PhD in Computer Science Program Guide
Marquette University

This document outlines PhD in Computer Science program expectations and requirements.

1. **45 credit hours** of approved course work beyond a bachelor's degree in Computer Science or a related field:
   ○ 2 credit hours of research methods/professional development class completed by the end of the second year.
   ○ 6-8 credit hours of COSC 6974 Practicum for Research and Development in Computer Science or COSC 6960 Seminar in Computer Science.
   ○ 35-37 credit hours of electives. Elective course work must be chosen based on **mutual agreement** of the student and his or her adviser's mutual research interests. Each student is advised to take such courses as are properly related to academic background and research interests. No more than 18 credit hours may be taken at the 5000 level.
2. Students must pass PhD Qualifying, Proposal, and Dissertation.
3. 12 credit hours of PhD Dissertation.
4. Students must follow all the graduate school forms and directions listed under "Doctoral Program Forms and Directions" at : https://www.marquette.edu/grad/forms.php
5. Students must submit the "Doctoral Program Planning Form" to the Graduate School no later than the end of the second semester.
6. PhD Qualifying Exam

   The PhD Qualifying Exam tests the students' ability to survey, synthesize and critically evaluate a selected research area. Students are expected to conduct a deep literature review of a particular topic and then write a written survey report of the research area. Students must defend the survey in a professional oral presentation and answer questions about the topic.

PhD Qualifying Exam Steps

- The PhD Qualifying Exam must be attempted by the end of the student's fourth semester. The student must submit the "PhD in Computer Science – Qualifying/Proposal Exam Form" to the Graduate Committee Chair at least 14 weeks before their expected PhD Oral Qualifying Exam date with the intention to take the exam. The student must also select a research topic in consultation with their research advisor and inform the Graduate Committee Chair of the topic. At this time, the student must also form the Qualifying Exam Committee (approved by the Graduate Committee Chair).
- The Qualifying Exam Committee must consist of 3 members of which at least 2 must be COSC faculty members, where the chair or co-chair must be a COSC tenure-track/tenured research active faculty member. We recommend that at least one member of the committee be working on the selected research topic.
- The Qualifying Exam is typically offered in April/May and then in Nov/December.
- The Qualifying Exam Committee Chair will give the student 3-5 seminal research papers in the student's selected research topic within 2 weeks of the student announcing the intention to take the exam.
- Once the seminal research papers are given to the student, the student has about 8-10 weeks to prepare for the Qualifying Exam.
- As part of the preparation, students will not only read the given papers but also find other related papers by consulting the references or by conducting general literature searches of the area. The suggested number of relevant papers to read is about 30.

- In a good literature review, the student does not merely report the results and findings from the papers one reads, rather organizes, and synthesizes results as a cohesive whole. The cohesive whole may
    - Identify common themes/approaches that different research papers have taken in the field.
    - Compare and contrast techniques and approaches in the field highlighting advantages/shortcomings of such techniques.
    - Formulate well-reasoned opinions about what is upcoming in the selected research topic.
- The written report must be 10-15 pages in length not counting the references section with 10-12 font size and single line spacing with 1" margins all around on a US Letter (8.5" X 11"). The written report must be submitted to the Qualifying Exam Committee at least one week before the Qualifying Oral Presentation.
- The student will prepare a 30-40-minute qualifying oral presentation summarizing the literature review followed by additional time for questions by the committee. We ask the student to reserve one hour for the qualifying exam.
- There are only two outcomes for the PhD Qualifying Exam: Pass or Fail. Students must pass the exam in at most two attempts. The second attempt, if necessary, must be made no later than the semester following the first attempt. If the student fails the qualifying exam twice, he/she is asked to leave the program with a master's degree in computing contingent on meeting the corresponding degree requirements.
- Once the student passes the PhD Qualifying Exam, the doctoral mentor will fill out and submit the "Advancement to Candidacy" form to the Graduate School.

7. PhD Proposal Exam

- The PhD Proposal exam must be taken by the end of the student's fifth semester. If the student is ready, **we strongly encourage the PhD Proposal exam to be attempted at the same time as the qualifying exam - the student's fourth semester.**
- The PhD Proposal exam consists of a written research proposal of a topic for dissertation and an oral defense of the proposal. The written proposal normally contains a clear problem statement, proposed methods of solution, review of related work, preliminary results of the research work, and a detailed research plan with a specified timeline.
- The student must form the PhD Dissertation Committee (with approval from the Graduate Committee) at least four weeks before the PhD proposal exam date.
- The written research proposal report must be 10-15 pages in length not counting the references section with 10-12 font size and single line spacing with 1" margins all around on a US Letter (8.5" X 11"). The written proposal report must be submitted to the Dissertation Committee at least one week before the oral defense of the proposal.
- The student must prepare a 30-40-minute oral presentation defense of the proposal followed by additional time for questions by the committee. We ask the student to reserve one hour for the defense of the proposal.
- If the student is attempting the PhD Proposal Exam at the same time as the PhD Qualifying Exam, the student must prepare for 50 minutes of combined oral presentation defense followed by additional time for questions by the committee. We ask the student to reserve 75 minutes for the combined oral presentation defense. The student must consult the dissertation mentor for the exact time length and logistics of the presentation.
- Students must pass the PhD Proposal exam in at most two attempts. The second attempt, if necessary, must be made no later than the semester following the first attempt.
- If a student fails the PhD proposal exam twice, he/she is asked to leave the program with a master's degree in computing contingent on meeting the corresponding degree requirements.
- Once the student passes the PhD proposal exam, the student must submit the dissertation outline form to the graduate school.

8. PhD Dissertation Committee

- The PhD Dissertation Committee must consist of 3 to 5 members of which at least 2 members are Marquette COSC faculty members. The committee chair or co-chair has to be a COSC tenure-track/tenured research active faculty member.

9. PhD Dissertation

- Students must conduct original research leading to a dissertation. This final step consists of a written dissertation report and an oral defense.
- The written dissertation report must demonstrate extensive research and original contribution to knowledge in a given field. The written report must be submitted to the Dissertation Committee at least two weeks before the oral defense of the dissertation.
- The student must prepare a 45-50-minute oral presentation defense of the dissertation followed by additional time for questions. We ask the student to reserve one hour for the defense of the dissertation.
- Students must follow graduate school deadlines in making formal announcements for public defense of their dissertation.
- Once the student passes the PhD Dissertation, the doctoral mentor will fill out and submit the "Dissertation Approval" form to the Graduate School.
- Students must follow all the doctoral dissertation directives mentioned on the graduate school website.

10. Graduate Committee Annual Review

- The Graduate Committee evaluates the progress of all graduate students with respect to coursework, and research.
- Full-time students are expected to attend at least 75% of computer science department colloquia (verified by a sign-in sheet).
- Students are expected to document their research progress once a year to the Graduate Committee.
- The result of the annual review is one of the three: 1) exceeds expectations, 2)meets expectations, and 3) does not meet expectations. A student who receives two consecutive "does not meet expectations" review will be dismissed from the program.
- Full-time students are expected to graduate in 4-5 years. Normally, support is made for the first four years, and the student must request support for the fifth year. Sufficient progress toward the degree to warrant a fifth year of funding will be determined by the Graduate Committee.

Suggested Data Science and Analytics track Ph.D. curriculum

Fall semester 1st year	Spring semester 1st year
COSC 5800 Principles of Database Systems (3)	COSC 6060 Parallel and Distributed Systems (3)
COSC 6260 Advanced Algorithms (3)	COSC 5610 Data Mining (3)
COSC 6090 Research Methods/Professional Development (1)	COSC 6960 Research Seminar in Computer Science (1-2)

Fall semester 2nd year	Spring semester 2nd year
COSC 6510 Business Intelligence (3)	COSC 5500 Advanced Data Science (3)
COSC 6330 Advanced Machine Learning (3)	COSC 6380 Advanced Database Systems (3)
COSC 6090 Research Methods/Professional Development (1)	COSC 6995/ COSC 6390 Independent Study or Professional Seminar in Computing (1-2)
COSC 6995/ COSC 6390 Independent Study or Professional Seminar in Computing (1-2)	Qualifier Exam & Research Proposal
Fall semester 3rd year	**Spring semester 3rd year**
COSC 6360 Enterprise Architecture (3)	COSC 6540 Data Analytics (3)
COSC 6960 Research Seminar in Computer Science (3)	COSC 6960 Research Seminar in Computer Science (3)
COSC 6995/ COSC 6390 Independent Study or Professional Seminar in Computing (1-2)	COSC 8999 Doctoral Dissertation (3)
[Research Proposal]	
Fall semester 4th year	**Spring semester 4th year**
COSC 8999 Doctoral Dissertation (3)	COSC 8999 Doctoral Dissertation (6)
COSC 6530 Concepts of Data Warehousing (3) COSC 9999 Doctoral Dissertation Continuation (0)	COSC 9999 Doctoral Dissertation Continuation (0)

- Practicum for Research in Computer Science (COSC 6974) may be taken in place of the Research Seminar in Computer Science.

Suggested Systems track Ph.D. curriculum

Fall semester 1st year	Spring semester 1st year
COSC 6050 Elements of Software Development (3)	COSC 5360 Computer Security (3)
COSC 5300 Networks and Internets (3)	COSC 5610 Data Mining (3)
COSC 6090 Research Methods/Professional Development (1)	COSC 6960 Research Seminar in Computer Science (1-2)

Fall semester 2nd year	Spring semester 2nd year
COSC 6280 Advanced Security (3)	COSC 5500 Advanced Data Science (3)
COSC 6260 Advanced Algorithms (3)	COSC 6270 Adv. Operating Systems (3)
COSC 6960 Research Methods/Professional Development (1)	COSC 6995/ COSC 6390 Independent Study or Professional Seminar in Computing (1-2)
COSC 6995/ COSC 6390 Independent Study or Professional Seminar in Computing (1-2)	Qualifier Exam & Research Proposal
Fall semester 3rd year	Spring semester 3rd year
COSC 6550 Introduction to Cybersecurity (3)	COSC 6560 Principles of Service Management (3)
COSC 6960 Research Seminar in Computer Science (3)	COSC 6960 Research Seminar in Computer Science (3)
COSC 6995/ COSC 6390 Independent Study or Professional Seminar in Computing (1-2)	COSC 8999 Doctoral Dissertation (3)
[Research Proposal]	
Fall semester 4th year	Spring semester 4th year
COSC 8999 Doctoral Dissertation (3)	COSC 8999 Doctoral Dissertation (6)
COSC 6530 Concepts of Data Warehousing (3) COSC 9999 Doctoral Dissertation Continuation (0)	COSC 9999 Doctoral Dissertation Continuation (0)

- Practicum for Research in Computer Science (COSC 6974) may be taken in place of the Research Seminar in Computer Science.