Level Electives**: 3cr from the following: (8)
  - COSC 427, 429, 432, 454, 465, 482

**Minor in Criminology (2)** 15 cr

**Other Requirements**: 3 cr

**Additional Mathematics**:
- MATH 309 Discrete Mathematics 3cr

**Free Electives**: 9-10 cr

**Total Degree Requirements**: 120 cr

(1) MATH 125 can be substituted by MATH 121.
(2) CRIM 101 (taken as part of the social science requirement) is counted as part of the 18cr Criminology minor. Fifteen additional credits of CRIM are required.
(3) A CNSS 4011 certificate will be granted upon completion of COSC 316, 356, CRIM 321, 323.
(4) A CNSS 4012 certificate will be granted upon completion of COSC 316, 356, 454, CRIM 321, 323.
(5) A CNSS 4013 certificate will be granted upon completion of COSC 220, 316, 356, CRIM 321, 323.
(6) COSC 493 may be selected after completion of sophomore year. **Note**: Only 3cr of first 6cr of COSC 493 can be counted toward controlled electives or 6cr of a total 12cr of COSC 493 can be counted toward major. A student who does not complete all 12cr of COSC 493 must take COSC 473.
(7) Upper-level electives may be counted as controlled electives. 3cr of Intermediate Level foreign language may be applied toward controlled electives.
(8) Controlled and upper-level electives may not be applied toward more than one track in computer science.

Minor—Computer Science 18 cr

**Required Courses**:
- COSC 210 Object-Oriented and GUI Programming 3cr
- COSC electives (1, 2) 9cr
- Upper-Level Electives 6cr
(1) COSC 101 is an appropriate entry course for minor. However, COSC 101 cannot be counted as part of a Computer Science minor by management information systems majors.

(2) See Computer Science minor advisor for suggestions.

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**Minor—Cyber Security** (1)  

**Required Courses:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>COSC 108</td>
<td>Introduction to Programming via Alice</td>
<td>3 cr</td>
</tr>
<tr>
<td>or 110</td>
<td>Problem Solving and Structured Programming</td>
<td>3 cr</td>
</tr>
<tr>
<td>COSC 316</td>
<td>Host Computer Security</td>
<td>3 cr</td>
</tr>
<tr>
<td>COSC 345</td>
<td>Computer Networks (3) or COSC/IFMG 352</td>
<td>3 cr</td>
</tr>
<tr>
<td>or COSC/IMFG 352</td>
<td>LAN Design and Installation (3)</td>
<td>3 cr</td>
</tr>
<tr>
<td>CRIM 101</td>
<td>Crime and Justice Systems (4) or</td>
<td>3 cr</td>
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<tr>
<td>or 102</td>
<td>Survey of Criminology (4)</td>
<td>3 cr</td>
</tr>
<tr>
<td>CRIM 321</td>
<td>Cybersecurity and Loss Prevention</td>
<td>3 cr</td>
</tr>
<tr>
<td>CRIM 323</td>
<td>Cybersecurity and the Law</td>
<td>3 cr</td>
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</table>

(1) Computer Science/Cyber Security students are not eligible to take this minor; instead, they must take a Criminology minor.

(2) Computer science majors cannot count COSC 108 or 110; instead, they must take one additional course from the following: CRIM 344, 354, 401.

(3) Computer science majors cannot count COSC/IMFG 352. Computer science majors must take COSC 345.

(4) Criminology majors cannot count CRIM 101 or 102; instead, they must take one additional course from the following: COSC 341, 356, 362, 427, 429, 432, 454, 482, IFMG 382. Students must select COSC 356 to receive NSTISSE 4011 Certification.