Computer Science, BS

The major in computer science provides students with the necessary training for employment in careers such as software development and information management. It provides good preparation for graduate study in a variety of disciplines.

Students may declare a major in computer science when they are admitted to the university or afterward. They may declare either a Bachelor of Arts or a Bachelor of Science, but if no preference is indicated by a student, the Bachelor of Arts is designated. Students may switch to the Bachelor of Science at any time.

Undergraduates majoring in computer science develop competence in programming principles and methodologies, problem-solving techniques, mathematics, and computer systems. Computer science training is critical for many careers in science, engineering, business, and health care.

Computer science majors are advised at the Academic Advising Center until they have completed 30 s.h., at which point they are assigned a departmental advisor. Students being advised at the Academic Advising Center can also consult with a computer science faculty advisor.

Transfer students who have taken a course approved as equivalent to a required computer science or informatics course are exempt from that course. Transfer course grades are included in the computer science grade-point average.

Students should consult the Department of Computer Science website or visit the department's office for information about general policies, elective areas, internships, scholarships, and student groups, such as the university's chapter of the Association for Computing Machinery (ACM) and Women in Computing Sciences (WiCS).

Advanced Placement

The Computer Science Advanced Placement Program test may be used to satisfy requirements. See Advanced Placement Credit Policy on the Department of Computer Science website.

Learning Outcomes

- Students understand the mathematical, logical, and theoretical foundations of computing.
- Students can analyze and compare the relative merits of alternative software designs and develop high-quality software systems.
- Students understand the fundamental principles of computer organization, system software, networks, and security.
- Students can apply computer science principles to a variety of problems, such as databases, data mining, and various fields of artificial intelligence (AI).
- Students understand social, professional, and ethical issues related to computing.

Requirements

The Bachelor of Science with a major in computer science requires a minimum of 120 s.h., including at least 63 s.h. of work for the major. Students must maintain a grade-point average (GPA) of at least 2.00 in all courses for the major and in all UI courses for the major. A cumulative GPA of at least 2.00 is required for graduation. Students must also complete the College of Liberal Arts and Sciences GE CLAS Core.

The Bachelor of Science program is more rigorous than that of the Bachelor of Arts program; it is designed to provide in-depth training for students who would like to acquire strength in math and science in order to enhance their skills and job prospects. It is also appropriate for those who plan to pursue graduate work in computer science, although it is not required for graduate study at most universities.

Coursework for the major includes computer science courses as well as courses in mathematics, statistics, and other supporting disciplines. Work for the major may not be taken pass/nonpass.

Bachelor of Science students with a computer science major should choose their GE CLAS Core Natural Sciences courses carefully because they may be able to use the same courses to satisfy the computer science major natural science sequences requirement; see "Natural Science Sequences" below.

Students who major in computer science may not also major or minor in computer science and engineering, data science, or informatics.

Departmental Residency Requirement

Students who earn a BS in computer science must complete at least seven courses (minimum of 21 s.h.) at the University of Iowa from the following: CS:2630 Computer Organization or ECE:3350 Computer Architecture and Organization, CS:2820 Introduction to Software Development, CS:3330 Algorithms, and at least four computer science courses (prefix CS) numbered 3620–5899, but excluding CS:3910 Informatics Project, CS:3980 Topics in Computer Science I, and CS:4310 Design and Implementation of Algorithms; these courses are requirements for the BS in computer science as listed below.

Program Requirements

The BS with a major in computer science requires the following coursework. Enrollment in many courses for the major requires a minimum grade of C-minus in prerequisite courses.

Requirements	Hours
Computer Science Core Courses	27-28
Mathematics Core Courses	15-16
Computation Theory Course	3
Advanced Technical Electives	12
Natural Sciences Sequence Courses	6-8

Computer Science Core

Course #	Title	Hours
All of these:		
CS:1210	Computer Science I: Fundamentals	4
CS:2210	Discrete Structures	3
CS:2230	Computer Science II: Data Structures	4
CS:2820	Introduction to Software Development	4
CS:3330	Algorithms	3

Course #	Title	Hours
CS:3820	Programming Language Concepts	3
One of these:		
CS:2630	Computer Organization	4
ECE:3350	Computer Architecture and Organization	3
One of these:		
CS:3620	Operating Systems	3
CS:3640	Introduction to Networks and Their Applications	3

Mathematics Core

Calculus I

Course #	Title	Hours
One of these:		
MATH:1550	Engineering Calculus I	4
MATH:1850	Calculus I	4

Calculus II

Course #	Title	Hours
One of these:		
MATH:1560	Engineering Calculus II	4
MATH:1860	Calculus II	4

Linear Algebra

Students who take MATH:2550 Engineering Matrix Algebra and MATH:2560 Engineering Differential Equations can use these courses together to satisfy the linear algebra requirement.

Course #	Title	Hours
This course:		
MATH:2700	Introduction to Linear Algebra	4

Probability and Statistics

Course #	Title	Hours
One of these:		
STAT:2020	Probability and Statistics for the Engineering and Physical Sciences	3
STAT:3120	Probability and Statistics	4

Other probability and statistics courses (prefix STAT) with a calculus prerequisite approved by the department

Computation Theory

Course #	Title	Hours
One of these:		
CS:4330	Theory of Computation	3
CS:4350	Logic in Computer Science	3

Advanced Technical Electives

Students must earn at least 12 s.h. (four courses) in advanced technical electives, as follows.

Course #	Title	Hours
At least 6 s.h. from these:		
A computer science course (prefix CS) numbered 3620-5899, except CS:3910, CS:3980, or CS:4310; a maximum of 3 s.h. in CS:3990 will count toward the requirement		
A computer science course (prefix CS) numbered 5900 or above, with department approval		

Remaining courses may be chosen from advanced technical elective courses in computer science (prefix CS) or in other disciplines with department approval; the following are preapproved technical electives.

Course #	Title	Hours
Biology		
BIOL:2512	Fundamental Genetics	4
BIOL:3172	Evolution	4
Chemistry		
CHEM:2210	Organic Chemistry I	3
CHEM:2220	Organic Chemistry II	3
CHEM:2230	Organic Chemistry I for Majors	3
CHEM:2240	Organic Chemistry II for Majors	3
CHEM:2410	Organic Chemistry Laboratory	3
Electrical and Computer Engineering		
ECE:3600	Control Systems	3
ECE:5450	Machine Learning	3
ECE:5480	Digital Image Processing	3
ECE:5600	Control Theory	3
Earth, Environment, and Sustainability		
SEES:2410	Mineralogy	4
SEES:3020	Earth Surface Processes	3
SEES:3210	Principles of Paleontology	3
SEES:3330	Sedimentary Geology	4
SEES:3360	Soil Genesis and Geomorphology	3
SEES:3380	Fluvial Geomorphology	3
SEES:3390	Integrated Watershed Analysis	3
SEES:3510	Igneous and Metamorphic Petrology	4
SEES:3520	GIS for Environmental Applications	3
SEES:3540	Geographic Visualization	3
SEES:3840	Structural Geology	4
SEES:4800	Global Geophysics	3
Economics		
ECON:4700	Topics in Analytical Economics	3
Linguistics		
LING:3117	Psychology of Language	3
Mathematics		
MATH:2560	Engineering Differential Equations	3
MATH:2850	Calculus III	4
MATH:3550	Engineering Vector Calculus	3
MATH:3600	Introduction to Ordinary Differential Equations	2-3

MATH:3720	Introduction to Abstract Algebra	4
MATH:3770	Foundations of Analysis	4
MATH:4040	Matrix Theory	3
MATH:4050	Introduction to Discrete Mathematics	3
MATH:4060	Discrete Mathematical Models	3
Philosophy		
PHIL:4590	Foundations of Cognitive Science	3
PHIL:4691	Mathematical Logic	3
PHIL:4692	Modal Logic	3
Physics		
PHYS:2703	Physics III	4
PHYS:2704	Physics IV	3-4
Statistics and Actuarial Science		
ACTS:3080	Mathematics of Finance I	3
STAT:4100	Statistical Inference I	3
STAT:4101	Statistical Inference II	3

Natural Science Sequences

Students take two or more courses in a sequence (totaling at least 6 s.h.) in a cognate area of natural science. The natural science sequence is intended to enhance a student's perspective by providing a deeper understanding of the scientific method. Typically, it consists of a sequence of courses taken in the same science department. Students often choose courses that also fulfill the GE CLAS Core Natural Sciences requirement. Some possible choices are listed below; the director of undergraduate studies may approve others.

CLEP/AP credit may be used to satisfy part or all of the natural science requirement only if the appropriate science department at the University of Iowa accepts the credit as equivalent to one or more of the specific courses listed below.

Course #	Title	Hours
Astronomy		
ASTR:1771	Fundamental Astronomy I: The Solar System and Exoplanets	4
ASTR:1772	Fundamental Astronomy II: Evolution of Stars, Galaxies, and the Universe	4
Biology		
BIOL:1411	Foundations of Biology	4
BIOL:1412	Diversity of Form and Function	4
Chemistry		
CHEM:1110	Principles of Chemistry I	4
CHEM:1120	Principles of Chemistry II	4
Earth, Environment, and Sustainability		
One of these sequences:		
SEES:1030	Introduction to Earth Science	3-4
or SEES:1050	Introduction to Geology	
SEES:1080	Introduction to Environmental Science	3-4
or		
SEES:1020	The Global Environment	3
SEES:2050	Foundations of GIS	4

Physics		
PHYS:1611-PHYS:1612	Introductory Physics I-II	8
or		
PHYS:1701-PHYS:1702	Physics I-II	8

Early Admission to the Graduate College

Undergraduate computer science students who have 6 s.h. or less to earn toward graduation may apply for early admission to the Graduate College. Early admission allows students in their final undergraduate semester to take courses for graduate credit in addition to the courses they need to complete their bachelor's degrees.

Combined Programs

BS/MCS

Qualified computer science undergraduate students who plan to earn the Master of Computer Science degree may apply for the combined Bachelor of Science/Master of Computer Science program. The combined BS/MCS program allows students to earn both degrees in five years. The program requires a total of 140 s.h. Students are granted a BS when they complete all requirements for the undergraduate degree.

Students in the combined program must complete all requirements for each degree, but may count a maximum of 12 s.h. (four courses) toward both degrees. The four courses must be taken during the fourth year of undergraduate study, after admission to the combined program, and must satisfy degree requirements of both the BS and the MCS.

If students withdraw from the combined program before completing their bachelor's degree, credit earned in the four courses is counted only toward the undergraduate degree.

Students apply for admission to the combined program during their third year as an undergraduate and enter the program at the beginning of their fourth year. They typically complete the combined program in one year after completing the BS requirements.

Applicants to the combined program must:

- be enrolled as a BS student majoring in computer science at the University of Iowa;
- have completed a minimum of 80 s.h. at the time of admission to the combined program, with at least 30 s.h. earned at the University of Iowa; and
- have a cumulative University of Iowa grade-point average (GPA) of at least 3.25 and a GPA of at least 3.25 in the computer science major (computed on math prerequisites and core computer science coursework taken at the University of Iowa).

Applicants must meet the admission requirements of the Graduate College; see the Manual of Rules and Regulations on the Graduate College website.

Students must submit an application for admission to the program, a statement of purpose, three letters of recommendation, and transcripts from all colleges attended; they also must apply to the Graduate College. Graduate Record Examination (GRE) scores are not required. For

more detailed information, see Graduate Programs on the Department of Computer Science website.

Honors

Honors in the Major

Students majoring in computer science have the opportunity to graduate with honors in the major. They must maintain a minimum UI cumulative grade-point average (GPA) of 3.33 and a minimum major GPA of 3.50; additionally, students complete 4–6 s.h. of CS:3990 Honors in Computer Science or Informatics and submit an acceptable honors thesis or project. At any time, students can communicate to the computer science professional advisor that they have an honors interest and can have that designation placed on their academic record.

A student is responsible for finding a faculty member willing to supervise the honors project. The student can register for CS:3990 Honors in Computer Science or Informatics under the project supervisor's name once the faculty member approves the proposed project and a timetable for the work. Once that is accomplished, the student must then communicate with the Department of Computer Science honors director, who changes the student's status to denote the student is pursuing honors in the major. It is not necessary to have declared an honors interest before finding a thesis supervisor and beginning to pursue honors in the major, but the student must be coded as pursuing honors prior to completing the application for degree.

An honors project can be completed in one semester, but it usually takes two semesters to complete. In their final semester, a student must register for CS:3999 Computer Science or Informatics Honors Cohort. The honors thesis/project must be approved by the thesis supervisor and then submitted to the honors director who will give initial approval that the student can graduate with honors in the major. Final approval is given after final grades are submitted and all requirements are met. For more details regarding project requirements, see Honors in Computer Science on the department's website.

Students who pursue honors in the major may count a maximum of 3 s.h. in CS:3990 Honors in Computer Science or Informatics toward the advanced technical elective requirement. Those in the combined BS/MCS program may register for 4–6 s.h. in CS:5990 Individualized Research or Programming Project instead of CS:3990; this registration allows them to receive graduate credit for the course while satisfying the course requirements to graduate with honors.

University of Iowa Honors Program

In addition to honors in the major, students can pursue honors study and activities through membership in the University of Iowa Honors Program. Visit Honors at Iowa to learn about the university's honors program.

Membership in the UI Honors Program is not required to earn honors in the computer science major. However, the semester hours earned in CS:3990 Honors in Computer Science or Informatics or CS:5990 Individualized Research or Programming Project can be used to partially satisfy the UI Honors requirement of 12 s.h. of experiential learning coursework.

For more information, contact the Department of Computer Science honors director.

Career Advancement

Computer science graduates work primarily in two market sectors. One sector is the software and computer industry where the words computer science are being used—those in Silicon Valley, among other areas, that can range from start-ups to giants like Amazon, Google, Facebook, and Microsoft. The other sector allows computer science students to use their technical expertise in fields beyond computer science. Examples would be working as a user experience (UX) designer for a marketing agency or developing software for a financial group; there are computer science majors working in media, health care, the government, and even in law firms. Computer science skills are needed everywhere so students have ample opportunities to find an environment that fits their interests and strengths.

As many as one-third of computer science graduates go into research or elect to pursue graduate studies in computer science, including the University of Iowa's five-year BS/MCS program, or pursue other areas where computer science provides a strong foundation.

A recent job placement survey indicates that more than 97% of computer science graduates have a job, are continuing education, or are not seeking employment within six months of graduation.

View post-graduation data on the Pomerantz Career Center website, which uses University of Iowa placement information to explore what recent computer science alumni are doing, including median salaries, job titles, companies of employment, and other facts about UI graduates.

The Pomerantz Career Center offers multiple resources to help students find internships and jobs.

Academic Plans

Four-Year Graduation Plan

The Four-Year Graduation Plan is not available to BS students majoring in computer science. Students work with their advisors on individual graduation plans.

Sample Plan of Study

Sample plans represent one way to complete a program of study. Actual course selection and sequence will vary and should be discussed with an academic advisor. For additional sample plans, see MyUI.

Computer Science, BS

Course	Title	Hours
Academic Career		
Any Semester		
Effective fall 2022, computer science majors enrolled full-time and with 60 s.h. or more overall earned hours reflected on the UI grade report will be assessed $500 per semester supplemental tuition; the amount is pro-rated for part-time students. For more information see: https://cs.uiowa.edu/supplemental-tuition-effective-fall-2022.		
GE CLAS Core: Sustainability [a]		
Hours		**0**

First Year
Fall

CS:1210	Computer Science I: Fundamentals [b]	4
MATH:1850	Calculus I [c]	4
RHET:1030 or ENGL:1200	Rhetoric: Writing and Communication or The Interpretation of Literature	3 - 4
CSI:1600	Success at Iowa	1
Elective course [d]		1
	Hours	**13-14**

Spring

CS:2210	Discrete Structures	3
CS:2230	Computer Science II: Data Structures	4
MATH:1860	Calculus II	4
RHET:1030 or ENGL:1200	Rhetoric: Writing and Communication or The Interpretation of Literature	3 - 4
GE CLAS Core: Understanding Cultural Perspectives [e]		3
	Hours	**17-18**

Second Year
Fall

CS:2630	Computer Organization [f]	4
CS:3330	Algorithms [f]	3
Major: mathematics elective [g]		3 - 4
GE CLAS Core: World Languages First Level Proficiency or elective course [h]		4 - 5
Elective course [d]		1
	Hours	**15-17**

Spring

CS:2820	Introduction to Software Development [f]	4
CS:3820	Programming Language Concepts	3
Major: mathematics elective [g]		3 - 4
GE CLAS Core: Literary, Visual, and Performing Arts [e]		3
GE CLAS Core: World Languages Second Level Proficiency or elective course [h]		4 - 5
Elective course [d]		2
	Hours	**19-21**

Third Year
Fall

CS:3620 or CS:3640	Operating Systems or Introduction to Networks and Their Applications	3
Major: advanced computer science elective [i]		3
GE CLAS Core: Natural Sciences without Lab [e, j]		3
GE CLAS Core: World Languages Third Level Proficiency or elective course [h]		4 - 5
	Hours	**13-14**

Spring

CS:4350 or CS:4330	Logic in Computer Science or Theory of Computation	3
Major: advanced computer science elective [i]		3
GE CLAS Core: Natural Sciences with Lab [e, j]		4

GE CLAS Core: World Languages Fourth Level Proficiency or elective course [h]		4 - 5
Elective course [d]		1
	Hours	**15-16**

Fourth Year
Fall

Major: advanced computer science or technical elective [k]		3
GE CLAS Core: Historical Perspectives [e]		3
GE CLAS Core: International and Global Issues [e]		3
Elective course [d]		3
Elective course [d]		3
	Hours	**15**

Spring

Major: advanced computer science or technical elective [k]		3
GE CLAS Core: Social Sciences [e]		3
GE CLAS Core: Values and Society [e]		3
Elective course [d]		3
Elective course [d]		3
Degree Application: apply on MyUI before deadline (typically in February for spring, September for fall) [l]		
	Hours	**15**
	Total Hours	**122-130**

a Sustainability must be completed by choosing a course that has been approved for Sustainability AND for one of these General Education areas: Natural Sciences; Quantitative and Formal Reasoning; Social Sciences; Historical Perspectives; International and Global Issues; Literary, Visual, and Performing Arts; or Values and Society.

b Enrollment in this course requires completion of a placement exam.

c Enrollment in math courses requires completion of a placement exam.

d Students may use elective courses to earn credit towards the total s.h. required for graduation or to complete a double major, minors, or certificates.

e GE CLAS Core courses may be completed in any order unless used as a prerequisite for another course. Students should consult with an advisor about the best sequencing of courses.

f Students may take CS:2630, CS:2820 and CS:3330 in any order after completing CS:1210, CS:2210, and CS:2230.

g Required math electives include (1) MATH:2700 and (2) STAT:2020 or STAT:3120

h Students who have completed four levels of a single language or two levels of two different languages in high school or college have satisfied the GE CLAS Core World Languages requirement. Students who have completed three levels of a single language may complete a fourth-level course in the same language or may choose an approved World Language and Cultural Exploration course. Enrollment in world languages courses requires a placement exam, unless enrolling in a first-semester-level course. Contact your academic advisor or CLAS Undergraduate Programs Office with questions concerning the World Languages requirement.

i Students may choose a computer science course (prefix CS) numbered 3620-5899, except CS:3910, CS:3980 and CS:4310, or a CS course numbered 5900 or above with department approval. A course used to complete a core requirement cannot also be used as a major elective.

j The BS in computer science requires a 6-8 s.h., two-semester sequence science cognate. Select courses approved to meet the major requirement may also be used to meet the GE CLAS Core Natural Science requirement. See your academic advisor for additional information.

k Students may choose a computer science course (prefix CS) numbered 3620-5890, except CS:3910, CS:3980 and CS:4310, or a CS course numbered 5900 or above with department approval. A course used to satisfy a core requirement cannot also be used as an advanced major elective. Alternatively, students may take a course in other disciplines with department approval. See academic advisor for additional information.

l Please see Academic Calendar, Office of the Registrar website for current degree application deadlines. Students should apply for a degree for the session in which all requirements will be met. For any questions on appropriate timing, contact your academic advisor or Degree Services.