COMPUTER SCIENCES, B.A.

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 complete one COMP SCI course at UW–Madison and achieve a grade of C or better in that course. The course must be worth 2 or more credits.

Information on declaring the major is available on the Department of Computer Sciences advising pages (https://www.cs.wisc.edu/advising).

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/#requirementsforundergraduatetestudytext) 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

BREADTH AND DEGREE REQUIREMENTS:

BACHELOR OF ARTS (B.A.)

Students pursuing a bachelor of arts 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 a bachelor of arts or a bachelor of science curriculum. View a comparison of the degree requirements here (https://pubs.wisc.edu/home/archives/ug15/images/babs2009.pdf)

BACHELOR OF ARTS DEGREE REQUIREMENTS

Mathematics
- Fulfilled with completion of University General Education requirements Quantitative Reasoning a (QR A) and Quantitative Reasoning b (QR B) coursework. Please note that some majors may require students to complete additional math coursework beyond the B.A. mathematics requirement.

Foreign Language
- Complete the fourth unit of a foreign language; OR
- Complete the third unit of a foreign language and the second unit of an additional foreign language

Note: A unit is one year of high school work or one semester/term of college work.

L&S Breadth
- Humanities, 12 credits: 6 of the 12 credits must be in literature
- Social Sciences, 12 credits
- Natural Sciences, 12 credits: must include one 3+ credit course in the biological sciences; must include one 3+ credit course in the physical sciences

Liberal Arts and Science Coursework 108 credits

Depth of Intermediate/Advanced work 60 intermediate or advanced credits

Major Declare and complete at least one (1) major

Total Credits 120 credits

UW-Madison 30 credits in residence, overall

Experience 30 credits in residence after the 90th credit
Minimum GPAs

- 2.00 in all coursework at UW–Madison
- 2.00 in intermediate/advanced 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 and do not need to complete the L&S breadth and degree requirements above. Please note that the following special degree programs are not considered majors so are not available to non–L&S degree-seeking candidates:

- Applied Mathematics, Engineering and Physics (Bachelor of Science–Applied Mathematics, Engineering and Physics)
- Journalism (Bachelor of Arts–Journalism; Bachelor of Science–Journalism)
- Music (Bachelor of Music)
- Social Work (Bachelor of Social Work)

REQUIREMENTS FOR THE MAJOR

REQUIRED COURSEWORK

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
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</thead>
<tbody>
<tr>
<td>No course may be used to satisfy more than one requirement in the computer sciences major. Courses taken on a pass/fail basis will not count toward any major requirements.</td>
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BASIC COMPUTER SCIENCES

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete all of the following courses:</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>COMP SCI/ MATH 240</td>
<td>Introduction to Discrete Mathematics</td>
<td></td>
</tr>
<tr>
<td>COMP SCI/ E C E 252</td>
<td>Introduction to Computer Engineering</td>
<td></td>
</tr>
<tr>
<td>COMP SCI 300</td>
<td>Programming II</td>
<td></td>
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<tr>
<td>COMP SCI/ E C E 354</td>
<td>Machine Organization and Programming</td>
<td></td>
</tr>
<tr>
<td>COMP SCI 400</td>
<td>Programming III</td>
<td></td>
</tr>
</tbody>
</table>

BASIC CALCULUS

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select one of the following options:</td>
<td>9-14</td>
<td></td>
</tr>
<tr>
<td>MATH 221 &amp; MATH 222</td>
<td>Calculus and Analytic Geometry I and Calculus and Analytic Geometry 2</td>
<td></td>
</tr>
<tr>
<td>MATH 171 &amp; MATH 217 &amp; MATH 222</td>
<td>Calculus with Algebra and Trigonometry I and Calculus with Algebra and Trigonometry II and Calculus and Analytic Geometry 2</td>
<td></td>
</tr>
<tr>
<td>MATH 275 &amp; MATH 276</td>
<td>Topics in Calculus I and Topics in Calculus II</td>
<td></td>
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</tbody>
</table>

ADDITIONAL MATHEMATICS

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 340</td>
<td>Elementary Matrix and Linear Algebra (recommended)</td>
<td>1</td>
</tr>
<tr>
<td>STAT 324</td>
<td>Introductory Applied Statistics for Engineers (recommended)</td>
<td></td>
</tr>
<tr>
<td>COMP SCI 412</td>
<td>Introduction to Numerical Methods</td>
<td>2</td>
</tr>
<tr>
<td>COMP SCI/E C E/ MATH 435</td>
<td>Introduction to Cryptography</td>
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<tr>
<td>COMP SCI/ MATH 513</td>
<td>Numerical Linear Algebra</td>
<td></td>
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<tr>
<td>COMP SCI/ MATH 514</td>
<td>Numerical Analysis</td>
<td></td>
</tr>
<tr>
<td>COMP SCI/I SY E/ MATH/STAT 525</td>
<td>Linear Programming Methods</td>
<td></td>
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<tr>
<td>COMP SCI/ I SY E 526</td>
<td>Advanced Linear Programming</td>
<td></td>
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<tr>
<td>MATH 234</td>
<td>Calculus–Functions of Several Variables</td>
<td>1</td>
</tr>
<tr>
<td>MATH 319</td>
<td>Techniques in Ordinary Differential Equations</td>
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</tr>
<tr>
<td>MATH 320</td>
<td>Linear Algebra and Differential Equations</td>
<td>1</td>
</tr>
<tr>
<td>MATH 321</td>
<td>Applied Mathematical Analysis</td>
<td></td>
</tr>
<tr>
<td>MATH 322</td>
<td>Applied Mathematical Analysis</td>
<td></td>
</tr>
<tr>
<td>MATH 331</td>
<td>An Introduction to Probability and Markov Chain Models</td>
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<tr>
<td>MATH 341</td>
<td>Linear Algebra</td>
<td></td>
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<tr>
<td>MATH 375</td>
<td>Topics in Multi-Variable Calculus and Linear Algebra</td>
<td>1</td>
</tr>
<tr>
<td>MATH 376</td>
<td>Topics in Multi-Variable Calculus and Differential Equations</td>
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<tr>
<td>MATH/STAT 431</td>
<td>Introduction to the Theory of Probability</td>
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<tr>
<td>MATH 443</td>
<td>Applied Linear Algebra</td>
<td></td>
</tr>
<tr>
<td>MATH 461</td>
<td>College Geometry I</td>
<td></td>
</tr>
<tr>
<td>MATH/COMP SCI/ STAT 475</td>
<td>Introduction to Combinatorics</td>
<td></td>
</tr>
<tr>
<td>MATH 521</td>
<td>Analysis I</td>
<td></td>
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<tr>
<td>MATH 541</td>
<td>Modern Algebra</td>
<td></td>
</tr>
<tr>
<td>MATH 542</td>
<td>Modern Algebra</td>
<td></td>
</tr>
<tr>
<td>MATH 567</td>
<td>Elementary Number Theory</td>
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<tr>
<td>MATH/ PHILOS 571</td>
<td>Mathematical Logic</td>
<td></td>
</tr>
<tr>
<td>STAT/MATH 309</td>
<td>Introduction to Probability and Mathematical Statistics</td>
<td>1</td>
</tr>
<tr>
<td>STAT/MATH 310</td>
<td>Introduction to Probability and Mathematical Statistics</td>
<td>2</td>
</tr>
<tr>
<td>STAT 311</td>
<td>Introduction to Theory and Methods of Mathematical Statistics I</td>
<td></td>
</tr>
<tr>
<td>STAT 312</td>
<td>Introduction to Theory and Methods of Mathematical Statistics II</td>
<td></td>
</tr>
</tbody>
</table>
### ADVANCED COMPUTER SCIENCES

**Code** | **Title** | **Credits**
---|---|---
COMP SCI 577 | Introduction to Algorithms (recommended) | 3
COMP SCI 520 | Introduction to Theory of Computing | 

**SOFTWARE/HARDWARE**

**Code** | **Title** | **Credits**
---|---|---
COMP SCI 407 | Foundations of Mobile Systems and Applications | 
COMP SCI/ECE 506 | Software Engineering | 
COMP SCI 536 | Introduction to Programming Languages and Compilers | 1
COMP SCI 537 | Introduction to Operating Systems | 
COMP SCI 538 | Introduction to the Theory and Design of Programming Languages | 1
COMP SCI/ECE 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**
---|---|---
COMP SCI 412 | Introduction to Numerical Methods | 1
COMP SCI/ECE 425 | Introduction to Combinatorial Optimization | 
MATH 513 | Numerical Linear Algebra | 
COMP SCI/ECE 435 | Introduction to Cryptography | 
COMP SCI/MATH 471 | Introduction to Computational Statistics | 
COMP SCI/MATH/STAT 475 | Introduction to Combinatorics | 
COMP SCI/ECE 506 | Software Engineering | 
COMP SCI/ECE 513 | Numerical Linear Algebra | 
COMP SCI/ECE 514 | Numerical Analysis | 
COMP SCI 520 | Introduction to Theory of Computing | 
COMP SCI/ECE 525 | Introduction to Optimization | 
COMP SCI/ECE 526 | Linear Programming Methods | 
COMP SCI/ECE 532 | Matrix Methods in Machine Learning | 
COMP SCI/ECE 533 | Image Processing | 
COMP SCI 534 | Computational Photography | 
COMP SCI 536 | Introduction to Programming Languages and Compilers | 
COMP SCI 537 | Introduction to Operating Systems | 

1. COMP SCI 412 Introduction to Numerical Methods is used to satisfy the "Additional Mathematics" requirement, it cannot satisfy the "Applications" requirement.

### COMPUTER SCIENCES ELECTIVES

**Code** | **Title** | **Credits**
---|---|---
COMP SCI 407 | Foundations of Mobile Systems and Applications | 
COMP SCI 412 | Introduction to Numerical Methods | 
COMP SCI/ECE 425 | Introduction to Combinatorial Optimization | 
COMP SCI/ECE 435 | Introduction to Cryptography | 
COMP SCI/MATH 471 | Introduction to Computational Statistics | 
COMP SCI/MATH/STAT 475 | Introduction to Combinatorics | 
COMP SCI/ECE 506 | Software Engineering | 
COMP SCI/ECE 513 | Numerical Linear Algebra | 
COMP SCI/ECE 514 | Numerical Analysis | 
COMP SCI 520 | Introduction to Theory of Computing | 
COMP SCI/ECE 525 | Introduction to Optimization | 
COMP SCI/ECE 526 | Linear Programming Methods | 
COMP SCI/ECE 532 | Matrix Methods in Machine Learning | 
COMP SCI/ECE 533 | Image Processing | 
COMP SCI 534 | Computational Photography | 
COMP SCI 536 | Introduction to Programming Languages and Compilers | 
COMP SCI 537 | Introduction to Operating Systems | 

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1. COMP SCI 375 may not be combined with MATH 234 Calculus–Functions of Several Variables, MATH 320 Linear Algebra and Differential Equations, or MATH 340 Elementary Matrix and Linear Algebra. The math department may have additional restrictions on giving credit to certain pairs of math courses.
COMP SCI 538 Introduction to the Theory and Design of Programming Languages
COMP SCI/ECE/MEE 539 Introduction to Artificial Neural Network and Fuzzy Systems
COMP SCI 540 Introduction to Artificial Intelligence
COMP SCI 545 Natural Language and Computing
COMP SCI 547 Computer Systems Modeling Fundamentals
COMP SCI/ECE 552 Introduction to Computer Architecture
COMP SCI/ECE/MEE 558 Introduction to Computational Geometry
COMP SCI 559 Computer Graphics
COMP SCI 564 Database Management Systems: Design and Implementation
COMP SCI/BMI 567 Medical Image Analysis
COMP SCI 570 Introduction to Human-Computer Interaction
COMP SCI/BMI 576 Introduction to Bioinformatics
COMP SCI 577 Introduction to Algorithms
COMP SCI/DS 579 Virtual Reality
COMP SCI/I SYE 635 Tools and Environments for Optimization
COMP SCI 640 Introduction to Computer Networks
COMP SCI 642 Introduction to Information Security
COMP SCI 679 Computer Game Technology
COMP SCI 639 Undergraduate Elective Topics in Computing 3-4

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
15 credits in COMP SCI, taken on campus
COMP SCI courses numbered 400 and higher count as upper level.

DISTINCTION IN THE MAJOR:
Code Title Credits

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMP SCI 691 &amp; COMP SCI 692 for at least 6 credits, or</td>
<td></td>
</tr>
<tr>
<td>One COMP SCI course, at the 500 level or above, and counted towards the major, must be taken for honors credit and completed with a grade of “B” or better</td>
<td></td>
</tr>
</tbody>
</table>

HONORS IN THE MAJOR
Students may declare Honors in the Computer Sciences Major in consultation with the Computer Sciences undergraduate coordinator(s).

HONORS IN THE MAJOR IN COMPUTER SCIENCES:
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 3.300 overall university GPA
- Earn a 3.500 GPA for all COMP SCI courses, and all courses accepted in the major
- Complete the following coursework, earning a B or better in each individual course:
  - One COMP SCI course, at the 500 level or above, taken for Honors credit, which counts toward the computer sciences major
  - A two-semester Senior Honors Thesis in COMP SCI 681 Senior Honors Thesis and COMP SCI 682 Senior Honors Thesis, for a total of 6 credits. ¹

¹ The 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 filed with the Department of Computer Sciences before a final grade for COMP SCI 682 can be awarded.

UNIVERSITY DEGREE REQUIREMENTS
Total Degree To receive a bachelor’s degree from UW–Madison, students must earn a minimum of 120 degree credits. The requirements for some programs may exceed 120 degree credits. Students should consult with their college or department advisor for information on specific credit requirements.
Residency Degree candidates are required to earn a minimum of 30 credits in residence at UW–Madison. “In residence” means on the UW–Madison campus with an undergraduate degree classification. “In residence” credit also includes UW–Madison courses offered in distance or online formats and credits earned in UW–Madison Study Abroad/Study Away programs.
Quality of Work Undergraduate students must maintain the minimum grade point average specified by the school, college, or academic program to remain in good academic standing. Students whose academic performance drops below these minimum thresholds will be placed on academic probation.

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.

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/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

SuccessWorks at the College of Letters & Science helps students leverage the academic skills learned in their major, certificates, and liberal arts degree; explore and try out different career paths; participate in internships; prepare for the job search and/or graduate school applications; and network with professionals in the field (alumni and employers).

SuccessWorks can also assist students in career advising, résumé and cover letter writing, networking opportunities, and interview skills, as well as course offerings for undergraduates to begin their career exploration early in their undergraduate career.

- SuccessWorks (https://careers.ls.wisc.edu)
- Set up a career advising appointment (https://careers.ls.wisc.edu/make-an-appointment)
- INTER-LS 210 L&S Career Development: Taking Initiative (1 credit, targeted to first- and second-year students)—for more information, see Inter-LS 210: Career Development, Taking Initiative (https://careers.ls.wisc.edu/inter-ls-210-career-development-taking-initiative)
- Learn how we’re transforming career preparation: L&S Career Initiative (http://ls.wisc.edu/lsci)

PEOPLE


Associate Professors Akella, Chawla, Liblit, Mutlu, Sankaralingam, Swift

Assistant Professors Albarghouthi, D’Antoni, Gupta, Koutris, Sifakis

Faculty Associates Dahl, Deppeler, Hasti, Legault, Lewis-Williams, Skrentny, Williams

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.