Twin Cities Campus

Computer Science Ph.D.

Computer Science and Engineering Administration
College of Science and Engineering

Link to a list of faculty for this program.

Contact Information:
Department of Computer Science and Engineering, University of Minnesota, 4-192 Keller Hall, 200 Union Street S.E., Minneapolis, MN 55455 (612- 625-4002; fax: 612-625-0572)
Email: admissions@cs.umn.edu
Website: http://www.cs.umn.edu

- Program Type: Doctorate
- Requirements for this program are current for Fall 2017
- Length of program in credits: 55
- This program does not require summer semesters for timely completion.
- Degree: Doctor of Philosophy

Along with the program-specific requirements listed below, please read the General Information section of the catalog website for requirements that apply to all major fields.

The graduate program in computer science offers coursework from across a broad spectrum of theoretical and applied computer science, combined with research opportunities in nearly all areas of the field. Faculty members advise students in such areas as algorithms and theoretical computer science; numerical, parallel, and high-performance computing; distributed computing and systems; artificial intelligence, robotics, and computer vision; databases and data mining; human-computer interaction and information systems; graphics and visualization; software engineering and programming languages; computer architecture and compilers; networking; bio-informatics and computational biology;machine learning; and computer security. In addition, students may choose a course of study that integrates research in computer science with applications in other fields.

Computer science degrees include the Ph.D., as well as the M.C.S. (a terminal, coursework-only degree), and the M.S. (offered Plan A with thesis, Plan B with project, or coursework-only Plan C with coursework-based projects). The department also supports a master of science in software engineering (M.S.S.E.) degree.

Faculty from the Department of Computer Science and Engineering also participate in a variety of other graduate programs, including BioInformatics and Computational Biology, Health Informatics, Cognitive Science, Scientific Computation and Human Factors and Ergonomics.

Program Delivery

This program is available:
- via classroom (the majority of instruction is face-to-face)

Prerequisites for Admission

The preferred undergraduate GPA for admittance to the program is 3.45.

A degree in any major with a substantial background in computer science is required; a computer science major is preferred.

Other requirements to be completed before admission:
The program requires all applicants to complete the department's online application, as well as the University's online application. The names and email addresses of three recommenders are required; they will be asked to upload their letters of recommendation to the CS&E online application only. Scores from the General (Aptitude) Test of the GRE are required for Ph.D. program applicants. Ph.D. students are accepted for fall admission only. The application deadline is April 1. Students seeking financial aid must apply by December 5. Additional information is available at https://www.cs.umn.edu/admissions/graduate

Applicants must submit their test score(s) from the following:
- GRE

International applicants must submit score(s) from one of the following tests:
- TOEFL
  - Internet Based - Total Score: 85
  - Internet Based - Writing Score: 23
  - Internet Based - Reading Score: 23

- Paper Based - Total Score: 550
- IELTS
  - Total Score: 6.5
- MELAB
  - Final score: 80

Key to test abbreviations(GRE, TOEFL, IELTS, MELAB).

For an online application or for more information about graduate education admissions, see the General Information section of the catalog website.

Program Requirements

16 to 25 credits are required in the major.
6 to 15 credits are required outside the major.
24 thesis credits are required.

This program may be completed with a minor.

Use of 4xxx courses towards program requirements is not permitted.

A minimum GPA of 3.45 is required for students to remain in good standing.

The Ph.D. requires a total of 55 credits consisting of 31 course credits and 24 thesis credits. Of the 31 course credits, 16 must be in computer science courses and at least 6 from outside the major. The 16 major credits must include five 3-credit courses that fulfill the breadth requirement in three different areas: theory and algorithms; architecture, systems and software; and applications; plus 1 credit of colloquium (CSCI 8970).

The remaining 9 credits may be taken as additional graduate-level courses in the major or in any supporting field. Students are recommended to take CSCI 8001/2 Introduction to Research in Computer Science I and II and a directed research course (CSCI 8994).

Students are expected to complete all courses in their degree program with a GPA of at least 3.45. All courses must be taken for graduate credit and on the A-F grading basis.

All doctoral students must demonstrate background knowledge in computer science as explained in the program requirements at: https://www.cs.umn.edu/academics/graduate/phd/bg-req

Breadth Requirement Courses

Students must take a total of 5 courses (typically 15 credits): one from each of the three subject areas and the remaining two from any of the three subject areas.

Take 5 or more course(s) from the following:

Theory and Algorithms

Take 1 or more course(s) from the following:

- CSCI 5302 - Analysis of Numerical Algorithms (3.0 cr)
- CSCI 5304 - Computational Aspects of Matrix Theory (3.0 cr)
- CSCI 5403 *{Inactive}*(3.0 cr)
- CSCI 5421 - Advanced Algorithms and Data Structures (3.0 cr)
- CSCI 5481 - Computational Techniques for Genomics (3.0 cr)
- CSCI 5525 - Machine Learning: Analysis and Methods (3.0 cr)

Architecture, Systems and Software

Take 1 or more course(s) from the following:

- CSCI 5103 - Operating Systems (3.0 cr)
- CSCI 5105 - Introduction to Distributed Systems (3.0 cr)
- CSCI 5106 - Programming Languages (3.0 cr)
- CSCI 5161 - Introduction to Compilers (3.0 cr)
- CSCI 5211 - Data Communications and Computer Networks (3.0 cr)
- CSCI 5221 - Foundations of Advanced Networking (3.0 cr)
- CSCI 5231 *{Inactive}*(3.0 cr)
- CSCI 5451 - Introduction to Parallel Computing: Architectures, Algorithms, and Programming (3.0 cr)
- CSCI 5708 - Architecture and Implementation of Database Management Systems (3.0 cr)
- CSCI 5801 - Software Engineering I (3.0 cr)
- CSCI 5802 - Software Engineering II (3.0 cr)
- CSCI 5204 - Advanced Computer Architecture (3.0 cr)

•Applications

Take 1 or more course(s) from the following:

- •CSCI 5115 - User Interface Design, Implementation and Evaluation (3.0 cr)
- •CSCI 5125 - Collaborative and Social Computing (3.0 cr)
- •CSCI 5271 - Introduction to Computer Security (3.0 cr)
- •CSCI 5471 - Modern Cryptography (3.0 cr)
- •CSCI 5511 - Artificial Intelligence I (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 5551 - Introduction to Intelligent Robotic Systems (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 5707 - Principles of Database Systems (3.0 cr)

Supporting Program

Take 6 credits in courses outside of computer science. These credits may be used toward the requirements for a doctoral minor.

Colloquium Credits

Take 1 credit of CS colloquium.

CSCI 8970 - Computer Science Colloquium (1.0 cr)

Thesis Credits

Take 24 credits after passing preliminary oral exam.

CSCI 8888 - Thesis Credit: Doctoral (1.0 - 24.0 cr)

Computer Science Courses

The remaining 9 credits of coursework may be taken in the major field or any supporting field. Students may choose courses from this list or consult with their adviser for additional options.

Take 0 or more credit(s) from the following:

- •CSCI 5103 - Operating Systems (3.0 cr)
- •CSCI 5105 - Introduction to Distributed Systems (3.0 cr)
- •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 5125 - Collaborative and Social Computing (3.0 cr)
- •CSCI 5161 - Introduction to Compilers (3.0 cr)
- •CSCI 5204 - Advanced Computer Architecture (3.0 cr)
- •CSCI 5211 - Data Communications and Computer Networks (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 5403 *{Inactive}*(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 5511 - Artificial Intelligence I (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 5561 - Computer Vision (3.0 cr)
- •CSCI 5607 - Fundamentals of Computer Graphics 1 (3.0 cr)
- •CSCI 5611 - Animation & Planning in Games (3.0 cr)
- •CSCI 5619 - Virtual Reality and 3D Interaction (3.0 cr)
- •CSCI 5707 - Principles of Database Systems (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 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)
- CSCI 8001 - Introduction to Research in Computer Science I (1.0 cr)
- CSCI 8002 - Introduction to Research in Computer Science, II (2.0 cr)
- CSCI 8115 - Human-Computer Interaction and User Interface Technology (3.0 cr)
- CSCI 8205 - Parallel Computer Organization (3.0 cr)
- CSCI 8363 - Numerical Linear Algebra in Data Exploration (3.0 cr)
- CSCI 8442 - Computational Geometry and Applications (3.0 cr)
- CSCI 8551 - Intelligent Agents (3.0 cr)
- CSCI 8735 - Advanced Database Systems (3.0 cr)
- CSCI 8801 - Advanced Software Engineering (3.0 cr)
- CSCI 8980 - Special Advanced Topics in Computer Science (1.0 - 3.0 cr)
- CSCI 8991 - Independent Study (1.0 - 3.0 cr)
- CSCI 8994 - Directed Research in Computer Science (1.0 - 3.0 cr)