Twin Cities Campus

Computer Science B.A.

Computer Science and Engineering Administration

College of Liberal Arts

- Program Type: Baccalaureate
- Requirements for this program are current for Fall 2019
- Required credits to graduate with this degree: 120
- Required credits within the major: 55
- Degree: Bachelor of Arts

Computer science concerns the study of the hardware, software, and theoretical aspects of high-speed computing devices and the application of these devices to a broad spectrum of scientific, technological, and business problems. The curriculum gives students a basic understanding of computer science. After completing a required set of fundamental courses, students can arrange their subsequent work around one of several emphases within computer science. The program prepares students for a variety of industrial, governmental, and business positions involving the use of computers, or for graduate work in the field.

Program Delivery

This program is available:

- via classroom (the majority of instruction is face-to-face)

Admission Requirements

Students must complete 5 courses before admission to the program.

Freshman and transfer students students are usually admitted to pre-major status before admission to this major

A GPA above 2.0 is preferred for the following:

- 3.20 already admitted to the degree-granting college
- 3.20 transferring from another University of Minnesota college
- 3.20 transferring from outside the University

A 3.2 technical GPA or above will guarantee admission. Students applying to the major with below a 3.2 technical GPA will be considered for admission based on space available in the program. Information on the Technical GPA can be found z.umn.edu/techgpa

For information about University of Minnesota admission requirements, visit the Office of Admissions website.

Required prerequisites

Mathematics Core

Take 3 or more course(s) totaling 12 or more credit(s) from the following:

- MATH 1271 - Calculus I [MATH] (4.0 cr)
  or MATH 1371 - CSE Calculus I [MATH] (4.0 cr)
  or MATH 1571H - Honors Calculus I [MATH] (4.0 cr)
- MATH 1272 - Calculus II (4.0 cr)
  or MATH 1372 - CSE Calculus II (4.0 cr)
  or MATH 1572H - Honors Calculus II (4.0 cr)
- CSCI 2011 - Discrete Structures of Computer Science (4.0 cr)
  or CSCI 2011H - Honors Discrete Structures of Computer Science (4.0 cr)

Computer Science Introductory Core

Option 1 is the recommended sequence. Sequences cannot be mixed and matched. Students who intend to major in Computer Science should take Option 1. Students who have AP credit in computer science will receive credit for CSCI 1103 and must take CSCI 1913 (Option 2). Students who are in other majors and would like to transfer to the computer science program may choose either sequence.

Take exactly 2 course(s) totaling exactly 8 credit(s) from the following:

Option 1

CSCI 1133 - Introduction to Computing and Programming Concepts (4.0 cr)
or CSCI 1133H - Honors Introduction to Computing and Programming Concepts (4.0 cr)
CSCI 1933 - Introduction to Algorithms and Data Structures (4.0 cr)

- **Option 2**

CSCI 1103 - Introduction to Computer Programming in Java (4.0 cr)
or CSCI 1113 - Introduction to C/C++ Programming for Scientists and Engineers (4.0 cr)
CSCI 1913 - Introduction to Algorithms, Data Structures, and Program Development (4.0 cr)

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General Requirements

All students are required to complete general University and college requirements including writing and liberal education courses. For more information about University-wide requirements, see the liberal education requirements.Required courses for the major or minor in which a student receives a D grade (with or without plus or minus) do not count toward the major or minor (including transfer courses).

Program Requirements

Students are required to take 4 semester(s) of any second language.

All CLA BA degrees require 18 upper-division (3xxx-level or higher) credits outside the major designator. These credits must be taken in designators different from the major designator and cannot include courses that are cross-listed with the major designator. The major designator for the Computer Science BA is CSCI.

At least 12 upper-division credits in the major must be taken at the University of Minnesota - Twin Cities campus.

Students may complete no more than one degree in the computer science program: a BA or a BS or a minor.

All incoming CLA freshmen must complete the First-Year Experience course sequence.

Core Courses

Take exactly 6 course(s) totaling exactly 23 credit(s) from the following:

- STAT 3021 - Introduction to Probability and Statistics (3.0 cr)
  - *or* IE 3521 - Statistics, Quality, and Reliability (4.0 cr)
  - *or* EE 3025 - Statistical Methods in Electrical and Computer Engineering (3.0 cr)
  - *or* STAT 4101 - Theory of Statistics I (4.0 cr)
  - *or* STAT 4102 - Theory of Statistics II (4.0 cr)
  - *or* STAT 5101 - Theory of Statistics I (4.0 cr)
  - *or* STAT 5102 - Theory of Statistics II (4.0 cr)
  - *or* MATH 4653 - Elementary Probability (4.0 cr)
  - *or* MATH 5651 - Basic Theory of Probability and Statistics (4.0 cr)
  - *or* **Stat 3011 Combination Substitution**
    - STAT 3011 - Introduction to Statistical Analysis [MATH] (4.0 cr)
    - STAT 3022 - Data Analysis (4.0 cr)
- CSCI 2021 - Machine Architecture and Organization (4.0 cr)
  - *or* EE 2361 - Introduction to Microcontrollers (4.0 cr)
- CSCI 2033 - Elementary Computational Linear Algebra (4.0 cr)
  - *or* MATH 2142 - Elementary Linear Algebra (4.0 cr)
  - *or* **Math Linear Algebra and Differential Equations Double Substitution**
    - MATH 4242 - Applied Linear Algebra (4.0 cr)
    - **Linear Algebra and Differential Equations**
      - MATH 2243 - Linear Algebra and Differential Equations (4.0 cr)
      - *or* MATH 2373 - CSE Linear Algebra and Differential Equations (4.0 cr)
      - *or* MATH 2471 - UM Talented Youth Mathematics Program--Calculus II, Second Semester [MATH] (2.0 cr)
      - *or* MATH 2574H - Honors Calculus IV (4.0 cr)
  - *or* **Honors Math Sequence**
    - MATH 3592H - Honors Mathematics I (5.0 cr)
    - MATH 3593H - Honors Mathematics II (5.0 cr)
- CSCI 2041 - Advanced Programming Principles (4.0 cr)
- CSCI 4041 - Algorithms and Data Structures (4.0 cr)
- CSCI 4061 - Introduction to Operating Systems (4.0 cr)

Electives

Students must complete a minimum of 8 credits of approved CSCI 4xxx/5xxx coursework.There are courses that are cross-listed with CSCI courses that are acceptable. CSCI 5465, 5996, and 5997 can not count toward the elective requirement.

Take 8 or more credit(s) from the following:

- CSCI 4011 - Formal Languages and Automata Theory (4.0 cr)
- CSCI 4131 - Internet Programming (3.0 cr)
- CSCI 4611 - Programming Interactive Computer Graphics and Games (3.0 cr)
- CSCI 4950 - Senior Software Project (3.0 cr)
- CSCI 4994H *{Inactive}*(1.0 - 3.0 cr)
- CSCI 5103 - Operating Systems (3.0 cr)
- CSCI 5105 - Introduction to Distributed Systems (3.0 cr)

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- CSCI 5106 - Programming Languages (3.0 cr)
- CSCI 5115 - User Interface Design, Implementation and Evaluation (3.0 cr)
- CSCI 5117 - Developing the Interactive Web (3.0 cr)
- CSCI 5123 - Recommender Systems (3.0 cr)
- CSCI 5125 - Collaborative and Social Computing (3.0 cr)
- CSCI 5127W - Embodied Computing: Design & Prototyping [WI] (3.0 cr)
- CSCI 5143 - Real-Time and Embedded Systems (3.0 cr)
- CSCI 5161 - Introduction to Compilers (3.0 cr)
- CSCI 5221 - Foundations of Advanced Networking (3.0 cr)
- CSCI 5231 *{Inactive}*(3.0 cr)
- CSCI 5271 - Introduction to Computer Security (3.0 cr)
- CSCI 5302 - Analysis of Numerical Algorithms (3.0 cr)
- CSCI 5304 - Computational Aspects of Matrix Theory (3.0 cr)
- CSCI 5421 - Advanced Algorithms and Data Structures (3.0 cr)
- CSCI 5451 - Introduction to Parallel Computing: Architectures, Algorithms, and Programming (3.0 cr)
- CSCI 5461 - Functional Genomics, Systems Biology, and Bioinformatics (3.0 cr)
- CSCI 5471 - Modern Cryptography (3.0 cr)
- CSCI 5481 - Computational Techniques for Genomics (3.0 cr)
- CSCI 5512 - Artificial Intelligence II (3.0 cr)
- CSCI 5521 - Machine Learning Fundamentals (3.0 cr)
- CSCI 5523 - Introduction to Data Mining (3.0 cr)
- CSCI 5525 - Machine Learning: Analysis and Methods (3.0 cr)
- CSCI 5551 - Introduction to Intelligent Robotic Systems (3.0 cr)
- CSCI 5552 - Sensing and Estimation in Robotics (3.0 cr)
- CSCI 5561 - Computer Vision (3.0 cr)
- CSCI 5607 - Fundamentals of Computer Graphics 1 (3.0 cr)
- CSCI 5608 - Fundamentals of Computer Graphics II (3.0 cr)
- CSCI 5609 - Visualization (3.0 cr)
- CSCI 5611 - Animation & Planning in Games (3.0 cr)
- CSCI 5619 - Virtual Reality and 3D Interaction (3.0 cr)
- CSCI 5708 - Architecture and Implementation of Database Management Systems (3.0 cr)
- CSCI 5715 - From GPS, Google Maps, and Uber to Spatial Data Science (3.0 cr)
- CSCI 5801 - Software Engineering I (3.0 cr)
- CSCI 5802 - Software Engineering II (3.0 cr)
- CSCI 4271W - Development of Secure Software Systems [WI] (4.0 cr)
- CSCI 4203 - Computer Architecture (4.0 cr)
  or EE 4363 - Computer Architecture and Machine Organization (4.0 cr)
- CSCI 4211 - Introduction to Computer Networks (3.0 cr)
  or CSCI 5211 - Data Communications and Computer Networks (3.0 cr)
- CSCI 4511W - Introduction to Artificial Intelligence [WI] (4.0 cr)
  or CSCI 5511 - Artificial Intelligence I (3.0 cr)
- CSCI 4707 - Practice of Database Systems (3.0 cr)
  or CSCI 5707 - Principles of Database Systems (3.0 cr)
- CSCI 4921 - History of Computing [TS, HIS] (3.0 cr)
  or HSCI 4321 - History of Computing [TS, HIS] (3.0 cr)
- **Advanced Project Laboratory, Topics, and Directed Study**

  No more than 3 credits from CSCI 4970 or 59xx courses may count toward the elective requirement. CSCI 5996 and CSCI 5997 can not count toward the elective requirement.

  Take at most 3 credit(s) from the following:
  - CSCI 4970W - Advanced Project Laboratory [WI] (3.0 cr)
  - CSCI 5980 - Special Topics in Computer Science (1.0 - 3.0 cr)
  - CSCI 5991 - Independent Study (1.0 - 3.0 cr)
  - CSCI 5994 - Directed Research (1.0 - 3.0 cr)
- **Advanced Computer Architecture**
  - CSCI 5204 - Advanced Computer Architecture (3.0 cr)

  or EE 5364 - Advanced Computer Architecture (3.0 cr)

Capstone

Students who double major within CLA and choose to complete the capstone requirement in their other major are still required to take the Computer Science BA capstone.

Take exactly 1 course(s) totaling exactly 4 credit(s) from the following:

- CSCI 3081W - Program Design and Development [WI] (4.0 cr)

Upper Division Writing Intensive within the major

Students are required to take one upper division writing intensive course within the major. If that requirement has not been satisfied within the core major requirements, students must choose one course from the following list. Some of these courses may also fulfill

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other major requirements.
Take 0 - 1 course(s) from the following:
•CSCI 3081W - Program Design and Development [WI] (4.0 cr)
•CSCI 3921W - Social, Legal, and Ethical Issues in Computing [CIV, WI] (3.0 cr)
•CSCI 4511W - Introduction to Artificial Intelligence [WI] (4.0 cr)
•CSCI 4970W - Advanced Project Laboratory [WI] (3.0 cr)
•CSCI 5127W - Embodied Computing: Design & Prototyping [WI] (3.0 cr)
•CSCI 4271W - Development of Secure Software Systems [WI] (4.0 cr)

Program Sub-plans

A sub-plan is not required for this program.

Integrated Computer Science B.A./M.S. Program

The Department of Computer Science & Engineering offers an integrated Bachelors and Masters Degree program. Students accepted to the integrated program will be guaranteed admission to the Computer Science MS as long as they complete their undergraduate program. Accepted students will not need to take the GRE exam as part of their graduate application, unlike other students applying to our graduate programs. Applicants must be enrolled University of Minnesota - Twin Cities students admitted to a Computer Science or Computer Engineering undergraduate program. Applicants must meet a Technical GPA minimum of 3.5 (as defined by the College of Science & Engineering) or they must have a strong recommendation from a Computer Science and Engineering faculty member or instructor (not an ECE Faculty member). Applicants must have at least 75 credits completed at the time of their application. Applicants must have passed with a C- or better all of the following courses: CSCI 1933 or 1913 CSCI 2011 CSCI 2021 (CSCI students) or EE 2361 (CompE students) CSCI 2033 or a math course containing linear algebra content CSCI 2041 (CSCI students only) CSCI 3081W (CSCI students only), CSCI 4041, and CSCI 4061 (applicants can have one of these courses in progress at the time of application) Full application instructions can be found at cs.umn.edu/integrated

Students can transfer a maximum of 16 credits to the graduate program taken during their integrated senior undergraduate year. Students must spend a minimum of two semesters as a graduate student after the completion of their undergraduate degree. Coursework applied to the graduate degree must be taken at the graduate level (i.e., 5xxx or above) Credits being applied to the Computer Science Masters taken while the student is an undergraduate for use in the integrated program can also be applied later to a Computer Science Ph.D. within our department if a student applies and is admitted. Credits cannot also be applied to the undergraduate degree (i.e., no double dipping). Students should consider taking the following courses/requirements to apply toward their graduate degree as an undergraduate integrated program student (16 credits max):

CSCI 8970 - Computer Science Colloquium (1 credit)

Course to meet the Theory and Algorithms Breadth requirement (3 credits)*

Course to meet the Architecture, Systems, & Software Breadth requirement (3 credits)*

Course to meet the Applications Breadth requirement (3 credits)*

CSCI 5XXX level course that fits your interests and background (3 credits) or an approved graduate level elective or graduate minor course. We recommend waiting to take CSCI 8XXX level courses for your graduate year, but this level of coursework is still available to you if you have the appropriate prerequisites.

CSCI 5XXX level course that fits your interests and background (3 credits) or an approved graduate level elective or graduate minor course. We recommend waiting to take CSCI 8XXX level courses for your graduate year, but this level of coursework is still available to you if you have the appropriate prerequisites.

*Please refer to the Department of Computer Science & Engineering webpage for more details on which courses count for specific breadth requirements.

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