

**PhD in Computer Science Program Guide
Marquette University
Effective from fall 2023**

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

1. Research Methods (2 credit hours)

- Two (2) credit hours of COSC 6090 - Research Methods/ Professional Development class must be completed by the end of the second year. COSC 6090 is a 1 credit hour class and must be taken twice to earn two (2) credit hours.

2. Core Course Work (15 credit hours)

Theory (select one) COSC 6260 - Advanced Algorithms (3) COSC 6330- Advanced Machine Learning (3)
Software Systems (select two) COSC 6060 - Parallel and Distributed Systems (3) COSC 6270 - Advanced Operating Systems (3) COSC 6280 - Advanced Computer Security (3) COSC 6380- Big Data Systems (3)
Applications (select two) COSC 6050 - Elements of Software Development (3) COSC 6580 Data Security and Privacy (3) COSC 6820 Data Ethics (3) Topics class in Human Computer Interaction - TBA (3)

3. COSC 6975 - Curriculum Integrated Practicum in Computer Science (0 credit hours)

- Students are required to enroll once in COSC 6975 – zero (0) credit hour course and may enroll up to a maximum of two times during their degree program.
- This course serves the intended purpose of advancing practical research and development of the student in relation to the degree program. This course is an integral part of the degree program by providing an opportunity for students to enrich student’s educational training in Computer Science with practical working experience while applying concepts learned in the degree program to the work environment. It is also envisioned that the students pick something new from the work environment and apply the practical knowledge to the concepts back in the class when they come back from the

practicum experience. Students may also choose to work on a real-world research application with strong implementation component with a faculty mentor in their research lab. In this case, the faculty mentor will be the student's Supervising Sponsor. Practicum sites include corporate offices, federal/state/local organizations, national laboratories, research labs, university labs, community-based organizations, non-profit organizations, and other relevant organizations.

4. Electives (28 credit hours)

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.

- A maximum of sixteen (16) credit hours of Seminar (COSC 6960) or Independent study (COSC 6995/8995) are allowed as electives. Only nine (9) of the sixteen (16) credit hours may be taken as independent study.
- A maximum of twelve (12) credit hours may be taken at the 5000 level.
- A maximum of six (6) credit hours may be taken outside the Department.

5. PhD Dissertation (12 credit hours)

- Students must complete 12 credit hours of COSC 8999 - Doctoral Dissertation. Students can start registering for Dissertation Credit hours around the time of their Qualifying Exam, but should not complete all 12 credit hours before passing the Qualifying Exam.
6. Students must pass PhD Qualifying, Proposal, and Dissertation.
 7. 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>
 8. Students must submit the "Doctoral Program Planning Form" to the Graduate School no later than the end of the second semester.
 9. The residency requirement for COSC doctoral students is met when the student has completed either (i) three consecutive semesters with a minimum of three credits of coursework each semester or (ii) three consecutive semesters with a minimum of one credit of COSC 6960 – Research Seminar in Computer Science or COSC 6090 - Research Methods/Professional Development in Computer Science each semester. Summer can be, but is not required to be, included to meet the residency requirement.
 10. Full-time students are expected to graduate in four (4) to five (5) years. Part-time students are expected to graduate in six (6) to eight (8) years. The timelines for Qualifier, Proposal, and Dissertation listed in this document are for full-time students. Part-time students should add additional one to two years to the timelines.
 11. 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 tenure-track/tenured 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 Computer Science contingent on meeting the corresponding degree requirements.

- Once the student passes the PhD Qualifying Exam and completes the lecture course work, the doctoral mentor will fill out and submit the “Advancement to Candidacy” form to the Graduate School.

12. 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.**
- It is expected that the student has published as a first author at least one peer reviewed manuscript in a reputed venue (workshop/conference/journal) before the Proposal Exam.
- 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 Computer Science 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.

13. PhD Dissertation Committee

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

14. PhD Dissertation

- Students must conduct original research leading to a dissertation. This final step consists of a written dissertation and an oral defense.
- It is expected that the student has published as a first author at least two peer reviewed manuscripts in reputed venues (workshop/conference/journal) before the PhD Dissertation.
- The written dissertation must demonstrate extensive research and original contribution to knowledge in a given field. The written dissertation 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.

15. 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” reviews 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	Summer semester 1st year
COSC 5800 Principles of Database Systems (3)	COSC 6060 Parallel and Distributed Systems (3)	
COSC 6260 Advanced Algorithms (3)	COSC 6380 Big Data Systems (3)	
COSC 6090 Research Methods/Professional Development (1)	COSC 6960 Research Seminar in Computer Science (1)	

<p>Fall semester 2nd year</p> <p>COSC 6510 Data Intelligence (3)</p> <p>COSC 6820 Data Ethics (3)</p> <p>COSC 6090 Research Methods/Professional Development (1)</p> <p>COSC 6960 Research Seminar in Computer Science (1)</p>	<p>Spring semester 2nd year</p> <p>COSC 5500 Visual Analytics (3)</p> <p>COSC 6330 Advanced Machine Learning (3)</p> <p>COSC 6960 Research Seminar in Computer Science (1)</p> <p>Qualifier Exam & Research Proposal</p>	<p>Summer semester 2nd year</p> <p>COSC 6975 Curriculum Integrated Practicum in CS (0)</p>
<p>Fall semester 3rd year</p> <p>COSC 6530 Concepts of Data Warehousing (3)</p> <p>COSC 6960 Research Seminar in Computer Science (4)</p> <p>[Research Proposal]</p>	<p>Spring semester 3rd year</p> <p>COSC 6540 Data Analytics (3)</p> <p>COSC 6960 Research Seminar in Computer Science (3)</p> <p>COSC 8999 Doctoral Dissertation (1)</p>	
<p>Fall semester 4th year</p> <p>COSC 8999 Doctoral Dissertation (4)</p> <p>COSC 6960 Research Seminar in Computer Science (3)</p>	<p>Spring semester 4th year</p> <p>COSC 8999 Doctoral Dissertation (7)</p>	

Suggested Systems track Ph.D. curriculum

<p>Fall semester 1st year</p> <p>COSC 6050 Elements of Software Development (3)</p> <p>COSC 5300 Network Design and Security (3)</p> <p>COSC 6090 Research Methods/Professional Development (1)</p>	<p>Spring semester 1st year</p> <p>COSC 5360 Computer Security (3)</p> <p>COSC 5610 Data Mining (3)</p> <p>COSC 6960 Research Seminar in Computer Science (1)</p>	<p>Summer semester 1st year</p> <p>COSC 6975 Curriculum Integrated Practicum in CS (0)</p>
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<p>Fall semester 2nd year</p> <p>COSC 6260 Advanced Algorithms (3)</p> <p>COSC 6960 Research Seminar in Computer Science (3)</p> <p>COSC 6090 Research Methods/Professional Development (1)</p>	<p>Spring semester 2nd year</p> <p>COSC 6270 Adv. Operating Systems (3)</p> <p>COSC 6960 Research Seminar in Computer Science (4)</p> <p>Qualifier Exam & Research Proposal</p>	<p>Summer semester 2nd year</p> <p>COSC 6975 Curriculum Integrated Practicum in CS (0)</p>
<p>Fall semester 3rd year</p> <p>COSC 6280 Advanced Security (3)</p> <p>COSC 6960 Research Seminar in Computer Science (5)</p> <p>[Research Proposal]</p>	<p>Spring semester 3rd year</p> <p>COSC 6560 Principles of Service Management (3)</p> <p>COSC 6960 Research Seminar in Computer Science (3)</p> <p>COSC 8999 Doctoral Dissertation (3)</p>	
<p>Fall semester 4th year</p> <p>COSC 8999 Doctoral Dissertation (4)</p> <p>COSC 6550 Introduction to Cybersecurity (3)</p>	<p>Spring semester 4th year</p> <p>COSC 8999 Doctoral Dissertation (5)</p> <p>COSC 9998 Doctoral Dissertation Continuation (0)</p>	