Academic Requirements for PhD in Computer Science

A minimum of 48 semester hours of course work beyond the BS/BA degree is required of all students.

Admission to Candidacy

All students must demonstrate sufficient knowledge in the fundamentals of computer science, as well as the ability to carry out research in an area of computer science.

The student must maintain a minimum grade-point average (GPA) of 3.500 among the six core courses satisfying the above course requirements and receive a grade of B or better in each of these courses. Students who have taken equivalent courses in other institutions may petition to be exempted from the course(s) (subject to the approval of the PhD CS curriculum committee). Each student may repeat a course once for no more than three out of the six courses if they do not receive a B or better in the course. Students with an Master of Science in Computer Science may petition to the PhD CS curriculum committee for an exemption from these courses. Petition forms are available on the college website.

The fields listed do not necessarily represent areas of specialization or separate tracks within the PhD program. Rather, they attempt to delineate areas on which the student must be examined in order to measure his or her ability to complete the degree. Therefore, they may be adjusted in the future to reflect changes in the discipline of computer science and in faculty interests within the College of Computer and Information Science (CCIS). Similarly, these fields do not represent the only areas in which a student may write his or her dissertation. They are, however, intended to serve as a basis for performing fundamental research in computer science.

Paper Requirement

To demonstrate research ability, the student is required to submit to the PhD committee a research or a survey paper in an area of specialty under the supervision of a faculty advisor. A submitted paper from a student is considered to have fulfilled the paper requirement if:

1. The paper has been submitted to a selective conference.
2. The student has made a substantial contribution to the paper.
3. The advisor has endorsed the paper with a written statement indicating the student's contribution.
4. The PhD CS curriculum committee has voted on a positive recommendation. The committee may require a presentation from the student before making a recommendation.

Upon completion of the course and the research paper requirements, the student is admitted to candidacy for the PhD degree. It is highly recommended that the student complete the candidacy requirement by the end of his or her second year but no later than the third year.

Residency

One year of continuous full-time study is required after admission to the PhD candidacy. It is expected that during this period the student will make substantial progress in preparing for the comprehensive examination.

Teaching Requirement

All computer science PhD students must satisfy the teaching requirement in order to graduate. This requirement is fulfilled when the student works as a teaching assistant (TA) or instructor of record (IoR) for one semester and during this semester:

- Teaches at least 3 hours of classes
- Prepares at least one assignment, or quiz, or equivalent

PhD students are expected to satisfy the teaching requirement some time after completing their first year and at least one semester prior to scheduling their PhD defense.

Comprehensive Examination/Dissertation Proposal

The examination is taken after the student has achieved sufficient depth in a field of study in order to prepare a prospectus for the PhD dissertation. This process should take place no later than the end of the fifth year in residence. Prior to taking the examination, the student prepares a dissertation proposal, which describes the proposed research, including the relevant background materials from the literature. The proposal should clearly specify the research problems to be attacked, the techniques to be used, and a schedule of milestones toward completion.

The dissertation proposal must be approved by the dissertation committee. With the help of the advisor, a student selects the committee, consisting of at least four members, to be approved by the PhD CS curriculum committee. The four members must include the advisor, two internal members, and an external examiner.

Upon approval of the written proposal, the student has to present the proposed work orally in a public forum, followed by a closed-door oral examination from the dissertation committee. The student may take the dissertation proposal examination twice, at most.

Doctoral Dissertation

Upon successful completion of solving the research proposed in the dissertation proposal, the candidate has an opportunity to prepare the dissertation for approval by the dissertation committee. The dissertation must contain results of extensive research and make an original contribution to the field of computer science. The work should give evidence of the candidate's ability to carry out independent research. It is expected that the dissertation should be of sufficient quality to merit publication in a reputable journal in computer science.

DOCTORAL COMMITTEE

With the help of the advisor, a student selects the committee, consisting of at least four members, to be approved by the PhD CS curriculum committee. The four members must include the advisor, two internal members, and an external examiner.

DISSERTATION DEFENSE

The dissertation defense is held in accordance with the regulations of the University Graduate Council. It consists of a lecture given by the candidate on the subject matter of the dissertation. This is followed by questions from the dissertation committee and others in attendance concerning the results of the dissertation as well as any related matters. The examination is chaired by the PhD advisor.
TIME AND TIME LIMITATION
After the establishment of degree candidacy, a maximum of five years will be allowed for the completion of the degree requirements, unless an extension is granted by the college graduate committee.

LEARNING OUTCOMES
Students graduating with a PhD in Computer Science must:

• Gain a broad understanding of computer science fundamentals, spanning a substantial portion of the following core areas: artificial intelligence and data science, human-centered computing, software, systems, and theory.
• Gain significant expertise in at least one research area in computer science.
• Produce and defend original research in an area of computer science.
• Be able to communicate research results effectively in both oral and written forms.

Program Requirements
Complete all courses and requirements listed below unless otherwise indicated.

Milestones
Course requirements
Paper requirement
Dissertation proposal
Dissertation defense

Core Requirements
A grade of B or higher is required in each course. A cumulative 3.500 GPA is required for the core requirement.

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Breadth Areas
Complete one course from four of the five following breadth areas:

Artificial Intelligence and Data Science
CS 6140 Machine Learning

Human-Centered Computing
CS 7340 Theory and Methods in Human Computer Interaction
CS 7250 Information Visualization: Theory and Applications

Software
CS 7400 Intensive Principles of Programming Languages
CS 6410 Compilers

Systems
CS 7600 Intensive Computer Systems

Theory
CS 7800 Advanced Algorithms
CS 7805 Theory of Computation

Specialization Courses
Complete 8 semester hours from the specialization course lists. (p. 2)

Electives
Complete 24 semester hours in the following:

Note: Consult faculty advisor for the other acceptable courses.
CS 5100 to CS 5850, except CS 5340
CS 6110 to CS 6810
CS 7340 Theory and Methods in Human Computer Interaction
CS 8982 Readings

Dissertation
Upon achieving PhD candidacy, complete the following (repeatable) courses for two consecutive semesters:
CS 9990 Dissertation
CS 8982 Readings

For remaining semester(s), complete the following (repeatable) course until graduation:
CS 9996 Dissertation Continuation

Specialization Course Lists

Artificial Intelligence

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Computer-Human Interface

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Data Science

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Graphics

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Information Security

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CS 6750  Cryptography and Communications Security
CS 6760  Privacy, Security, and Usability
CS 7580  Special Topics in Software Engineering
CS 7810  Foundations of Cryptography

**Networks**
CS 5700  Fundamentals of Computer Networking
CS 6710  Wireless Network
CS 6740  Network Security
CS 6750  Cryptography and Communications Security
CS 6760  Privacy, Security, and Usability
CS 7775  Seminar in Computer Security
CS 7780  Special Topics in Networks

**Programming Languages**
CS 5400  Principles of Programming Language
CS 6410  Compilers
CS 6510  Advanced Software Development
CS 7400  Intensive Principles of Programming Languages
CS 7480  Special Topics in Programming Language
CS 7485  Special Topics in Formal Methods

**Software Engineering**
CS 5610  Web Development
CS 6510  Advanced Software Development
CS 7580  Special Topics in Software Engineering

**Systems**
CS 6620  Fundamentals of Cloud Computing
CS 6650  Building Scalable Distributed Systems
CS 6740  Network Security
CS 7600  Intensive Computer Systems
CS 7610  Foundations of Distributed Systems
CS 7680  Special Topics in Computer Systems

**Theory**
CS 6750  Cryptography and Communications Security
CS 6800  Application of Information Theory
CS 7485  Special Topics in Formal Methods
CS 7800  Advanced Algorithms
CS 7805  Theory of Computation
CS 7880  Special Topics in Theoretical Computer Science

**Game Design**
CS 5150  Game Artificial Intelligence
CS 5310  Computer Graphics
CS 5340  Computer/Human Interaction
CS 5850  Building Game Engines
CS 7140  Advanced Machine Learning

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**Plan of Study**

**Sample Curriculum**

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**Total Hours: 48**

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**Program Credit/GPA Requirements**

48 total semester hours required
Minimum overall 3.000 GPA required