



[College of Engineering and Applied Science](#)

Computer Science

Degree Requirements

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Advising

Each graduate student is assigned an initial advisor when they are accepted into the program. PhD students consult with their faculty advisor to develop the Plan of Study, detailing courses to fulfill the breadth and depth requirements and the Preliminary Exam to be attempted. First-year PhD students must submit their Plan of Study, signed by their advisor, before registering for courses in their second semester. The duties of the faculty advisor will later be assumed by the chair of the student's thesis committee.

Plan of Study

[The PhD Plan of Study](#) document lists the courses intended to fulfill the breadth and depth course requirements. This is an online form that students submit and may be resubmitted as many times as plans change. A minimum of 30 credit hours of graduate level courses are required. In addition, a minimum of 30 credit hours of thesis work are required for all doctoral degrees within the Graduate School. Students are encouraged to take a mixture of breadth and depth courses during the first 2.5 years.

Several examinations that are required by the Computer Science Department for graduation with a PhD degree are described below. In addition, there are requirements of the Graduate School that must be met. These include requirements related to:

- Preliminary Exam (Area Exams)
 - Thesis Advisor and Committee
 - PhD Comprehensive Exam/Proposal
 - Thesis Defense
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Course Requirements

The doctoral degree requires 30 credits of courses plus 30 credits of dissertation hours. Coursework includes both breadth and depth courses. Depth courses should be closely related to the student's research interests and should be intellectually distinct from breadth courses. Breadth courses should cover a range of Computer Science topics outside the student's research interests.

Required Professional Development (3 credits)

- CSCI 6000 Intro to PhD 1 (1 credit) - taken during first fall.
- CSCI 6100 Research Colloquium (1 credit) - taken any semester.
- CSCI 6200 Intro to PhD 2 (1 credit) - typically, taken once students pass their area exam. The objective of this class is to prepare our graduates for their careers.
 - (Note: students may not double count the same course credit towards two degrees at the same level i.e. two PhDs, if you are in a more than one PhD program)

Depth Courses (18 credits)

18 graduate-level credits with faculty advisor approval. Within this 18 credits, no more than **six** credits can be Independent Study research hours and up to **five** (15 graduate level credits) non-CS classes with advisor approval. Students need at least a B or better in these courses.

Breadth Courses (9 credits)

- All **three** breadth courses must have a grade B or better.
- All **three** breadth courses must be taken within the first five semesters.
- All **three** breadth courses must be listed on the Plan of Study.

Default Option

- [Breadth Course Bins](#)
 - One course from each of three bins (9 credits).

- Bins get updated every 2-3 years.

Specialized Option

- Students and advisors develop customized breadth plan and petition to the Graduate Committee, preferably during the student's first year in the program.
- The petition should explain why the selected courses are each in distinct areas of computer science that together represent a broad set of topics outside of the student's research interests.
- The Graduate Committee will review all petitions and either approve or provide feedback.
- Graduate Committee approval on the customized plan is strongly recommended before classes are taken.

CSCI Courses

At least 12 of the 27 depth and breadth credits (i.e., 4 out of the 9 courses) must be CSCI courses, excluding dissertation credits, professional development series and independent studies. No more than **six** credits of independent study research and up to **five** (15 graduate level credits) of non-CS classes with advisor approval.

Area Examination Requirement

The purpose of the Area Examination is to ensure that the student has sufficient depth to begin research in a selected area. The exam tests knowledge of the general area of computer science that contains the research topic, deeper specialized knowledge of the specific research area that the student will be working in, and intellectual sophistication needed to conduct research in the area.

The Area Exam is a component of the PhD Preliminary Exam. The PhD Preliminary Exam fulfills the Graduate School requirement for a Preliminary Exam. The Preliminary Exam consists of an Area Examination Requirement plus Course Requirements. It complements the course work requirement of the preliminary exam, which is meant to build breadth in computer science in general and general knowledge of the student's research area. The area examination contrasts with the comprehensive exam (proposal defense) which is devoted to a focused research theme.

Selecting an Examination

- Each student is given an advisor upon entry to the PhD program. Students must discuss with their advisors on the format and requirements of their area exams. Because the Area Exam and coursework selections are related to competencies in a specific subject area, any students with an academic advisor outside of CSEN or their area of interest should attempt to find a faculty member qualified to advice on the coursework and area exam components of the

plan of study. The academic advisor signing the plan of study need not be a student's PhD research advisor, but should be in a related area in order to make the transition easier.

- A student may switch academic advisors with the approval of the new advisor. The new advisor will approve a revised Area Exam Plan. A student changing areas who has already completed an area examination will not be required to take another. Instead the student will be required to make up any deficiencies as determined by the new advisor.

Examination Scope and Scheduling

- Committee requirements: There must be an area exam committee which consists of three members who hold graduate faculty appointment with Graduate School. It must have significant CS participation: at least two CS tenured or tenure-track faculty. Faculty outside Computer Science may serve on the committee as members; however, the chair of the committee must a tenured or tenure track Computer Science faculty member.
- Fairness requirements: The area exam requirements must be clearly written out and communicated to the student and the committee. These requirements can be standardized by area or for an individual student, it can be standardized by the committee in consultation with the student. However, it is important that these requirements along with expectations for pass/conditional pass/fail communicated up front.
- Timing Requirements: The area examination must be passed by the end of the sixth semester in order to be making adequate progress. It will normally be taken during the end of second academic year or start of third academic year.
- Reporting Requirements: An [Area Exam Report](#) must be submitted upon successful completion of the exam. This report form must be sent to the graduate advisor within 7 days of the exam's completion. It must be signed by all committee members and include the outcome: pass/conditional pass (if yes, what conditions)/fail. The candidate must get feedback from the committee.
- A student is allowed at most two attempts total to pass the Area Exam.
- The date the exam will be offered, as well as its format, are at the sole discretion of the committee offering the exam.
- Faculty will attempt to maintain consistency in the exams. Exams in different areas should be at similar levels of difficulty. The material tested by the exam is roughly the equivalent of two graduate courses minimum and three graduate courses maximum, although the exam need not be based on any specific courses.
- An exam must be offered again, within a year, if a student wishes to retake it to earn a passing grade.

Grad Comm suggested format:

- Choose 20 papers on a broad topic related to the student's PhD research.
- Choose a set of 3 breadth + depth classes related to this area as pre-requisites that the student must complete with a grade of B or better before taking the exam.
- Present a survey of these papers for 45 minutes in front of the student's committee. The exam is open to other graduate students, faculty members, and members of the public. Ideally, the

presentation should summarize, critique, and identify opportunities for new research to be carried out.

- After the presentation, members of the public may ask questions of the candidate
 - After that, the committee will privately ask additional questions of the candidate. These questions can be free form but should pertain to the content of the papers read by the student and/or the pre-requisite classes in their area.
 - The committee then decides whether to pass, conditionally pass, or fail the student based on the quality of the presentation, the level of sophistication of the student's understanding of the area, and their ability to properly answer the questions posed to them.
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Thesis Advisor & Committee

The student must find a thesis topic and a thesis committee; these are usually done in parallel. The committee must include five faculty and your advisor is automatically one of these and is the committee Chair. The other members need to have Graduate faculty appointment with Graduate School, who will agree to serve. The Chair's policy requires that at least **three** members of the committee have to be tenured or tenure track CS faculty. There does not have to be a non-CS member on the committee for your Proposal Defense. Rules for your final Dissertation Defense committee are a bit different, so you might as well assemble your committee only once. For, your final Dissertation Defense committee, one member has to be from outside the Computer Science Department but from CU Boulder(termed as "Outside Member").

The thesis topic must be acceptable to the committee and the committee must believe that the student is capable of doing the research needed to complete a thesis on this topic. This is measured by the comprehensive exam (Graduate School's terminology), which as implemented in Computer Science is really a thesis proposal to the student's committee.

The student's thesis advisor is the chair of the thesis committee and takes over the advisory role from the student's initial advisor.

Comprehensive Exam/Proposal

Each student is expected to take the Comprehensive Exam/Proposal within four years of the student's admission to regular degree status. The purposes of the Comprehensive Exam are to insure that:

- the student has a sufficient grasp of the fundamentals of the chosen thesis area to begin research;
- the student has the ability to exchange ideas and information with the members of the Advisory Committee; and
- the student has a broad base of knowledge about computer science.

The exam, normally an oral exam, will be given by the student's five-person thesis committee (approved by the Graduate Director). A passing grade is given if at least four of the five members of the examining committee vote to award to passing grade. The student shall not, however, receive a passing grade if the chair of the examining committee does not vote to award a passing grade. Doctoral Comprehensive Examinations must be scheduled with the Graduate School at least two weeks in advance by submitting a Doctoral Examination Report.

Thesis Defense

A thesis based on original investigation and showing mature scholarship and critical judgment, as well as familiarity with tools and methods of research, must be written on some subject approved by the student's Thesis Advisory Committee.

After the thesis has been completed, a final exam on the thesis and related topics will be conducted. This exam is oral and open to anyone.

The exam will be conducted by a committee, appointed by the Dean, which will consist of no fewer than five representatives, including at least three tenured or tenure track members of the home department, one outside member from CU but outside the home department, and the last member could be from CU or professor from the University at large or experts from industry, if required by their research.

More than one dissenting vote will disqualify the candidate in the final exam. Thesis Defense must be scheduled with the Graduate School at least two weeks in advance by submitting a Doctoral Examination Report.

Transfer Credit

The Graduate School will allow doctoral students to transfer up to 21 semester hours of graduate course work at another institution toward the PhD degree. All transfer requests must have departmental approval. Students have to complete at least 6.0 credits of approved graduate level coursework at CU Boulder and get a grade of B or better to be eligible to request for transfer of credits. Transfer requests can be made with the [Graduate School's Request for Transfer of Credit form](#).

MS Degree for PhD Students

Many doctoral students enter the program directly from an undergraduate program and do not have a master's degree. During the course of a normal doctoral program, if you complete either of the following TWO options for Traditional MS requirements, you may pick up a master's degree on your way to PhD. Professional MS degree option is **not** available to PhD students. This does not apply to

students who already have a Master's degree and are using transferred credits from MS to meet their 30 course credits towards their PhD requirement, unless they have any graduate level approved credits that have not been used towards any degree.

Option I: PhD students who have successfully completed an approved PhD Area exam.

- Must complete 30 approved course credits of course work for PhD.
- Must have completed PhD BREADTH and DEPTH requirements.
- Successful completion of the Area Exam.

After the term a student successfully **completes** the PhD area exam, if you are interested in picking up the MS degree on way to PhD, you have to inform the Graduate Advisor at the beginning of the term that you plan to pick up your MS degree, so that an MS stack is created in your portal. Then you will have to file an Application-for-Candidacy Form as well as log into your myCUInfo, click on the Student tab and click on 'Apply for Graduation' for MS degree at the beginning of the semester to obtain your Master's degree even though you are not formally in the Master's program. It is to your benefit to consider doing this so that if you have to leave the doctoral program for financial or personal reasons you will have something to show for your efforts

Option II: PhD students who have not successfully completed PhD Area exam.

- The MS breadth requirement plus Research Based MS degree requirements which are listed at [MS Degree Requirements page](#).
- Must have completed 21 course credits, 3 professional development credits and 6 credits of independent study OR MS thesis hours.
- May count only two non -CS approved courses towards MS degree.

During the term you have **completed** the MS degree requirements, if you are interested in picking up the MS degree on way to PhD, you have to inform the Graduate Advisor at the beginning of the term you plan to pick up your MS degree so that an MS stack is created in your portal. Then you will have to file an Application-for-Candidacy Form as well as log into your [Buff Portal](#), click on the Student tab and click on 'Apply for Graduation' at the beginning of the semester to obtain your Master's degree even though you are not formally in the Master's program. It is to your benefit to consider doing this so that if you have to leave the doctoral program for financial or personal reasons you will have something to show for your efforts.

Grades

The Graduate School requires that to receive PhD, a student must maintain a cumulative grade point average of at least 3.0 in all courses taken as a graduate student. No grade lower than a B- can be counted toward the doctoral degree. No grades lower than a B can be counted toward the breadth requirement.

Timeline

All requirements for the PhD degree must normally be completed within six years of the start of course work.

In addition to completing your course requirements, preliminary exam and comprehensive exam, you should get started with your research agenda as soon as possible. This includes exploring research areas/topics, getting to know your research community, attending professional conferences in your research area, doing research and disseminating research results via writing/submitting/publishing research papers and presenting them at appropriate venues. An important first step towards achieving this goal is to start meeting with your adviser regularly and integrate yourself into a research group of interest as soon as possible.

The guidelines below serve as a checklist for you to ensure that you are making adequate progress. They are based on a timeline set by the Graduate School and the Graduate Committee, but we encourage you to complete them and the PhD program sooner if possible.

If you feel that you are behind according to this schedule, the Graduate Committee encourages you to seek discussion with your adviser, a faculty mentor or the Graduate Committee.

Please note that adhering to these guidelines is a necessary but not sufficient condition for success. Ultimately, the quality of your research and successful completion of the course requirements, preliminary exam, comprehensive exam and PhD dissertation will lead to the PhD degree.

Year 1

- Find a research advisor by actively integrating yourself into a research group of interest
- Meet with your adviser regularly
- Complete 12-15 credit hours of course work
- Create web page (include your resume, a description of research interests and research projects, and a publication list)

Year 2

- Conduct research with adviser and disseminate your research results
- Complete 12-15 credit hours of course work
- Prepare for your preliminary exam

Year 3

- Conduct research with adviser and disseminate your research results
- Complete Preliminary Exam
- Complete coursework (30 hours, including breadth requirement)
- Complete Area Exam

Year 4

- Conduct research with adviser and disseminate your research results
- Defend Proposal (Comprehensive Exam)

Year 5

- Conduct research with adviser and disseminate your research results
- Dissertation research work

Year 6

- Complete dissertation work
- Defend PhD dissertation
- Apply for jobs

Breadth Courses

Breadth Courses

Computer Science courses are listed in the three different breadth bins below.

To earn a Computer Science PhD, MS or MSCPS (Professional masters) degree, you must earn a B or better (not a B-) in at least **one** 5000-level course (not 6000 or higher) from each of the **three** bins. By petition to the Graduate Committee, similar transferred graduate work done elsewhere may be used to satisfy part of this requirement. Below is a list of courses for each bin.

Pre-Fall 2019 Breadth Requirements

Current Breadth BIN Courses

Bin 1

- [CSCI 5229](#) Computer Graphics
- [CSCI 5254](#) Convex Optimization
- [CSCI 5434](#) Probability for Computer Science
- [CSCI 5444](#) Introduction to Theory of Computation
- [CSCI 5446](#) Chaotic Dynamics
- [CSCI 5454](#) Design and Analysis of Algorithms
- [CSCI 5576](#) High-Performance Scientific Computing
- [CSCI 5606](#) Principles of Numerical Computation

- [CSCI 5636](#) Numerical Solution of Partial Differential Equations
- [CSCI 5646](#) Numerical Linear Algebra
- [CSCI 5654](#) Linear Programming
- [CSCI 5676](#) Numerical Methods for Unconstrained Optimization

Bin 2

- [CSCI 5302](#) Advanced Robotics
- [CSCI 5322](#) Algorithmic Human-Robot Interaction
- [CSCI 5352](#) Network Analysis and Modeling
- [CSCI 5502](#) Data Mining
- [CSCI 5616](#) Introduction to Virtual Reality
- [CSCI 5622](#) Machine Learning
- [CSCI 5722](#) Computer Vision
- [CSCI 5822](#) Probabilistic Models of Human and Machine Learning
- [CSCI 5832](#) Natural Language Processing
- CSCI 5839 User-Centered Design
- [CSCI 5849](#) Input Interaction and Accessibility
- [CSCI 5922](#) Neural Networks and Deep Learning

Bin 3

- CSCI 5135 Computer-Aided Verification
- [CSCI 5253](#) Datacenter Scale Computing
- [CSCI 5273](#) Network Systems
- CSCI 5403 Intro to Cyber Security
- [CSCI 5413](#) Ethical Hacking
- [CSCI 5448](#) Object-Oriented Analysis and Design
- CSCI 5525 Compiler Construction
- [CSCI 5535](#) Fundamental Concepts of Programming Languages
- [CSCI 5573](#) Advanced Operating Systems
- [CSCI 5673](#) Distributed Systems
- CSCI 5817 Database Systems
- [CSCI 5828](#) Foundations of Software Engineering
- [CSCI 5854](#) Theoretical Foundation of Autonomous System

Professional Internship Credit

As of Fall 2021, graduate students in the Department of Computer science have the option of completing three credits of professional internship credit (CSCI 6930) and count these towards their degree requirement. [More information on the Professional Internship credit](#). For Summer 2021, this

course is available to students as INFO 5931 and we will be following all the requirements of CSCI 6930 and students may count this class towards their degree requirements.

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