

Computer Science, B.S.

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 24 s.h., at which point they are assigned a departmental advisor. Students being advised at the Academic Advising Center also can 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, and 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, statistical, 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, graphics, 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 g.p.a. of at least 2.00 in all courses for the major and in all UI courses

for the major. A cumulative g.p.a. of at least 2.00 is required for graduation. Students also must 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 also is 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 since 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 majoring in computer science may not earn a second major or minor in business analytics and information systems, computer science and engineering, data science, or informatics.

Departmental Residency Requirement

Students who earn a B.S. 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 numbered CS:3620-CS: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 B.S. in computer science as listed below.

Program Requirements

The B.S. with a major in computer science requires the following coursework. Many courses for the major require a minimum grade of C-minus in the prerequisite courses.

Code	Title	Hours
	Computer Science Core Courses	27-28
	Mathematics Core Courses	15-16
	Computation Theory Course	3
	Advanced Technical Electives	12
	Natural Sciences Sequences Courses	6-8
Total Hours		63-67

Computer Science Core

Code	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

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

Code	Title	Hours
One of these:		
MATH:1550	Engineering Mathematics I: Single Variable Calculus	4
MATH:1850	Calculus I	4

Calculus II

Code	Title	Hours
One of these:		
MATH:1560	Engineering Mathematics II: Multivariable Calculus	4
MATH:1860	Calculus II	4

Linear Algebra

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

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

Probability and Statistics

Code	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

Code	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.

Code	Title	Hours
At least 6 s.h. from these:		
A computer science course (prefix CS) numbered 3620-5899, except CS:3910, CS:3980, and 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		
And:		
Remaining courses may be chosen from advanced technical elective courses in computer science (prefix CS) or in other disciplines with department approval; preapproved technical electives are these:		
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
Geographical and Sustainability Sciences		
GEOG:3520	GIS for Environmental Studies	3
GEOG:3540	Geographic Visualization	3
Earth and Environmental Sciences		
EES:2410	Mineralogy	4
EES:3020	Earth Surface Processes	3
EES:3210	Principles of Paleontology	3
EES:3300	Sedimentary Geology	4
EES:3360	Soil Genesis and Geomorphology	3
EES:3380	Fluvial Geomorphology	3
EES:3390	Integrated Watershed Analysis	3
EES:3500	Igneous and Metamorphic Petrology	4
EES:3840	Structural Geology	4
EES:4800	Global Geophysics	3
Economics		
ECON:4700	Topics in Analytical Economics	3
Mathematics		
MATH:2560	Engineering Mathematics IV: Differential Equations	3
MATH:2850	Calculus III	4
MATH:3550	Engineering Mathematics V: Vector Calculus	3
MATH:3600	Introduction to Ordinary Differential Equations	2-3

MATH:3720	Introduction to Abstract Algebra I	4
MATH:3770	Fundamental Properties of Spaces and Functions I	4
MATH:4040	Matrix Theory	3
MATH:4050	Introduction to Discrete Mathematics	3
MATH:4060	Discrete Mathematical Models	3

Philosophy

PHIL:4691	Mathematical Logic	3
PHIL:4692	Modal Logic	3

Physics

PHYS:2703	Physics III	4
PHYS:2704	Physics IV	3-4

Psychology

LING:3117	Psychology of Language	3
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Statistics and Actuarial Science

ACTS:3080	Mathematics of Finance I	3
STAT:4100	Mathematical Statistics I	3
STAT:4101	Mathematical Statistics 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/APP 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.

Code	Title	Hours
Astronomy		
ASTR:1771	Introductory Astronomy I: Basic Astrophysics and Planetary Astronomy	4
ASTR:1772	Introductory Astronomy II: Stellar, Galactic, and Extragalactic Astronomy	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 and Environmental Sciences		
EES:1030	Introduction to Earth Science	3-4
or EES:1050	Introduction to Geology	
EES:1080	Introduction to Environmental Science	3-4
Geographical and Sustainability Sciences		
GEOG:1020	The Global Environment	3
GEOG:1050	Foundations of GIS	4

Physics

One of these sequences:

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

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

B.S./M.C.S.

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 B.S./M.C.S. program allow students to earn both degrees in five years. The program requires a total of 140 s.h. Students are granted a B.S. 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 B.S. and the M.C.S.

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 comfortably in one year after completing the B.S. requirements.

Applicants to the combined program must:

- be enrolled as a B.S. 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 g.p.a. of at least 3.25 and a g.p.a. 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.

B.S./M.S. in Business Analytics (Career Subprogram)

Students majoring in computer science who are interested in earning a master's degree in business analytics with a career subprogram may apply to the combined B.S./M.S. program offered by the College of Liberal Arts and Sciences and the Tippie College of Business. The program enables students to begin the study of business analytics before they complete their bachelor's degree. Students are able to complete both degrees in five years rather than six.

Separate application to each degree program is required. Applicants must be admitted to both programs before they may be admitted to the combined degree program. For information about the business analytics program, see the M.S. in business analytics (career) in the Tippie College of Business section of the Catalog.

B.S./M.S. in Finance

Students majoring in computer science who are interested in earning a master's degree in finance may apply to the combined B.S./M.S. program offered by the College of Liberal Arts and Sciences and the Tippie College of Business. The program enables students to begin the study of finance before they complete their bachelor's degree. Students are able to complete both degrees in five years rather than six.

Separate application to each degree program is required. Applicants must be admitted to both programs before they may be admitted to the combined degree program. For information about the finance program, see the M.S. in finance (Tippie College of Business) in the Catalog.

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 g.p.a. of 3.33 and a minimum major g.p.a. 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 (0 s.h.). 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 B.S./M.C.S. program may register for 4-6 s.h. in CS:5990 Individualized Research or Programming Project instead of CS:3990; this 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, and 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; those are computer science majors working in media, health care, the government, and even in law firms. Computer science skills are needed everywhere so students has ample opportunities to find an environment that fits their interest 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 B.S./M.C.S. program, or pursue other areas where computer science provides a strong foundation.

A recent job placement survey indicates that more than 97 percent 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 that uses University of Iowa placement information to explore what recent computer science alumni are doing that includes 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 B.S. 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, B.S.

Course	Title	Hours
First Year		
Fall		
CS:1210	Computer Science I: Fundamentals	4
MATH:1850	Calculus I ^a	4
ENGL:1200 or RHET:1030	The Interpretation of Literature or Rhetoric	3 - 4
CSI:1600	Success at Iowa	2
Elective course ^b		1

Hours 14-15

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 or The Interpretation of Literature	3 - 4
Elective course ^b		1

Hours 15-16

Second Year		
Fall		
CS:2630	Computer Organization ^c	4
Major: Math elective ^d		3
GE CLAS Core: World Languages First Level Proficiency or elective course ^e		4 - 5
GE CLAS Core: Diversity and Inclusion ^f		3
Elective course ^b		3

Hours 17-18

Spring		
CS:2820	Introduction to Software Development ^c	4
Major: Math elective ^d		3 - 4
GE CLAS Core: World Languages Second Level Proficiency or elective course ^e		4 - 5
GE CLAS Core: Literary, Visual, and Performing Arts ^f		3
Elective course ^b		2

Hours 16-18

Third Year		
Fall		
Major: Computer Science core course ^g		3
CS:3330	Algorithms ^c	3
GE CLAS Core: World Languages Second Level Proficiency or elective course ^e		4 - 5

GE CLAS Core: Natural Sciences with Lab ^{f, h}	4
Elective course ^b	2

Hours 16-17

Spring	
Major: Computer Science core course ^{g, i}	3
Major: Computer Science advanced elective course ^j	3
GE CLAS Core: World Languages Fourth Level Proficiency or elective course ^e	4 - 5
GE CLAS Core: Natural Sciences without Lab ^{f, h}	3
Elective course ^b	3

Hours 16-17

Fourth Year	
Fall	
Major: Computer Science computational theory or logic course ^k	3
Major: Computer Science advanced elective ^j	3
GE CLAS Core: Historical Perspectives ^f	3
GE CLAS Core: International and Global Issues ^f	3
Elective course ^b	3

Hours 15

Spring	
Major: Computer Science advanced or technical elective course ⁱ	3
Major: Computer Science advanced or technical elective course ⁱ	3
GE CLAS Core: Social Sciences ^f	3
GE CLAS Core: Values and Culture ^f	3
Elective course ^b	3

Degree Application: apply on MyUI before deadline (typically in February for spring, September for fall)^m

Hours 15

Total Hours 124-131

- Enrollment in math courses requires completion of a placement exam.
- 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.
- Students may take CS:2630, CS:2820 and CS:3330 in any order after completing CS:1210, CS:2210, and CS:2230.
- Required math electives include (1) MATH:2700 and (2) STAT:2020 or STAT:3120
- Students who have completed four years of a single language in high school have satisfied the GE CLAS Core World Languages requirement. Enrollment in world languages courses requires a placement exam, unless enrolling in a first-semester-level course.
- 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.
- Possible courses include (1) CS:3620 or CS:3640 for systems requirement or (2) CS:3820.
- The Computer Science B.S. degree 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.
- Systems course must be taken after CS:2630.
- 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 complete a core requirement cannot also be used as a major elective.
- Students may choose CS:4330 or CS:4350. Check with your advisor to see if these courses are offered in the semester you plan to take them.

- l 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.
- m 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 Graduation Services.