COMPUTER SCIENCES, B.S.

Our graduates discover that **computer science (CS)** opens up a world of possibilities.

Computer scientists enjoy **exceptional career opportunities**, in settings ranging from large, established companies to adventurous new start-ups. They are also well qualified to pursue graduate study in a number of fields.

Our students are **creative, analytical problem-solvers**. This is a rich, collaborative and varied field that you will find challenging, no matter where your individual interests lie.

And there is more to CS than programming. While **software engineering** is an important skill, computer scientists also **work with robots** and other physical devices, **design hardware that runs faster** and more efficiently, and **apply machine learning techniques** to gain insight from large data sets—to name just a few examples.

Because CS has become highly **interconnected with medicine, business and many other fields**, it is a great fit with other interests you may have. You will enjoy a strong career outlook while having an **impact on society**.

HOW TO GET IN

DECLARATION REQUIREMENTS

To declare the computer sciences major, students must meet the following requirements[1]:

- Completion of COMP SCI 300 and either MATH 222 or MATH 276
- Grade of BC or higher in one of these introductory programming courses, taken at UW-Madison: COMP SCI 300, COMP SCI/E C E 354 or COMP SCI 400
- 2.250 GPA or higher among the first completed attempts of these courses: COMP SCI 300 and either MATH 222 or MATH 276

1

For purposes of computer sciences major declaration requirements, GPA is calculated with UW-Madison courses only and does include the first attempt of all eligible major declaration coursework completed at time of submitting major declaration request. Repeated coursework is not included.

If a student needs additional coursework to meet the 2.250 GPA requirement, COMP SCI/MATH 240, COMP SCI/E C E 354, and/or COMP SCI 400 Programming III may also be used.

Students having difficulties meeting the above requirements should schedule a meeting with a computer sciences advisor.

For instructions on declaring the major, see the Department of Computer Sciences website (https://www.cs.wisc.edu/undergraduate/ba-bs-in-compsci/).

REQUIREMENTS

UNIVERSITY GENERAL EDUCATION REQUIREMENTS

All undergraduate students at the University of Wisconsin–Madison are required to fulfill a minimum set of common university general education requirements to ensure that every graduate acquires the essential core of an undergraduate education. This core establishes a foundation for living a productive life, being a citizen of the world, appreciating aesthetic values, and engaging in lifelong learning in a continually changing world. Various schools and colleges will have requirements in addition to the requirements listed below. Consult your advisor for assistance, as needed. For additional information, see the university Undergraduate General Education Requirements (http://guide.wisc.edu/undergraduate/#requirementsforundergraduatestudytext) section of the *Guide*.

General Education	• Breadth—Humanities/Literature/Arts: 6 credits • Breadth—Natural Science: 4 to 6 credits, consisting of one 4- or 5-credit course with a laboratory component; or two courses providing a total of 6 credits • Breadth—Social Studies: 3 credits • Communication Part A & Part B * • Ethnic Studies * • Quantitative Reasoning Part A & Part B *

* The mortarboard symbol appears before the title of any course that fulfills one of the Communication Part A or Part B, Ethnic Studies, or Quantitative Reasoning Part A or Part B requirements.

COLLEGE OF LETTERS & SCIENCE DEGREE REQUIREMENTS: BACHELOR OF SCIENCE (B.S.)

Students pursuing a Bachelor of Science degree in the College of Letters & Science must complete all of the requirements below. The College of Letters & Science allows this major to be paired with either the Bachelor of Arts or the Bachelor of Science degree requirements.

BACHELOR OF SCIENCE DEGREE REQUIREMENTS

Mathematics	Complete two courses of 3+ credits at the Intermediate or Advanced level in MATH, COMP SCI, or STAT subjects. A maximum of one course in each of COMP SCI and STAT subjects counts toward this requirement.
Foreign Language	Complete the third unit of a foreign language.
L&S Breadth	Complete: • 12 credits of Humanities, which must include at least 6 credits of Literature; and • 12 credits of Social Science; and • 12 credits of Natural Science, which must include 6 credits of Biological Science and 6 credits of Physical Science.

Liberal Arts and Science Coursework	Complete at least 108 credits.
Depth of Intermediate/Advanced Coursework	Complete at least 60 credits at the Intermediate or Advanced level.
Major	Declare and complete at least one major.
Total Credits	Complete at least 120 credits.
UW-Madison Experience	Complete both: • 30 credits in residence, overall, and • 30 credits in residence after the 86th credit.
Quality of Work	• 2.000 in all coursework at UW–Madison • 2.000 in Intermediate/Advanced level coursework at UW–Madison

NON–L&S STUDENTS PURSUING AN L&S MAJOR

Non–L&S students who have permission from their school/college to pursue an additional major within L&S only need to fulfill the major requirements. They do not need to complete the L&S Degree Requirements above.

REQUIREMENTS FOR THE MAJOR

BASIC COMPUTER SCIENCES

Code	Title	Credits
COMP SCI/ MATH 240	Introduction to Discrete Mathematics	3
COMP SCI/ E C E 252	Introduction to Computer Engineering	3
COMP SCI 300	Programming II	3
COMP SCI/ E C E 354	Machine Organization and Programming	3
COMP SCI 400	Programming III	3
Total Credits		**15**

BASIC CALCULUS

Code	Title	Credits
Complete one of these sequences:		**9-14**
MATH 221 & MATH 222	Calculus and Analytic Geometry 1 and Calculus and Analytic Geometry 2	
MATH 171 & MATH 217 & MATH 222	Calculus with Algebra and Trigonometry I and Calculus with Algebra and Trigonometry II and Calculus and Analytic Geometry 2	
MATH 275 & MATH 276	Topics in Calculus I and Topics in Calculus II	
Total Credits		**9-14**

ADDITIONAL MATHEMATICS (BEYOND CALCULUS)

Code	Title	Credits
Complete two courses for at least 6 credits:		**6-10**
MATH 340	Elementary Matrix and Linear Algebra [1]	
or MATH 375	Topics in Multi-Variable Calculus and Linear Algebra	
STAT 324	Introductory Applied Statistics for Engineers	
COMP SCI 412	Introduction to Numerical Methods [2]	
COMP SCI/E C E/ MATH 435	Introduction to Cryptography	
COMP SCI/ MATH 513	Numerical Linear Algebra	
COMP SCI/ MATH 514	Numerical Analysis	
COMP SCI/I SY E/ MATH/STAT 525	Linear Optimization	
COMP SCI/ I SY E 526	Advanced Linear Programming	
E C E 331	Introduction to Random Signal Analysis and Statistics	
MATH 234	Calculus--Functions of Several Variables [1]	
or MATH 375	Topics in Multi-Variable Calculus and Linear Algebra	
MATH 319	Techniques in Ordinary Differential Equations	
MATH 320	Linear Algebra and Differential Equations [1]	
or MATH 375	Topics in Multi-Variable Calculus and Linear Algebra	
MATH 321	Applied Mathematical Analysis	
MATH 322	Applied Mathematical Analysis	
MATH 331	Introductory Probability	
MATH 341	Linear Algebra	
MATH 376	Topics in Multi-Variable Calculus and Differential Equations	
MATH/STAT 431	Introduction to the Theory of Probability	
MATH 443	Applied Linear Algebra	
MATH 461	College Geometry I	
MATH/ COMP SCI/ STAT 475	Introduction to Combinatorics	
MATH 521	Analysis I	
MATH 541	Modern Algebra	
MATH 542	Modern Algebra	
MATH 567	Modern Number Theory	
MATH/ PHILOS 571	Mathematical Logic	
STAT/MATH 309	Introduction to Probability and Mathematical Statistics I	

STAT/MATH 310	Introduction to Probability and Mathematical Statistics II
STAT 311	Introduction to Theory and Methods of Mathematical Statistics I
STAT 312	Introduction to Theory and Methods of Mathematical Statistics II

[1]

MATH 375 Topics in Multi-Variable Calculus and Linear Algebra will not meet the requirement if a student already has credit for MATH 234 Calculus--Functions of Several Variables, MATH 320 Linear Algebra and Differential Equations or MATH 340 Elementary Matrix and Linear Algebra.

ADVANCED COMPUTER SCIENCE COURSES

THEORY OF COMPUTER SCIENCE

Code	Title	Credits
Complete one:		**3**
COMP SCI 577	Introduction to Algorithms	
COMP SCI 520	Introduction to Theory of Computing	

SOFTWARE & HARDWARE

Code	Title	Credits
Complete two:		**6-8**
COMP SCI 407	Foundations of Mobile Systems and Applications	
COMP SCI/ E C E 506	Software Engineering	
COMP SCI 536	Introduction to Programming Languages and Compilers	
or COMP SCI 53	Introduction to the Theory and Design of Programming Languages	
COMP SCI 537	Introduction to Operating Systems	
COMP SCI 542	Introduction to Software Security	
COMP SCI 544	Introduction to Big Data Systems	
COMP SCI/ E C E 552	Introduction to Computer Architecture	
COMP SCI 564	Database Management Systems: Design and Implementation	
COMP SCI 640	Introduction to Computer Networks	
COMP SCI 642	Introduction to Information Security	

APPLICATIONS

Code	Title	Credits
Complete one:		**3**
COMP SCI 412	Introduction to Numerical Methods [1]	
COMP SCI/I SY E/ MATH 425	Introduction to Combinatorial Optimization	
COMP SCI/ MATH 513	Numerical Linear Algebra	
COMP SCI/ MATH 514	Numerical Analysis	
COMP SCI/E C E/ I SY E 524	Introduction to Optimization	
COMP SCI/I SY E/ MATH/STAT 525	Linear Optimization	
COMP SCI 534	Computational Photography	
COMP SCI 540	Introduction to Artificial Intelligence	
COMP SCI 545	Natural Language and Computing	
COMP SCI 559	Computer Graphics	
COMP SCI 566	Introduction to Computer Vision	
COMP SCI 570	Introduction to Human-Computer Interaction	
COMP SCI 571	Building User Interfaces	

[2]

In every case, a course used toward one requirement may not be used again toward another requirement. For example, if COMP SCI 412 is applied to the ADDITIONAL MATH (BEYOND CALCULUS) requirement, it cannot also apply to the APPLICATIONS requirement.

ELECTIVES

Code	Title	Credits
Complete two:		**6-8**
COMP SCI 407	Foundations of Mobile Systems and Applications	
COMP SCI 412	Introduction to Numerical Methods	
COMP SCI/I SY E/ MATH 425	Introduction to Combinatorial Optimization	
COMP SCI/E C E/ MATH 435	Introduction to Cryptography	
COMP SCI/ STAT 471	Introduction to Computational Statistics	
COMP SCI/ MATH/STAT 475	Introduction to Combinatorics	
COMP SCI/ E C E 506	Software Engineering	
COMP SCI/ MATH 513	Numerical Linear Algebra	
COMP SCI/ MATH 514	Numerical Analysis	
COMP SCI/DS/ I SY E 518	Wearable Technology	
COMP SCI 520	Introduction to Theory of Computing	
COMP SCI/E C E/ I SY E 524	Introduction to Optimization	
COMP SCI/I SY E/ MATH/STAT 525	Linear Optimization	
COMP SCI/ I SY E 526	Advanced Linear Programming	
COMP SCI/E C E/ M E 532	Matrix Methods in Machine Learning	
COMP SCI/ E C E 533	Image Processing	
COMP SCI 534	Computational Photography	
COMP SCI 536	Introduction to Programming Languages and Compilers	
COMP SCI 537	Introduction to Operating Systems	
COMP SCI 538	Introduction to the Theory and Design of Programming Languages	
COMP SCI/E C E/ M E 539	Introduction to Artificial Neural Networks	

COMP SCI 540	Introduction to Artificial Intelligence
COMP SCI 542	Introduction to Software Security
COMP SCI 545	Natural Language and Computing
COMP SCI/ E C E 552	Introduction to Computer Architecture
COMP SCI/I SY E/ M E 558	Introduction to Computational Geometry
COMP SCI 559	Computer Graphics
COMP SCI/ E C E 561	Probability and Information Theory in Machine Learning
COMP SCI 564	Database Management Systems: Design and Implementation
COMP SCI/ B M I 567	Medical Image Analysis
COMP SCI 570	Introduction to Human-Computer Interaction
COMP SCI 571	Building User Interfaces
COMP SCI/ B M I 576	Introduction to Bioinformatics
COMP SCI 577	Introduction to Algorithms
COMP SCI/ DS 579	Virtual Reality
COMP SCI/ I SY E 635	Tools and Environments for Optimization
COMP SCI 640	Introduction to Computer Networks
COMP SCI 642	Introduction to Information Security
COMP SCI 639	Undergraduate Elective Topics in Computing

RESIDENCE AND QUALITY OF WORK

- 2.000 GPA in all COMP SCI courses and courses counting toward the major
- 2.000 GPA on 15 upper-level credits, taken in residence [3]
- 15 credits in COMP SCI, taken on campus

3

COMP SCI courses numbered 400 through 699 count as Upper Level.

HONORS IN THE MAJOR

Students may declare Honors in the Computer Sciences Major in consultation with the Computer Sciences undergraduate coordinator(s). To earn Honors in the Major in Computer Sciences, students must satisfy both the requirements for the major (above) and the following additional requirements:

- Earn a minimum 3.300 University GPA
- Earn a minimum 3.500 GPA for all COMP SCI and major courses
- Complete one COMP SCI course numbered 500 through 699, taken for Honors with a grade of B or higher
- Complete COMP SCI 681 and COMP SCI 682 for a total of 6 credits. [4]

4

Senior Honors Thesis proposal must be approved by both the thesis/project advisor and the department undergraduate coordinator before enrollment in COMP SCI 681. A final thesis or project must be completed before a final grade for COMP SCI 682 can be awarded.

LEARNING OUTCOMES

1. Recognize and apply the core principles of Computing (abstractions and algorithms) to solve real-world problems.
2. Describe and apply the theoretical foundations of Computer Science (e.g., complexity analysis) in practical settings.
3. Demonstrate knowledge of key elements of computer systems, e.g., hardware, operating systems, networks.
4. Use fundamental and detailed knowledge, skills, and tools (e.g., specific algorithms, techniques methods, etc.) of computer science and develop the ability to acquire new knowledge, skills, and tools.
5. Design, implement, and evaluate software in multiple programming paradigms and languages.
6. Develop a substantial piece of software, and recognize the challenges of designing and developing software.
7. Exhibit technical (designing, implementing, and testing) and teamwork (communication, collaboration, and professional practice) skills in order to develop solutions as a computer science practitioner.
8. Can solve problems by applying a broad toolbox of knowledge and techniques.

FOUR-YEAR PLAN

SAMPLE FOUR-YEAR PLAN

This Sample Four-Year Plan is a tool to assist students and their advisor(s). Students should use it—along with their DARS report, the Degree Planner, and Course Search & Enroll tools—to make their own four-year plan based on their placement scores, credit for transferred courses and approved examinations, and individual interests. As students become involved in athletics, honors, research, student organizations, study abroad, volunteer experiences, and/or work, they might adjust the order of their courses to accommodate these experiences. Students will likely revise their own four-year plan several times during college.

First Year

Fall	Credits	Spring	Credits
COMP SCI 200	3	COMP SCI 300	3
COMP SCI 304 (optional companion course)	1	MATH 222	4
MATH 221	5	Ethnic Studies	3
Communications Part A	3	Second Semester Language	4
First-Semester Language	4		
	16		**14**

Second Year

Fall	Credits	Spring	Credits
COMP SCI 400	3	COMP SCI/E C E 354	3
COMP SCI/E C E 252	3	COMP SCI/MATH 240	3

Additional Math Beyond Calculus (MATH 340 recommended)	3	INTER-LS 210	1
Third Semester Language	4	Communication Part B	3
Social Science Breadth	3	Fourth Semester Language	4
	16		**14**

Third Year

Fall	Credits	Spring	Credits
COMP SCI Theory (COMP SCI 577 recommended)	3-4	COMP SCI Software/ Hardware	3-4
Additional Math (STAT 324 recommended)	3	COMP SCI Applications	3
Humanities Breadth	3	Literature Breadth	3
Social Science Breadth	3	Biological Science Breadth	3
Elective	3	Elective	3
	15		**15**

Fourth Year

Fall	Credits	Spring	Credits
COMP SCI Software/ Hardware	3-4	COMP SCI Elective	3
COMP SCI Elective	3	Physical Science Breadth	3
Humanities Breadth	3	Literature Breadth	3
Social Science Breadth	3	Social Science Breadth	3
Elective	3	Elective	3
	15		**15**

Total Credits 120

ADVISING AND CAREERS

ADVISING

The undergraduate coordinators in the Department of Computer Sciences are ready to help students with questions about the major, L&S degree requirements and policy, and course selection. Information on academic advising for students interested or declared in the computer sciences major is posted to the Computer Sciences advising page (https://www.cs.wisc.edu/undergraduate/undergraduate-advisors/).

CAREERS

Demand for those with a computer sciences education is exceptionally strong. According to figures from the U.S. Bureau of Labor Statistics, the vast majority of growth in STEM (science, technology, engineering, and math) occupations through 2020 will occur within computing fields.

Computer sciences majors are encouraged to begin working on their career exploration and preparation soon after arriving on campus to explore different career paths, participate in co-ops or summer internships, prepare for the job search and/or graduate school applications, and network with professionals in the field.

Department of Computer Sciences: the department hosts one major career fair (https://www.cs.wisc.edu/connect/job-fair/) per year, in the fall, as well as other opportunities to connect with employers, such as technical talks and information sessions.

SuccessWorks at the College of Letters & Science: SuccessWorks offers two major career fairs per year, assists with resume writing and interviewing skills, and offers individual career advising appointments for L&S students.

Engineering Career Services (ECS): ECS (https://ecs.engr.wisc.edu/public/) offers two major career fairs per year, assists with resume writing and interviewing skills, and hosts workshops on the job search.

L&S CAREER RESOURCES

Every L&S major opens a world of possibilities. SuccessWorks (https://successworks.wisc.edu/) at the College of Letters & Science helps students turn the academic skills learned in their major, certificates, and other coursework into fulfilling lives after graduation, whether that means jobs, public service, graduate school or other career pursuits.

In addition to providing basic support like resume reviews and interview practice, SuccessWorks offers ways to explore interests and build career skills from their very first semester/term at UW all the way through graduation and beyond.

Students can explore careers in one-on-one advising, try out different career paths, complete internships, prepare for the job search and/or graduate school applications, and connect with supportive alumni and even employers in the fields that inspire them.

- SuccessWorks (https://careers.ls.wisc.edu/)
- Set up a career advising appointment (https://successworks.wisc.edu/make-an-appointment/)
- Enroll in a Career Course (https://successworks.wisc.edu/career-courses/) - a great idea for first- and second-year students:
  - INTER-LS 210 L&S Career Development: Taking Initiative (1 credit)
  - INTER-LS 215 Communicating About Careers (3 credits, fulfills Comm B General Education Requirement)
- Learn about internships and internship funding (https://successworks.wisc.edu/finding-a-job-or-internship/)
  - INTER-LS 260 Internship in the Liberal Arts and Sciences
- Activate your Handshake account (https://successworks.wisc.edu/handshake/) to apply for jobs and internships from 200,000+ employers recruiting UW-Madison students
- Learn about the impact SuccessWorks has on students' lives (https://successworks.wisc.edu/about/mission/)

PEOPLE

Visit the CS website to view our department faculty (https://www.cs.wisc.edu/people/faculty/) and staff (https://www.cs.wisc.edu/people/staff/).

RESOURCES AND SCHOLARSHIPS

Visit Scholarships@UW-Madison (https://scholarships.wisc.edu/Scholarships/) to find UW–Madison scholarships and apply online.

Visit the scholarships page (https://www.cs.wisc.edu/academics/scholarships/) on the Department of Computer Sciences website for a

compendium of opportunities available to students studying computer sciences.