Computer Science, PhD

The Doctor of Philosophy program in computer science emphasizes preparation for research and teaching in academic settings or for research in private, industrial, or government laboratories.

Current and prospective graduate students should consult the Computer Science Graduate Handbook, available from the department's office and its website. The handbook provides detailed information about specific degree requirements, such as required courses, examinations, and dissertation requirements.

Learning Outcomes

Students gain:

- broad, up-to-date knowledge of computer science;
- fluency in reading, analyzing, synthesizing, and communicating research;
- a thorough understanding of a research area and its major open problems;
- awareness of computing research ethics; and
- experience performing original research advancing the state of knowledge in an area of computer science.

Requirements

The Doctor of Philosophy program in computer science requires a minimum of 72 s.h. of graduate credit, four examinations (qualifying, comprehensive, dissertation proposal, and final), and a written dissertation. Students must maintain a UI cumulative grade-point average of at least 3.00. Consult the Computer Science Graduate Handbook for detailed information about PhD requirements and graduate study policies.

Basic PhD requirements are as follows.

Core Requirements

Course #	Title	Hours
This course:		
CS:5350	Design and Analysis of Algorithms	3
And one of these:		
CS:4330	Theory of Computation	3
CS:5340	Limits of Computation	3

Breadth

Students must complete at least three of the following courses, with at least one course selected from each area (9 s.h.).

Systems and Software

Course #	Title	Hours
CS:4640	Computer Security	3
CS:4980	Topics in Computer Science II (section approved by the director of graduate studies)	3
CS:5610	High Performance Computer Architecture	3

Networks and Distributed Systems

Course #	Title	Hours
CS:4980	Topics in Computer Science II (section approved by the director of graduate studies)	3
CS:5620	Distributed Systems and Algorithms	3
CS:5630	Cloud Computing Technology	3

Programming Languages and Compilers

Course #	Title	Hours
CS:4980	Topics in Computer Science II (section approved by the director of graduate studies)	3
CS:5810	Formal Methods in Software Engineering	3
CS:5850	Programming Language Foundations	3
CS:5860	Lambda Calculus and Applications	3

With departmental approval, new courses or specific section offerings of CS:4980 Topics in Computer Science II may also satisfy a given area requirement.

Practice

Students must complete at least one 3 s.h. course with significant practical or implementation-oriented content. Each semester the department designates courses that satisfy this requirement. The following are typical selections.

Course #	Title	Hours
CS:4400	Database Systems	3
CS:4420	Artificial Intelligence	3
CS:4440	Web Mining	3
CS:4470	Health Data Analytics	3
CS:4500	Research Methods in Human-Computer Interaction	3
CS:4630	Mobile Computing	3
CS:4700	High Performance and Parallel Computing	3
CS:4720	Optimization Techniques	3
CS:4980	Topics in Computer Science II (section approved by the director of graduate studies)	3
CS:5800	Fundamentals of Software Engineering	3
CS:5990	Individualized Research or Programming Project	3

Cognate Area

In consultation with their advisor, students are required to select three courses, totaling 9 s.h. or more, that constitute coherent coverage of an external cognate area; the courses need not be offered by the same department. Choices include,

but are not limited to, mathematics, statistics, genetics, biology, and engineering disciplines.

Colloquium

Students must earn at least 4 s.h. in the following.

Course #	Title	Hours
CS:6000	Research Seminar: Colloquium Series (taken at least four times for 1 s.h. each)	4

Responsible Conduct of Research Requirement

Students must complete this course within their first two years; it is offered in spring semesters.

Course #	Title	Hours
CS:5980	Topics in Computer Science III (Responsible Conduct of Research)	1 s.h.

Electives

Students fill their remaining semester hours with a selection of computer science graduate courses numbered 4300 or above and graduate courses outside of the Department of Computer Science, approved by their advisor.

Qualifying Exam

Students are required to pass a qualifying examination by the end of their second year of graduate study. Once students select a topic in consultation with their advisor, they are assigned a three-member faculty examination panel by the department. Then they prepare a written prospectus for review by the committee, followed by an oral presentation.

Comprehensive Exam

The comprehensive examination is an evaluation of a student's mastery of a research area near completion of formal coursework and before the preparation of the dissertation. The exam may be written, oral, or both, at the department's discretion, and is administered by a faculty committee. The comprehensive exam typically should be completed by the end of a student's third year and no later than the end of the fourth year in the PhD program.

Dissertation Proposal

At least six months prior to the final exam, a student must form a dissertation committee and circulate a formal thesis proposal to the committee. The proposal should describe the research performed to date and related work, and outline the expected thesis results. A student must argue the originality and significance of the expected results to the committee in a manner consistent with the advisor's counsel, which may or may not include an oral presentation.

Possible outcomes of a thesis proposal are that the committee finds the proposal satisfactory; the committee suggests modifications, and within a few weeks after the proposal defense, the student and committee reach a consensus by email or in face-to-face meetings on a modified set of expected thesis results; or the committee asks the student to redo their proposal, likely with a fresh proposal document and oral presentation, giving the student enough time to address the committee's concerns.

Dissertation

Each student must write a dissertation, a significant, original contribution to the field of computer science. The dissertation must be prepared in accordance with the format specified on the Graduate College Thesis and Dissertation website.

Final Oral Examination

Once the dissertation is complete and has been reviewed by the student's committee, a final oral examination is administered. This examination must take place no sooner than the semester following the successful completion of the comprehensive examination and no later than five years after completion of the comprehensive exam.

Admission

Admission decisions are based on prior academic performance, letters of reference, and the applicant's statement about background and purpose. Scores on the Graduate Record Examination (GRE) General Test are considered if applicants choose to include them. Students need not have a master's degree to begin the PhD program. Students admitted without a master's degree may choose to be granted an MS or the MCS while working toward the doctorate.

Applicants must meet the admission requirements of the Graduate College; see the Manual of Rules and Regulations on the Graduate College website.

Career Advancement

Many graduates obtain positions in industry research laboratories, such as Amazon, Disney, Google, Samsung, and Yahoo, or in government research laboratories. Others pursue research and teaching careers in higher education, with some starting their careers in postdoctoral positions at universities before seeking employment in tenure-track positions, and some are employed as faculty with more teaching-oriented positions. A few recent PhD graduates have founded or joined start-up companies.

Academic 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, PhD

Course	Title	Hours
Academic Career		
Any Semester		
72 s.h. must be graduate level coursework; up to 33 s.h. of graduate transfer credits allowed upon approval. More information is included in the General Catalog and on department website. [a]		
Graduate College program GPA of at least 3.00 is required. [b]		
Hours		**0**

First Year

Fall

CS:4330 or CS:5340	Theory of Computation or Limits of Computation	3
CS:5350	Design and Analysis of Algorithms	3
CS:6000	Research Seminar: Colloquium Series [c]	1
Breadth requirement course [d]		3
Hours		**10**

Spring

CS:5980	Topics in Computer Science III [e]	1
Breadth requirement course [d]		3
Breadth requirement course [d]		3
Practice requirement course [f]		3
Hours		**10**

Second Year

Any Semester

Exam: Doctoral Qualifying Exam [g]		
Hours		**0**

Fall

CS:6000	Research Seminar: Colloquium Series [c]	1
Cognate area course [h]		3
Cognate area course [h]		3
Cognate area course [h]		3
Hours		**10**

Spring

CS:6000	Research Seminar: Colloquium Series [c]	1
Elective course [i]		3
Elective course [i]		3
Elective course [i]		3
Hours		**10**

Third Year

Any Semester

Exam: Doctoral Comprehensive Exam [j]		
Hours		**0**

Fall

CS:6000	Research Seminar: Colloquium Series [c]	1
Elective course [i]		3
Elective course [i]		3
Elective course [i]		3
Hours		**10**

Spring

Elective course [i]		3
Elective course [i]		3
Elective course [i]		3
Elective course [i]		1
Hours		**10**

Fourth Year

Fall

Dissertation Proposal Defense [k]		
CS:7990	Research for Dissertation	7
Hours		**7**

Spring

CS:7990	Research for Dissertation	6

Exam: Doctoral Final Exam [l]		
Hours		**6**
Total Hours		**73**

a Students must complete specific requirements in the University of Iowa Graduate College after program admission. Refer to the Graduate College website and the Manual of Rules and Regulations for more information.

b Graduate College program GPA is comprised of all courses that are approved degree requirements. If a student takes more than the minimum required number of semester hours to complete the degree, but all courses taken are eligible to count toward the degree, those courses will be included in the Graduate College program GPA.

c Students must enroll four times for 1 s.h. each semester and attend at least 80% of scheduled talks for a satisfactory grade.

d Students must complete at least three courses (9 s.h.), with at least one course from each of the following areas: systems and software, networks and distributed systems, programming languages and compilers; see General Catalog and department website for list of approved courses.

e Students must complete this course during first two years; typically offered in spring semesters. Note: this course does not count toward degree requirements.

f Students must complete at least one course (3 s.h.) with significant practical or implementation-oriented content; see General Catalog and department website for list of approved courses.

g Taken before the end of second year; see General Catalog and department website for specifics.

h In consultation with their advisor, students are required to select three courses, totaling 9 s.h. or more, that constitutes coherent coverage of an external cognate area; the courses need not be offered by the same department. Choices include, but are not limited to, mathematics, statistics, genetics, biology, and engineering disciplines.

i See General Catalog and department website for specifics about elective coursework requirements; may be a combination of thesis hours, directed readings, or CS graduate or non-CS graduate coursework. Work with faculty advisor to determine appropriate graduate coursework and sequence.

j Taken before the end of third year; see General Catalog and department website for specifics.

k Usually takes place six months prior to doctoral final exam.

l Oral dissertation defense.