

DOCTOR OF PHILOSOPHY WITH A MAJOR IN COMPUTER SCIENCE

For more information about the Computer Science PhD program, visit www.cc.gatech.edu.

Program of Study

All PhD programs must incorporate a standard set of Requirements for the Doctoral Degree.

Code	Title	Credit Hours
Summary of Requirements		
CS 7001	Overview of Graduate Studies in Computing	5
Research Credit		
Breadth Component (4 classes) ¹		
Programming Proficiency Requirement		
Minor Field of Study		
GTA Apprenticeship Requirement		
Qualifying Exam		
Thesis Proposal		
Dissertation Defense		

¹ Of the four different courses, one must be from the Theory area. Students must earn an A or B in all of these courses, and more As than Bs total.

CS 7001: Introduction to Graduate Studies

During students' first semester at the College, they are expected to enroll in CS7001, Introduction to Graduate Studies. This course helps prepare students for research in computer science and provides an introduction to the various research areas in the College.

Research Credit

Research with a faculty member is an essential aspect of the Computer Science Ph.D. Newly admitted students are expected to work on one or more jointly-defined research projects with faculty members in the College. While one goal of this is for the student to gain practical experience in doing research, these semester-long projects also serve as a way for students and faculty to begin to explore potential advisor relationships.

Before students have a formal advisor, they are expected to register for CS 8903, Special Problems in Computer Science, under the supervision of a faculty member in the College. Registration for this course is restricted, and requires that students and the supervising faculty member complete a form describing the research to be completed over the course of the semester. Students may occasionally participate in multiple 8903 research projects in any given semester, given time and other commitments, and may participate in 8903 research projects for several semesters until they have a formal research advisor.

Once students have a formal advisor, they are expected to focus on what will become their dissertation research under the supervision of their advisor. At this stage, students will register for CS 8999, Doctoral Thesis

Preparation. Students and their advisor must fill out the CS 8999 permit form that indicates the general research direction and that confirms the establishment of the advisory relationship. This form only needs to be filled out one time.

Breadth Component (4 classes)

After admission, a student begins to work on fulfilling the breadth requirement. The breadth component of the program is intended to give students a view into a variety of areas within computing. Each student must take classes in 4 of the 18 areas of computer science. The 18 areas are:

- Computational Science and Engineering
- Computer Architecture
- Cryptography
- Database Systems
- Graphics and Visualization
- Human-Computer Interaction
- Artificial Intelligence
- Learning Sciences and Technology
- Machine Learning
- Network Security
- Networking and Communications
- Privacy, Security, and Policy
- Programming Languages and Compilers
- Social Computing
- Software Methodology and Engineering
- System Security
- Systems (Including Operating Systems, and Distributed and Parallel Processing)
- Theoretical Computer Science

Students who have taken graduate level courses elsewhere before entering the program can petition to have those classes count towards filling the breadth requirement.

Programming Proficiency Requirement

In addition, each student must complete a Programming Proficiency requirement. A single class may satisfy both the Programming Proficiency requirement and a Breadth area requirement. The Programming Proficiency requirement must be fulfilled at Georgia Tech and may not be satisfied by transfer credit or advanced standing.

Breadth Component Areas and Classes

Code	Title	Credit Hours
Artificial Intelligence		
CS 6601	Artificial Intelligence	3
CS 6795	Introduction to Cognitive Science	3
CS 7495	Computer Vision	3
CS 7630	Autonomous Robotics	3
CS 7631	Autonomous Multi-Robot Systems	3
CS 7632	Game Artificial Intelligence	3
CS 7633	Human-Robot Interaction	3
CS 7634	AI Storytelling in Virtual Worlds	3
CS 7636	Computational Perception	3

CS 7637	Knowledge-Based AI	3	CS 7497	Virtual Environments	3
CS 7641	Machine Learning	3	CS 7636	Computational Perception	3
CS 7643	Deep Learning	3	Human Computer Interaction		
CS 7647	Machine Learning with Limited Supervision	3	CS 6451	Introduction to Human-Centered Computing	3
CS 7648	Interactive Robot Learning	3	CS 6455	User Interface Design and Evaluation	3
CS 7649	Robot Intelligence: Planning	3	CS 6456	Principles of User Interface Software	3
CS 7650	Natural Language	3	CS 6470	Design of Online Communities	3
CS 7651	Human and Machine Learning	3	CS 6750	Human-Computer Interaction	3
CSE 6740	Computational Data Analysis: Learning, Mining, and Computation	3	CS 7450	Information Visualization	3
Computational Science and Engineering			CS 7451	Human-Centered Data Analysis	3
CSE 6140	Computational Science and Engineering Algorithms	3	CS 7460	Collaborative Computing	3
CSE 6220	High Performance Computing	3	CS 7470	Mobile and Ubiquitous Computing	3
CSE 6730	Modeling and Simulation: Foundations and Implementation	3	CS 7633	Human-Robot Interaction	3
CSE/MATH 6643	Numerical Linear Algebra	3	Learning Sciences and Technology		
CSE/ISYE 6740	Computational Data Analysis: Learning, Mining, and Computation	3	CS 6460	Educational Technology: Conceptual Foundations	3
Computer Architecture ¹			CS 6461	CS Education Research	3
CS 6290	High-Performance Computer Architecture	3	CS 7465	Educational Technology: Design and Evaluation	3
CS 7290	Advanced Topics in Microarchitecture and organization of high-performance processors.	3	CS 7467	Computer-Supported Collaborative Learning	3
CS 7292	Reliability and Security in Computer Architecture	3	CS 8803	Special Topics (Cognition and Education)	3
Cryptography			Machine Learning		
CS 6260	Applied Cryptography	3	CS 6476	Introduction to Computer Vision GR	3
CS 7560	Theoretical Foundations of Cryptography	3	CS 7545	Theoretical Foundations of Machine Learning	3
CS 8803	Special Topics (Blockchain and Cryptocurrencies)	3	CS 7616	Pattern Recognition	3
CS 8803	Special Topics (Secure Multitparty Computation)	3	CS 7641	Machine Learning	3
CS 8803	Special Topics (Secure Communication Protocols)	3	CS 7643	Deep Learning	3
Database Systems			CS 7646	Machine Learning for Trading	3
CS 4420	Database System Implementation	3	CSE 6240	Web Search and Text Mining	3
CS 6400	Database Systems Concepts and Design	3	CSE 6242	Data and Visual Analytics	3
CS 6411	Object-Oriented Database Models and Systems	3	CSE 6740	Computational Data Analysis: Learning, Mining, and Computation	3
CS 6421	Temporal, Spatial and Active Databases	3	Networking and Communications		
CS 6422	Database System Implementation	3	CS 6250	Computer Networks	3
CS 6430	Parallel and Distributed Database Systems and Applications	3	CS 7620	Case-Based Reasoning	3
Graphics & Visualization			CS 7270	Networked Applications and Services	3
CS 6421	Temporal, Spatial and Active Databases	3	CS 7280	Network Science: Methods and Applications	3
CS 6476	Introduction to Computer Vision GR	3	Network Security		
CS 6480	Computer Visualization Techniques	3	CS 6262	Network Security	3
CS 6491	Foundations of Computer Graphics	3	CS 6264	Information Security Lab: System and Network Defenses	3
CS 6780	Medical Image Processing	3	CS 8803	Special Topics (Empirical Computer Security)	3
CS 7476	Advanced Computer Vision	3	CS 8803	Special Topics (Advanced Network Security and Measurement)	3
CS 7490	Advanced Image Synthesis	3	CS 8803	Special Topics (Securing Internet Infrastructure)	3
CS 7491	3D Complexity Techniques for Graphics, Modeling, and Animation	3	Programming Languages and Compilers		
CS 7496	Computer Animation	3	CS 6241	Design and Implementation of Compilers	3
			CS 6245	Compiling for Parallelism	3
			CS 6390	Programming Language Design	3
			CS 8803	Special Topics (Topics in Program Analysis)	3
			Privacy, Security and Policy		
			CS 6268	Psychology of Cybersecurity	3
			CS 6725	Information Security Strategies and Policies	3

CS 6726	Privacy, Technology, Policy, and Law	3
CS 6268	Psychology of Cybersecurity	3
CS 8803	Special Topics (Security, Privacy, and Democracy)	3
Social Computing		
CS 6465	Computational Journalism	3
CS 6470	Design of Online Communities	3
CS 6474	Social Computing	3
CS 6675	Advanced Internet Computing Systems and Applications	3
CS 7270	Networked Applications and Services	3
CS 7460	Collaborative Computing	3
CS 7467	Computer-Supported Collaborative Learning	3
CS 8803	Special Topics (Cognition and Culture)	3
Software Methodology and Engineering		
CS 6300	Software Development Process	3
CS 6301	Advanced Topics in Software Engineering	3
CS 6310	Software Architecture and Design	3
CS 6320	Software Requirements Analysis and Specification	3
CS 6330	Software Generation, Testing, and Maintenance	3
CS 6340	Advanced Topics in Software Analysis and Testing	3
CS 8803	Special Topics (Formal Modeling and Analysis of Computing Systems)	3
Systems		
CS 6210	Advanced Operating Systems	3
CS 6235	Real-Time System Concepts and Implementation	3
CS 6365	Intro Enterprise Comput.	3
CS 6675	Advanced Internet Computing Systems and Applications	3
CS 7210	Distributed Computing	3
System Security		
CS 6238	Secure Computer Systems	3
CS 6263	Intro to Cyber-Physical Systems Security	3
CS 6265	Information Security Laboratory	3
CS 6402	Databases and Information Security	3
CS 6747	Advanced Topics in Malware Analysis	3
CS 8803	Special Topics (Cybersecurity of Drones)	3
CS 8803	Special Topics (Exploiting Smart Contract/ DeFi)	3
Theory		
CS 6505	Computability, Algorithms, and Complexity	3
CS 6515	Introduction to Graduate Algorithms	3
CS 6520	Computational Complexity Theory	3
CS 6550	Design and Analysis of Algorithms	3
CS 7510	Graph Algorithms	3
CS 7520	Approximation Algorithms	3
CS 7530	Randomized Algorithms	3
CSE 6140	Computational Science and Engineering Algorithms	3

¹ Students who have not already taken CS 6290 or the equivalent should take CS 6290 to satisfy this requirement. Those who have already taken CS 6290, or CS 4290 (Advanced Computer Organization) or the equivalent, can satisfy this requirement by taking CS 7290 or CS 7292.

Programming Proficiency Requirement:

Each student must complete a Programming Proficiency requirement. A single class may satisfy both the Programming Proficiency requirement and a Breadth area requirement. The Programming Proficiency requirement must be fulfilled at Georgia Tech and may not be satisfied by transfer credit or advanced standing.

Code	Title	Credit Hours
The courses that can satisfy the Programming Proficiency Requirement are:		
CS 6210	Advanced Operating Systems	3
CS 6238	Secure Computer Systems	3
CS 6241	Design and Implementation of Compilers	3
CS 6262	Network Security	3
CS 6264	Information Security Lab: System and Network Defenses	3
CS 6290	High-Performance Computer Architecture	3
CS 6476	Introduction to Computer Vision GR	3
CS 6601	Artificial Intelligence	3
CS 7490	Advanced Image Synthesis	3
CS 7492	Simulation of Biological Systems	3
CS 7632	Game Artificial Intelligence	3
CS 7637	Knowledge-Based AI	3
CS 7643	Deep Learning	3
CS 7646	Machine Learning for Trading	3
CS 7650	Natural Language	3

Minor Field of Study

The minor is a sequence of non-College of Computing courses with a coherent theme, totaling 6 credit hours. These courses should have a subject designator OTHER than "CS/CSE" as reported on your transcript. Their theme should somehow relate to the subject of the student's thesis and research.

The classes must be taken for a letter grade, with at least a "B" average. Courses should be at the graduate level, but one approved 4000-level course may be used. No more than three of the hours may be directed research.

After completing all the minor classes, download and fill out the Minor form.

GTA Apprenticeship Requirement

CS Ph.D. students must complete a one-semester teaching apprenticeship requirement. Through this requirement, students will develop general skills in pedagogy, communication, curriculum development, and organization. This type of practical experience will help students become effective communicators and will serve as valuable preparation for any career. Students are required to take a relevant one-semester training course, such as CETL 8000 Graduate Teaching

Assistant Preparation, during the same semester they serve as a teaching apprenticeship.

Qualifying Exam

As a student's research progresses, he or she must select a primary, and possibly secondary, area of focus from the areas of research in the College and then pass a Qualifier in that area or areas. The Qualifier is a student's first step toward achieving candidacy in the doctoral program. This Qualifier functions as Georgia Tech's Comprehensive Examination.

Thesis Proposal

The PhD. proposal consists of:

1. A proposal document written by the student in which he/she will propose the research work to be undertaken as part of his/her doctoral work and a schedule for completion
2. An oral defense of the proposal document

A student must have passed the qualifying examination to do a PhD. proposal. A student who has passed the proposal defense and has also completed all course requirements (except the minor), maintaining a satisfactory scholastic record, has achieved PhD. candidacy and should submit the Candidacy form.

Dissertation Defense

Before the announcement of the public PhD. dissertation defense, your advisor must approve that the dissertation is ready to be given to the dissertation committee, and the dissertation committee must approve that the dissertation is ready for the public dissertation defense. Before giving this approval, the entire committee is expected to have read the dissertation and to have given comments to the student. The committee must approve that a substantial and defensible portion of the dissertation has been completed. Three (3) weeks is a reasonable amount of time for reading the dissertation.

After the approval, the candidate's academic department must announce the public dissertation defense at least fifteen (15) days in advance, and it must forward this announcement together with the names of the dissertation committee to the Office of Graduate Studies and Research.

The public dissertation defense starts with a presentation by the candidate and is followed by a question-answer period. The advisor, who is the chair of the committee, determines who may ask questions and in which order and brings the discussion to a close at the appropriate time. The question-answer period is followed by a closed-door session attended by only the members of the PhD. dissertation committee and interested Georgia Tech faculty.