Undergraduate Catalog 2016–17

Department of Computer Science

College of Natural Sciences and Mathematics

www.iup.edu/compsci

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Indiana University of Pennsylvania

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,
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,
6. contribute to improving secure data communications,
7. strengthen the security of application programs.

Bachelor of Arts—Computer Science

Liberal Studies: As outlined in Liberal Studies section with the following specifications: 43-44
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	Introduction to Numerical Methods	3cr
COSC 316	Host Computer Security	3cr (3)
COSC 319	Software Engineering Concepts	3cr
COSC 345	Computer Networks	3cr
COSC/IFMG 354	Testing and Controlling LANs	3cr
COSC 355	Computer Graphics	3cr
COSC 356	Network Security	3cr
COSC 362	Unix Systems	3cr
COSC 365	Web Architecture and Application Development	3cr
COSC 473	Software Engineering Practice	3cr (4)
COSC 481	Special Topics in Computer Science (only sections approved for majors)	1-4cr
COSC 482	Independent Study	1-4cr
COSC 493	Internship in Computer Science (4)	12cr
IFMG 455	Business Data Mining	3cr

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
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

(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/Software Engineering Track

Liberal Studies: As outlined in Liberal Studies section with the following specifications: 44
Mathematics: 3cr, MATH 125 (1)
Natural Science: Must choose option 1 with two labs
Liberal Studies Electives: 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***	3cr
or 493	Internship in Computer Science (2)	
Controlled Electives: 9cr from the following: (3, 5)		
COSC/MATH 250	Introduction to Numerical Methods	3cr
COSC 316	Host Computer Security (4)	3cr
COSC 345	Computer Networks	3cr
COSC/IFMG 354	Testing and Controlling LANs	3cr
COSC 355	Computer Graphics	3cr
COSC 356	Network Security	3cr
COSC 362	Unix Systems	3cr
COSC 481	Special Topics in Computer Science (only sections approved for majors)	1-4cr
COSC 482	Independent Study	1-4cr
IFMG 455	Business Data Mining	3cr
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:	9-20
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) 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.
(3) Upper-level electives may be counted as controlled electives. 3cr of Intermediate Level foreign language may be applied toward controlled electives.
(4) COSC 316 cannot be counted for major credit if a student does a Cyber Security minor.
(5) Controlled and upper level electives may not be applied toward more than one track in computer science.

Bachelor of Science—Computer Science/Languages and Systems Track

Liberal Studies: As outlined in Liberal Studies section with the following specifications:	44
Mathematics: 3cr, MATH 125 (1)	
Natural Science: Must choose Option I	
Liberal Studies Electives: 3cr, MATH 126 (1), no course with COSC prefix	

Major:	48
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 Applied Computer Programming	4cr
COSC/MATH 250 Introduction to Numerical Methods	3cr (4)
COSC 316 Host Computer Security	3cr
COSC 355 Computer Graphics	3cr
COSC 362 Unix Systems	3cr
COSC 365 Web Architecture and Application Development	3cr
Upper-Level Electives: Select 6cr from the following: (6)	
COSC 405 Artificial Intelligence	3cr
COSC 410 Computer Architecture	3cr
COSC 420 Modern Programming Languages ***or***	
or 424 Compiler Construction	3cr
COSC 430 Systems Programming	3cr
COSC 465 Distributed Processing and Web Services	3cr
COSC 473 Software Engineering Practice ***or***	3cr
or 493 Internship in Computer Science (2)	3-6cr
COSC 481 Special Topics in Computer Science (as approved for majors)	1-4cr

Other Requirements:	12
Mathematics: A minor in mathematics including the following: (3)	12cr
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
Total Degree Requirements:	120

(1) MATH 125 and 126 can be substituted by MATH 121 and 122.
(2) COSC 493 may be selected after completion of sophomore year. **Note:** Only 3cr of first 6cr of COSC 493 or 6cr of a total 12cr of COSC 493 can be counted toward COSC electives.
(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: 43-44
Mathematics: 3cr, MATH 125 (1)
Social Science: CRIM 101 (2)
Liberal Studies Electives: 3cr, MATH 216, no courses with COSC prefix

Major:

Core Courses:		49
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	3cr
COSC 362	Unix Systems	3cr
COSC 365	Web Architecture and Application Development	3cr
IFMG 382	IT Audit and Control	3cr
Upper-Level Electives: 3cr from the following: (8)		
COSC 427	Introduction to Cryptography	3cr
COSC 429	Digital Forensics	3cr
COSC 432	Introduction to Operating Systems	3cr
COSC 454	Information Assurance Administration	3cr
COSC 465	Distributed Processing and Web Services	3cr
COSC 482	Independent Study	3cr

Minor in Criminology (2) 15

Other Requirements: 3
Additional Mathematics:

MATH 309	Discrete Mathematics	3cr

Free Electives: 9-10

Total Degree Requirements: 120

(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

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.
(3) See Computer Science minor advisor for suggestions.

Minor—Cyber Security (1) 18

Required Courses:

COSC 108	Introduction to Programming via Alice (2) ***or***	3cr
or 110	Problem Solving and Structured Programming	
COSC 316	Host Computer Security	3cr
COSC 345	Computer Networks (3) ***or***	
or COSC/IFMG 352	LAN Design and Installation (3)	3cr
CRIM 101	Crime and Justice Systems (4) ***or***	3cr
or 102	Survey of Criminology (4)	
CRIM 321	Cybersecurity and Loss Prevention	3cr
CRIM 323	Cybersecurity and the Law	3cr

(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.