

Computer Science, B.S.

The Computer Science major emphasizes the principles of computing that underlie our modern world, and provides a strong foundational education to prepare students for the broad spectrum of careers in computing. This major can serve as preparation for either graduate study or a career in industry. Students receive a solid background in low-level architecture and systems; middle-level infrastructure, algorithms, and mathematical foundations. This is a highly flexible degree that allows students to explore a broad range of topics in modern computing. In order to achieve some focus in their upper-division studies, students are required to satisfy the requirements for one of the nine specializations described below.

Algorithms. This specialization focuses on fundamental computational techniques, including their analysis and applications to topics in computer vision, computer games, graphics, artificial intelligence, and information retrieval. Topics include data structures, graph and network algorithms, computational geometry, probabilistic algorithms, complexity theory, and cryptography.

Architecture and Embedded Systems. This specialization integrates principles of embedded systems, software, hardware, computer architecture, distributed systems and networks, and prepares students to design and create efficient hardware/software architectures for emerging application areas. Students in this specialization will build upon a strong foundation in software and hardware and learn how to design networked embedded systems, and efficient computer architectures for a diverse set of application domains such as gaming, visualization, search, databases, transaction processing, data mining, and high-performance and scientific computing.

Bioinformatics. This specialization introduces students to the interdisciplinary intersection of biology and medicine with computer science and information technology. Students who complete the specialization will understand biomedical computing problems from the computer science perspectives, and be able to design and develop software that solves computational problems in biology and medicine.

General Computer Science. This specialization allows students to acquire a well-rounded knowledge of computer science that may be tailored to their individual interests. Students choose 11 upper-division computer science courses, including two project courses. This specialization will appeal to those who are interested in a broad education in computer science, or who wish to create their own unique specialization not found in the current list of (other) specializations under this major.

Information. This specialization is intended to prepare students for working with and developing a wide variety of modern data and information systems. Topics covered by this concentration include database management, information retrieval, Web search, data mining, and data-intensive computing.

Intelligent Systems. This specialization will introduce students to the principles underlying intelligent systems, including topics such as representing human knowledge, building automated reasoning systems, developing intelligent search techniques, and designing algorithms that adapt and learn from data. Students in this specialization will use these principles to solve problems across a variety of applications such as computer vision, information retrieval, data mining, automated recommender systems, bioinformatics, as well as individually designed projects.

Networked Systems. This specialization focuses on Internet architecture, Internet applications, and network security. It also encourages students to learn about operating systems, databases, search, programming, embedded systems, and performance.

Systems and Software. This specialization deals with principles and design of systems and software. It emphasizes the interaction between software and the computing infrastructure on which it runs and the performance impact of design decisions. Core topics include the hardware/software interface, languages and compilers, operating systems, parallel and distributed computing. Elective topics include networking, security, graphics, and databases.

Visual Computing. This specialization encompasses the digital capture, processing, synthesis and display of visual data such as images and video. This specialization includes computer vision, image processing, and graphics, and covers such topics as the representation of 3D objects, visual recognition of objects and people, interactive and photo-realistic image rendering, and physics and perception of light and color.

The Department also offers a joint undergraduate degree in Computer Science and Engineering, in conjunction with The Henry Samueli School of Engineering; information is available in the Interdisciplinary Studies section (http://catalogue.uci.edu/interdisciplinarystudies/computerscienceandengineering_bs/) of the *Catalogue*.

Freshman Applicants: See the Undergraduate Admissions section (<http://catalogue.uci.edu/informationforprospectivestudents/undergraduateadmissions/#admissionasafreshmanapplicanttext>).

Transfer Applicants:

Transfer applicants who satisfactorily complete course prerequisites will be given preference for admission. All applicants must complete the following required courses: one year of approved calculus, one year of object-oriented programming (python, java, C++), additional courses as specified by the major, and completion of lower-division writing. Students are encouraged to complete as many of the lower-division degree requirements as possible prior to transfer. Visit the *UCI Office of Admissions website* for information on transfer requirements for our major.

Major and Minor Restrictions

Bren School of ICS majors (including shared majors, BIM and CSE) pursuing minors within the Bren School of ICS may not count more than five courses toward both the major and minor. Some ICS majors and minors outside of the School are not permitted due to significant overlap. Visit the ICS Student Affairs Office website for Majors and Minors restrictions. (http://www.ics.uci.edu/ugrad/degrees/MajorMinor_Restrictions_Chart.pdf) All students

should check the Double Major Restrictions Chart (https://www.ics.uci.edu/ugrad/degrees/Dbl_Major_Restrictions_Chart.pdf) and view our information page (http://www.ics.uci.edu/ugrad/degrees/Double_Majors.php) on double majoring to see what degree programs are eligible for double majoring.

Requirements for the B.S. in Computer Science

All students must meet the University Requirements (<http://catalogue.uci.edu/informationforadmittedstudents/requirementsforabachelorsdegree/>).

Major Requirements

Lower-division

A. Select one of the following series:

I&C SCI 31- 32- 33	Introduction to Programming and Programming with Software Libraries and Intermediate Programming
or	
I&C SCI 32A- 33	Python Programming and Libraries (Accelerated) and Intermediate Programming

B. Complete:

I&C SCI 45C	Programming in C/C++ as a Second Language
I&C SCI 46	Data Structure Implementation and Analysis
I&C SCI 51	Introductory Computer Organization
I&C SCI 53	Principles in System Design
I&C SCI 53L	Principles in System Design Library
IN4MATX 43	Introduction to Software Engineering
MATH 2A- 2B	Single-Variable Calculus and Single-Variable Calculus
I&C SCI 6B	Boolean Logic and Discrete Structures
I&C SCI 6D	Discrete Mathematics for Computer Science
I&C SCI 6N	Computational Linear Algebra
or MATH 3A	Introduction to Linear Algebra
STATS 67	Introduction to Probability and Statistics for Computer Science

C. Two courses approved for General Education category II except those offered by CSE, Economics, Engineering, ICS, or Mathematics. University Studies courses can be used with the approval of the CS Vice Chair for Undergraduate Studies.

Upper-division

A. Core

COMPSCI 161	Design and Analysis of Algorithms
I&C SCI 139W	Critical Writing on Information Technology

B. Upper-division electives: Select 11 upper-division courses from the list below. Sections B-1 and B-2 must be completed as part of the 11 upper-division electives.

COMPSCI 103–160, 162-189	
IN4MATX 102	Concepts of Programming Language II
IN4MATX 113	Requirements Analysis and Engineering
IN4MATX 115	Software Testing, Analysis, and Quality Assurance
IN4MATX 117	Project in Software System Design
IN4MATX 121	Software Design: Applications
IN4MATX 122	Software Design: Structure and Implementation
IN4MATX 124	Internet Applications Engineering
IN4MATX 131	Human Computer Interaction
IN4MATX 133	User Interaction Software
IN4MATX 134	Project in User Interaction Software
I&C SCI 161	Game Engine Lab
I&C SCI 162	Modeling and World Building

B-1. Project Courses: Choose at least two projects courses from the following list:

COMPSCI 113	Computer Game Development
COMPSCI 114	Projects in Advanced 3D Computer Graphics
COMPSCI 117	Project in Computer Vision

COMPSCI 122B	Project in Databases and Web Applications
COMPSCI 122C	Principles of Data Management
COMPSCI 122D	Beyond SQL Data Management
COMPSCI 125	Next Generation Search Systems
COMPSCI 133	Advanced Computer Networks
COMPSCI 142B	Language Processor Construction
COMPSCI 143B	Project in Operating System Organization
COMPSCI 145- 145L	Embedded Software and Embedded Software Laboratory
COMPSCI 147	Internet of Things (IoT) Software and Systems
COMPSCI 153	Logic Design Laboratory
COMPSCI 154	Computer Design Laboratory
COMPSCI 165	Project In Algorithms And Data Structures
COMPSCI 175	Project in Artificial Intelligence
IN4MATX 117	Project in Software System Design
IN4MATX 134	Project in User Interaction Software

B-2. Specialization: Select and satisfy the requirements for one of the specializations below. (Note: Students may not pursue more than one specialization.)

Some of the specializations include recommended electives. These are courses related to the specialization and intended to help students choose courses to take toward their upper-division elective requirement.

Algorithms: Four courses from the following list:

COMPSCI 162	Formal Languages and Automata
COMPSCI 163	Graph Algorithms
COMPSCI 164	Computational Geometry and Geometric Modeling
COMPSCI 165	Project In Algorithms And Data Structures
COMPSCI 166	Quantum Computation and Information
COMPSCI 167	Introduction to Applied Cryptography
COMPSCI 169	Introduction to Optimization

Architecture and Embedded Systems: four courses from the following list:

COMPSCI 145- 145L	Embedded Software and Embedded Software Laboratory
COMPSCI 147	Internet of Things (IoT) Software and Systems
COMPSCI 151	Digital Logic Design
COMPSCI 152	Computer Systems Architecture
COMPSCI 153	Logic Design Laboratory
COMPSCI 154	Computer Design Laboratory

Bioinformatics: three courses from the following list:

COMPSCI 184A	Artificial Intelligence in Biology and Medicine
and complete:	
COMPSCI 172B	Neural Networks and Deep Learning
COMPSCI 172C	Artificial Intelligence Frontiers: Technical, Ethical, and Societal
COMPSCI 184C	Computational Systems Biology

General CS track

COMPSCI 103-189, except COMPSCI 161

Information

COMPSCI 121	Information Retrieval
COMPSCI 122A	Introduction to Data Management
COMPSCI 178	Machine Learning and Data-Mining

and four courses from:

I&C SCI 45J	Programming in Java as a Second Language
COMPSCI 122B	Project in Databases and Web Applications
COMPSCI 122C	Principles of Data Management
COMPSCI 122D	Beyond SQL Data Management

COMPSCI 125	Next Generation Search Systems
COMPSCI 132	Computer Networks
COMPSCI 134	Computer and Network Security
COMPSCI 141	Concepts in Programming Languages I
COMPSCI 142A	Compilers and Interpreters
COMPSCI 143A	Principles of Operating Systems
COMPSCI 163	Graph Algorithms
COMPSCI 165	Project In Algorithms And Data Structures
COMPSCI 167	Introduction to Applied Cryptography
COMPSCI 179	Algorithms for Probabilistic and Deterministic Graphical Models
at least one of which must be:	
COMPSCI 122B	Project in Databases and Web Applications
COMPSCI 122C	Principles of Data Management
COMPSCI 122D	Beyond SQL Data Management
COMPSCI 125	Next Generation Search Systems
COMPSCI 179	Algorithms for Probabilistic and Deterministic Graphical Models
Intelligent Systems	
COMPSCI 171	Introduction to Artificial Intelligence
COMPSCI 175	Project in Artificial Intelligence
COMPSCI 178	Machine Learning and Data-Mining
and at least three courses from:	
COMPSCI 116	Computational Photography and Vision
COMPSCI 121	Information Retrieval
COMPSCI 125	Next Generation Search Systems
COMPSCI 162	Formal Languages and Automata
COMPSCI 163	Graph Algorithms
COMPSCI 164	Computational Geometry and Geometric Modeling
COMPSCI 169	Introduction to Optimization
COMPSCI 177	Applications of Probability in Computer Science
COMPSCI 179	Algorithms for Probabilistic and Deterministic Graphical Models
Networked Systems	
COMPSCI 132	Computer Networks
COMPSCI 133	Advanced Computer Networks
COMPSCI 134	Computer and Network Security
COMPSCI 143A	Principles of Operating Systems
Systems and Software: three courses from the following list:	
COMPSCI 131	Parallel and Distributed Computing
COMPSCI 141	Concepts in Programming Languages I
COMPSCI 142A	Compilers and Interpreters
COMPSCI 142B	Language Processor Construction
COMPSCI 143A	Principles of Operating Systems
COMPSCI 143B	Project in Operating System Organization
Visual Computing: four courses from the following list:	
COMPSCI 111	Digital Image Processing
COMPSCI 112	Computer Graphics
COMPSCI 114	Projects in Advanced 3D Computer Graphics
COMPSCI 116	Computational Photography and Vision
COMPSCI 117	Project in Computer Vision
I&C SCI 162	Modeling and World Building

Freshman		
Fall	Winter	Spring
I&C SCI 31	I&C SCI 32	I&C SCI 33
MATH 2A	MATH 2B	IN4MATX 43
WRITING 39A	WRITING 39B	I&C SCI 6B
	General Education III	WRITING 39C
Sophomore		
Fall	Winter	Spring
I&C SCI 51	I&C SCI 46	Computer Science Spec./Elective
I&C SCI 6D	I&C SCI 53	STATS 67
I&C SCI 45C	I&C SCI 53L	General Education III
	I&C SCI 6N	
Junior		
Fall	Winter	Spring
COMPSCI 161	Computer Science Spec./Elective	Computer Science Spec./Elective
Science Elective	Computer Science Spec./Elective	Computer Science Spec./Elective
General Education III	I&C SCI 139W	Science Elective
General Education VII	General Education VIII	General Education VI
Senior		
Fall	Winter	Spring
Computer Science Spec./Elective	Computer Science Spec./Elective	Computer Science Spec./Elective
Computer Science Spec./Elective	Computer Science Spec./Elective	Computer Science Spec./Elective
General Education IV	General Education IV	General Education IV

NOTES:

1. Students are advised that this sample program lists the minimum requirements; it is possible that students may have to take additional courses to prepare for required courses.
2. The lower-division writing requirement must be completed by the end of the seventh quarter at UCI.
3. This is only a sample plan. Course offerings may be moved due to unforeseen circumstances. It is strongly recommended that students meet with an academic advisor to create an academic plan tailored to meet their specific areas of interest.