DOCTOR OF PHILOSOPHY IN COMPUTER SCIENCE

Credit hour requirements: 40 credit hours if entering with a Master of Science in Computer Science; 49 credit hours if entering with a master of science not in computer science; 72 credit hours if entering with a Bachelor of Science in Computer Science.

The doctoral program is designed for those students who have an interest in pursuing an academic or industrial research career. To be awarded a Ph.D. in Computer Science, a student must demonstrate mastery in several areas of computer science and must make a significant original contribution to research in the field of computer science. On entry into the program, a student is required to take coursework in a number of areas and pass written and oral qualifying exams. Next, the student must formulate a thesis research problem and present it and the proposed research to a committee of faculty at a comprehensive exam. Upon passing this examination, the student must carry out the research and write and defend a thesis, among other requirements.

Admission to the Ph.D. program is competitive and applicants must have high grade point averages, GRE scores, and (if required) TOEFL scores. Students who enter the program after completing a master's degree (not necessarily in computer science) normally require three to four years of full-time work to complete the Ph.D. Part-time students require more time. Students may also enter the program directly after completing only a bachelor's degree in computer science. The direct program enables bright, highly-motivated students to participate in departmental research programs immediately after their bachelor's degree. Students in the direct program take extra coursework and normally require an additional year to complete the Ph.D. compared to students in the post-master's program.

Overview

To receive a Ph.D., students must meet coursework requirements and pass qualifying exams, a comprehensive exam, and a thesis defense.

Curriculum

Students in the Ph.D. program have course requirements that depend on whether they enter the program with a Master of Science in Computer Science, a master of science not in computer science, or with a Bachelor of Science in Computer Science.

Students With a Master of Science in Computer Science

Requirement	Credits
Minimum Total Credits Required	72
Maximum Transfer Credit	32
Maximum 400-Level Credit	12
500- and 600-Level Course Credit Required	15-30

Code	Title	Credit Hours
Required Courses		**(10)**
Select a minimum of three courses from three different core course groups as listed below.		9
CS 695	Doctoral Seminar	1
Readings and Special Problems Courses		**(0-12)**
CS 597	Reading and Special Problems [1]	0-12
General Electives		**(0-6)**
Select zero to six credit hours		0-6
Ph.D. Research		**(24-36)**
CS 691	Research and Thesis Ph.D.	24-36
Transfer Credit		**(32)**
A maximum of 32 credit hours of masters transfer credit is allowed.		32

Students With a Master of Science Not In Computer Science

Requirement	Credits
Minimum Total Credits Required	72
Maximum Transfer Credit	23
Maximum 400-Level Credit	12
Minimum 500- and 600-Level Computer Science Course Credit	24

Code	Title	Credit Hours
Required Courses		**(16)**
Select a minimum of one course from each of the following groups: Theory of Computation, Systems, and Programming Languages		9
Select a minimum of two courses from two of the following groups: Networks and Security, Databases, Software Engineering, or Computational Intelligence		6
CS 695	Doctoral Seminar	1
Readings and Special Problems Courses		**(0-9)**
CS 597	Reading and Special Problems [1]	0-9
General Electives		**(0-9)**
Select zero to nine credit hours		0-9
Ph.D. Research		**(24-33)**
CS 691	Research and Thesis Ph.D. [1]	24-33
Transfer Credit		**(23)**
A maximum of 23 hours of masters transfer credit is allowed.		23

Students With a Bachelor of Science in Computer Science

Requirement	Credits
Minimum Credits Required	72
Maximum 400-Level Credit	12
500-Level Computer Science Course Credit Required	36-54

Code	Title	Credit Hours
Required Courses		**(16)**
Select a minimum of one course from each of the following groups: Theory of Computation, Systems, and Programming Languages		9
Select a minimum of two courses from two of the following groups: Networks and Security, Databases, Software Engineering, or Computational Intelligence		6
CS 695	Doctoral Seminar	1
Readings and Special Problems Courses		**(0-12)**
CS 597	Reading and Special Problems	0-12
General Electives		**(8-26)**
Select 8-26 credit hours		8-26
Ph.D. Research		**(24-36)**
CS 691	Research and Thesis Ph.D.	24-36

[1]   At least three credit hours of CS 597 or CS 691 are required in the first year.

Notes

- To be used to satisfy requirements, courses must be passed with a grade of "B" or better. CS 401, CS 402, CS 403, CSP, and accelerated courses cannot be used. With department approval, courses may be replaced by more advanced courses.
- The 500- and 600-level electives can include credit hours from CS 595. They cannot include credit hours from CS 597, CS 691, or CS 695. With department approval, up to six credit hours may come from outside the CS department.
- A student's adviser may require other courses to be taken.

Core Courses

There are six core course areas. To meet a core requirement, a course must be taken at Illinois Institute of Technology as part of the Ph.D. program; transfer courses cannot be used. Core courses must be passed with "B" or better to satisfy core course requirements.

Code	Title	Credit Hours
Group 1: Theory of Computation		**(15)**
CS 530	Theory of Computation	3
CS 533	Computational Geometry	3
CS 535	Design and Analysis of Algorithms	3

CS 538	Combinatorial Optimization	3
CS 539	Game Theory: Algorithms and Applications	3
Group 2: Systems		**(12)**
CS 546	Parallel and Distributed Processing	3
CS 550	Advanced Operating Systems	3
CS 562	Virtual Machines	3
CS 570	Advanced Computer Architecture	3
Group 3: Programming Languages		**(12)**
CS 536	Science of Programming	3
CS 540	Syntactic Analysis of Programming Languages	3
CS 541	Topics in Compiler Construction	3
CS 545	Distributed Computing Landscape	3
Group 4: Networks and Security		**(18)**
CS 528	Data Privacy and Security	3
CS 542	Computer Networks I: Fundamentals	3
CS 544	Computer Networks II: Network Services	3
CS 549	Cryptography and Network Security	3
CS 558	Advanced Computer Security	3
CS 543	Software-Defined Networking	3
Group 5: Databases		**(3)**
CS 525	Advanced Database Organization	3
Group 6: Software Engineering		**(3)**
CS 586	Software Systems Architectures	3
Group 7: Artificial Intelligence		**(24)**
CS 512	Computer Vision	3
CS 577	Deep Learning	3
CS 578	Interactive and Transparent Machine Learning	3
CS 579	Online Social Network Analysis	3
CS 581	Advanced Artificial Intelligence	3
CS 583	Probabilistic Graphical Models	3
CS 584	Machine Learning	3
CS 585	Natural Language Processing	3

Ph.D. Qualifying Examination

The Ph.D. qualifying examination has two parts: three written examinations and an oral examination. The written exam is used to judge a student's breadth of knowledge; the oral exam is used to judge a student's research potential. See the computer science website (iit.edu/computer-science) and the Examinations section of this bulletin for details.

Master of Science Exit from Program

Students wishing to leave the direct Ph.D. program with the degree of Master of Science in Computer Science must satisfy all the requirements of the master's degree and either write an M.S. thesis or pass the Ph.D. qualifying examination. In special circumstances students may petition the department for consideration.

Comprehensive (Research Proposal) Examination

The purpose of the comprehensive examination is to ensure that the candidate has the background to carry out successful research in the chosen area and that the research problem is properly formulated and has sufficient scholarly merit. The student (in concert with the student's research adviser) must develop a written research proposal containing a literature review, a proposed research topic, and a program of research based upon this topic, and then present it orally as well. See the computer science website (iit.edu/computer-science) and the Examinations section of this bulletin for details.

Thesis Defense

Each student must present an oral defense of their Ph.D. thesis. The thesis review committee is appointed in much the same way as the Ph.D. comprehensive examination committee. It will examine the written thesis and examine the student during the oral defense. All Ph.D.

thesis defenses are open to the public. See the computer science website (iit.edu/computer-science) and the Examinations section of this bulletin for details.