

# COMPUTER SCIENCE, PHD

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The PhD Program in Computer Science guides students from beginning graduate study in Computer Science all the way through to completion of their dissertation research.

The objective of the program is to ensure students obtain a solid foundation by requiring them to take graduate courses in a number of core areas of computer science. A depth requirement involving the attendance of a sequence of courses from one or more areas will enable the student to acquire world-class expertise on a research area of concentration. Students also will be expected to engage in research as early as their incoming semester. This will be accomplished by the research courses and research seminars that will prepare students by engaging them in research from the start.

More detailed information about the PhD program can be found on the following program page: <https://sse.tulane.edu/cs/academics/graduate/phd-programs> (<https://sse.tulane.edu/cs/academics/graduate/phd-programs/>).

## Requirements

The program requires 48 credit hours of graduate course work, including core computer science courses, research courses starting in the first year, as well as an interdisciplinary research project. After an oral qualifying examination at the end of the fifth semester, the prospectus presentation is scheduled at the beginning of the seventh semester, and the final milestone is to complete and defend a dissertation.

Course requirements are broken down into four areas: core courses, research courses, the interdisciplinary project and electives. Students are required to complete at least 48 credit hours (typically 16 classes) of coursework. This consists of:

- 9 credit hours of core classes
- 9 credit hours of research courses in the first two years
- 9 credit hours for the interdisciplinary project
- 9 credit hours of Computer Science electives
- 12 credit hours of general electives

Each student is required to devise a schedule of courses in consultation with their faculty advisor.

## Core Courses

As a breadth requirement that ensures a good foundation in graduate Computer Science coursework, each PhD student is required to take one class (3 credit hours) in each of the three categories below with a grade point average of at least 3.5 for these three courses. Courses in which an inadequate grade is received may be repeated once. These courses are from the following core areas:

- Algorithms: CMPS 6610 Algorithms (3 c.h.)
- Systems: One of CMPS 6750 Computer Networks (3 c.h.) or CMPS 6770 Operating Systems (3 c.h.) or CMPS 6780 Computer Architecture (3 c.h.)
- AI/ML: One of CMPS 6620 Artificial Intelligence (3 c.h.) or CMPS 6720 Machine Learning (3 c.h.)

The core courses have to be completed before the student's oral qualifying exam.

## Research Courses in the First Two Years

Students are expected to engage in research early on, possibly as early as their incoming semester, but no later than the third semester. This is facilitated through research courses, as well as through the interdisciplinary project. Students are required to take at least three research classes (9 credit hours). Typically, these classes consist of CMPS 7010 Research Seminar (3 c.h.) and two offerings of CMPS 7020 Research in Computer Science (3 c.h.) across their first two years. CMPS 7010 Research Seminar (3 c.h.) introduces students to research methods in Computer Science and to the research conducted in the department. In the CMPS 7020 Research in Computer Science (3 c.h.) course, PhD students engage in a research project in Computer Science, under the direction of a faculty member, normally the student's faculty advisor.

## Interdisciplinary Project

Each student is required to complete an interdisciplinary research project. The project is directed by a faculty member in Computer Science, and it consists of interdisciplinary research in a related area. During the first-year research seminar classes, students are exposed to the research areas represented by the department faculty. Students are encouraged to identify a faculty advisor and a research topic for their interdisciplinary project during these seminar classes. If a student is unable to identify a project, the Graduate Studies Committee assigns a faculty mentor to advise the student and help develop an interdisciplinary project. The requirements for the interdisciplinary project are:

- Students must take one graduate class (3 credits or more) in Computer Science that prepares them for the project. Examples include CMPS 6630 Computational Bio & Bioinform (3 c.h.), CMPS 6360 Data Visualization (3 c.h.), CMPS 6640 Advanced Computational Geometry (3 c.h.), CMPS 6150 Multi-agent Systems (3 c.h.).
- Students must take one graduate class (3 credits or more) outside of Computer Science in the area most relevant to the interdisciplinary project.

- Students must enroll in a directed research course (3 credits), such as CMPS 7020 Research in Computer Science (3 c.h.), to conduct the interdisciplinary research.
- The project culminates in a final report, possibly a published research paper, that summarizes the research outcomes. Students also are required to present the outcomes of their project in a public talk in the department.

Typically, students are exposed to interdisciplinary research during their first year in research seminar classes. They start the interdisciplinary project in their third semester, and the expectation is that the project is completed by the end of the second year.

## Elective Courses

The following elective courses are part of the PhD requirements:

- Computer Science electives: Students are required to enroll in 9 credit hours of graduate courses in Computer Science, chosen from PhD-level classes except for CMPS 7010 Research Seminar (3 c.h.), CMPS 7020 Research in Computer Science (3 c.h.), CMPS 7980 Independent Study (3 c.h.). PhD-level classes are listed on the graduate program's webpage and course catalog.
- General electives: Students are required to enroll in 12 credit hours of general electives that can be CMPS 7020 Research in Computer Science (3 c.h.) or graduate courses in Computer Science, chosen from PhD-level classes except for CMPS 7010 Research Seminar (3 c.h.). With approval of the Graduate Studies Committee, at most 9 credit hours of general electives may be replaced with graduate electives outside of Computer Science.

## Faculty Advisor

Students are typically paired with an advisor upon entry into the program and are encouraged to begin research with a faculty advisor and their dissertation research topic as soon as possible, but no later than the end of their second year. The advisor will be the faculty member supervising the student on the interdisciplinary research project. Students should plan and discuss their progress through coursework and PhD milestones with their advisor regularly, but at least once a year after receiving feedback from the Graduate Studies Committee.

It is also possible for students to be co-advised by more than one faculty member, as long as one of the advisors is a full-time faculty member in the Department of Computer Science. Co-advisors can include faculty members with adjunct appointments in the CS department. Additionally, any new co-advising arrangement must be supported with a mentoring plan approved by the Graduate Studies Committee. This mentoring plan will outline plans for financial support and how students will make progress through their degree milestones.

## PhD Committee

During the student's fourth semester, the student and the faculty advisor draft a proposed list of members of the student's PhD committee. The proposed committee must be approved by the Graduate Studies Committee. Initially, the PhD committee consists of at least three faculty members: the Computer Science faculty advisor and two additional faculty members. Two of these committee members must be full-time faculty members from the Department of Computer Science. The third committee member may be a Tulane faculty member from outside the Department of Computer Science, as appropriate. This committee administers the qualifying oral examination, attends the prospectus presentation and approves the written prospectus, and attends the thesis defense.

During the summer before the student's third year, a fourth member of the committee is recruited. This member must be external to Tulane. The external committee member must attend the student's prospectus presentation, approve the written thesis and attend the thesis defense. A requirement for the thesis committee is that at least three of the members, have a terminal (i.e., PhD) degree.

The PhD Committee provides advice and guidance throughout the student's course of study, oversees the qualifying exam, the prospectus, and the dissertation defense.

## Oral Qualifying Exam

The oral qualifying exam typically takes place in the fifth semester, administered by the PhD committee. Before taking the oral qualifying exam, the student must have completed the core requirements as well as the interdisciplinary project. The PhD committee compiles a reading list the student is responsible for in the oral qualifying exam. The purpose of this exam is to ensure the student is qualified to do independent research. The student is tested over a set of selected topics related to the student's research area. The student is informed about the material covered on the exam during the semester preceding the exam. The exam may start with a short presentation by the student and is followed by questions from the committee. The oral qualifying exam must be passed before the end of the fifth semester; it can be retaken at most once.

## Prospectus

At the beginning of the student's seventh semester, the PhD committee attends an oral prospectus presentation given by the student. In the presentation, the student describes the central problem that will be addressed in the dissertation, including the background needed to place the problem properly in perspective. The purpose of the presentation is to give the student feedback about the proposed problem(s), evaluate progress and the overall plan for the dissertation work, and finally to provide constructive feedback. The written component of the prospectus is a 10-15 page document that summarizes these points and is approved by the advisor and PhD committee. Upon successful completion of the Prospectus, candidacy forms and the written prospectus are submitted for departmental and SSE approval.

## Dissertation Research and the Dissertation

After passing the oral qualifying exam, a student focuses primarily on research in a particular area in which they have chosen to do their dissertation research, participating in research projects overseen by their advisor. In many cases, the student co-authors papers in conferences and journals about the research results obtained during these research activities. Then the dissertation will comprise a compilation of the results, with the expectation that the student utilizes the dissertation to present the material as a coherent theme. A draft of the thesis must be circulated to the PhD committee at least one month before the final version is due in the School of Science and Engineering, and the committee will render a verdict on whether the dissertation meets the standards to be accepted for the PhD degree.

## Example Schedule

In this example schedule, 48 credit hours (typically 16 classes of 3 credit hours each) are composed of:

- 9 credit hours of core classes:
  - Shown as CMPS 6610 Algorithms (3 c.h.), CMPS 6750 Computer Networks (3 c.h.), CMPS 6620 Artificial Intelligence (3 c.h.)
- 9 credit hours of research courses:
  - Shown as one offering of CMPS 7010 Research Seminar (3 c.h.) and two of CMPS 7020 Research in Computer Science (3 c.h.)
- 9 credit hours for the interdisciplinary project:
  - Shown as CMPS Elective, Non-CMPS Elective, CMPS 7021 Research in Computer Science (3 c.h.)
- 9 credit hours of Computer Science electives and 12 credit hours of general electives

|                           |                              | Credit Hours |
|---------------------------|------------------------------|--------------|
| <b>Year 1</b>             |                              |              |
| <b>Fall</b>               |                              |              |
| CMPS 6610                 | Algorithms                   | 3            |
| CMPS 6620                 | Artificial Intelligence      | 3            |
| CMPS 7010                 | Research Seminar             | 3            |
| <b>Credit Hours</b>       |                              | <b>9</b>     |
| <b>Spring</b>             |                              |              |
| CMPS 6750                 | Computer Networks            | 3            |
| CMPS 7020                 | Research in Computer Science | 3            |
| CMPS Elective             |                              | 3            |
| <b>Credit Hours</b>       |                              | <b>9</b>     |
| <b>Year 2</b>             |                              |              |
| <b>Fall</b>               |                              |              |
| CMPS 7020                 | Research in Computer Science | 3            |
| CMPS Elective             |                              | 3            |
| Non-CMPS Elective         |                              | 3            |
| <b>Credit Hours</b>       |                              | <b>9</b>     |
| <b>Spring</b>             |                              |              |
| CMPS 7021                 | Research in Computer Science | 3            |
| CMPS Elective             |                              | 3            |
| CMPS Elective             |                              | 3            |
| <b>Credit Hours</b>       |                              | <b>9</b>     |
| <b>Year 3</b>             |                              |              |
| <b>Fall</b>               |                              |              |
| General Elective          |                              | 3            |
| General Elective          |                              | 3            |
| General Elective          |                              | 3            |
| <b>Credit Hours</b>       |                              | <b>9</b>     |
| <b>Spring</b>             |                              |              |
| General Elective          |                              | 3            |
| <b>Credit Hours</b>       |                              | <b>3</b>     |
| <b>Total Credit Hours</b> |                              | <b>48</b>    |

**Contact**

For more information, contact the School of Science and Engineering (<https://applygrad.tulane.edu/register/SSEInquiry/>).