

Computer Science Graduate Program Rules and Procedures  
*Michigan Technological University*

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## 1 Introduction

The purpose of this handbook is to provide students pursuing the M.S. or Ph.D. in Computer Science (CS) with an overview of the rules governing those programs. Note that the rules and procedures contained in this handbook are subject to change. Please see the Graduate Director of the Department of Computer Science for updates.

## 2 Ph.D. Policies and Procedures

### 2.1 Admission Requirements

Applicants should have a BS or MS degree in computer science or a related field (exceptions may be made for well-qualified applicants from other disciplines). Ph.D. program applicants should have a minimum GRE Verbal score in the 50<sup>th</sup> percentile, a minimum GRE Quantitative score in the 85<sup>th</sup> percentile, and a minimum GRE Analytical Writing score of 3.0. A TOEFL score above 580 is required for international applicants whose native language is not English.

## 2.2 Choosing an Advisor

Each student will have an Advisor who is a member of both the MTU graduate faculty and the Computer Science tenured/tenure-track faculty. The Advisor will have the primary responsibility for supervising the student's research project and for directing the student's academic and professional development.

Each student will have an Advisory Committee consisting of the student's advisor and at least three additional members. Two of the three may be from the Department of Computer Science. At least one committee member must be from outside the CS department. All Advisory Committee members from MTU must be members of MTU's Graduate Faculty. The Advisory Committee members will be selected by the Advisor in consultation with the student. An advisor should be chosen during the first or second year of residence. Until the advisor is chosen, the student will be advised by the CS Graduate Director.

## 2.3 Courses

The Ph.D. student must complete

- C1) An approved M.S. program in computer science,
- C2) A Ph.D. credit requirement, and
- C3) A graduate-level breadth requirement.

To complete the M.S. program requirement the student may complete one of the options listed in Section 3, or complete an approved M.S. at another university. To complete the Ph.D. credit requirement a student must complete a total of 30 credits of course work and/or *CS6990: Dissertation Research* beyond the M.S. program requirement. These courses must be approved by the Advisory Committee on the *Preliminary Program of Study* form available from the Graduate School.

### 2.3.1 Graduate-level Breadth Requirement

To complete the *graduate-level breadth* requirement, each Ph.D. student must satisfactorily pass five courses from the areas listed below. A maximum of one course per area is allowed.

**Compiler Optimization:** CS5130

**Parallel Algorithms:** CS5331

**Operating Systems:** CS5411, CS5441

**Computer Architecture:** CS5431

**Networks:** CS5461, CS6461

**Computer Graphics:** CS5611

**Human-Computer Interaction:** CS5760

**Artificial Intelligence:** CS5811

**Non-CS Graduate Course:** Requires approval

Courses not included on this list require the approval of the student's advisory committee and the Graduate Director to count toward the graduate-level breadth requirement. Satisfactory completion of the graduate-level breadth requirement involves attaining an A in three of the five chosen courses and at least an AB in the other two.

Individual courses may be used to satisfy more than one of the above three course requirements in one of two ways. First, a 5000- or 6000-level course may count toward requirements C1 and C3. Or second, a 5000- or 6000-level course may count toward requirements C2 and C3. A single course may not count toward all three requirements.

The Advisory Committee approves the required courses by first signing the *Preliminary Program of Study* and later approving the *Degree Schedule*. The *Preliminary Program of Study* form should be turned in during the second semester of residence. It is recommended that students finish all of their course requirements within the first two years of enrollment in the graduate program in Computer Science. Note that the graduate-level breadth requirement must be completed as part of the Comprehensives described in the next section.

### 2.3.2 Credit Transfer

A maximum of six course credits taken as a graduate student at other colleges or universities may be accepted for graduate credits towards Ph.D./MS of Computer Science at Michigan Tech. If these credits were taken before enrollment at Michigan Tech, a request for transfer credit should be made during the students first semester on campus. Transfer credits must be

- A. approved by a CS faculty member who teaches an equivalent course and by the graduate director, or by the graduate committee and by the students advisory committee;
- B. 10 years within the students first semester at Tech;
- C. with grade B or better;
- D. and taken from an accredited US university or an international university accepted by the graduate committee.

## 2.4 Comprehensive Examination

The comprehensive examination is given to determine the general knowledge appropriate to the student's program and the student's ability to use this knowledge. The exam has two components: the Technical Qualifying Evaluation and the Research Qualifying Exam (RQE).

### 2.4.1 Technical Qualifying Evaluation

The Technical Qualifying Evaluation has two components: coursework and the TQE exam. The coursework requirement is met by completing the graduate-level breadth requirement described in Section 2.3.1. The TQE exam has two component exams, one in *Computation Theory* and one in *Analysis of Algorithms*. Each component exam is a three-hour written exam.

Each component exam will be both written and graded by two graduate faculty chosen by the CS Department Graduate Director. The exams are offered immediately before the spring and fall

semesters each year. A student who receives an A in CS5311 is exempt from taking the exam in Computation Theory, and a student who receives an A in CS5321 is exempt from taking the exam in Analysis of Algorithms.

The topics covered on each of the exams are specified via a syllabus that is available from the Graduate Secretary. Preparation for both exams should include the successful completion of the following courses: CS5311 and CS5321. Although the exams are not specifically tied to a course, these courses provide excellent preparation for the material contained on each exam syllabus.

Each student has up to two attempts to pass the TQE exam. All students *must* take the entire TQE exam (both components) during the first attempt, which must occur at the end of the first year of enrollment in the Ph.D. program. A student may earn one of the following grades on each component exam: *pass*, *marginal*, or *fail*. Each student must earn a *pass* on one exam and at least a *marginal* on the other exam in order to pass the entire TQE Exam. Figure 1 summarizes the possible outcomes and requirements after a student’s first attempt at the TQE exam. If a component exam is taken multiple times, the *highest* grade of the two attempts is counted. If a second attempt to pass the TQE exam is required, a student *must* make that attempt during the next offering. Thus, each student has two opportunities in 1.5 years from enrollment in the Ph.D. program to pass the TQE exam.

|               |                 | <b>Algorithms</b> |                 |             |
|---------------|-----------------|-------------------|-----------------|-------------|
|               |                 | <i>pass</i>       | <i>marginal</i> | <i>fail</i> |
| <b>Theory</b> | <i>pass</i>     | A                 | A               | C           |
|               | <i>marginal</i> | A                 | D               | C           |
|               | <i>fail</i>     | B                 | B               | E           |

(a) Matrix

- A) Successful completion of Qualifier.
- B) Retake Theory Exam.
- C) Retake Algorithms Exam.
- D) Retake either exam.
- E) Retake both exams.

(b) Explanation

Figure 1: Possible Qualifier Outcomes

Requests for a time extension due to extenuating circumstances will be considered on an individual basis and must be submitted to the Graduate Director in a timely fashion. The Graduate Committee will determine if a time extension is to be granted. Note that student not ready to complete CS5311 and CS5321 within the first year will be granted a time extension in order to complete these courses. These students must submit their time-extension request to the Graduate Directory during their first year of Ph.D. studies.

Students with a B.S. or M.S. in CS or a closely related field have 1.5 years from the start of the first semester of enrollment in the CS Ph.D. program to pass the TQE exam. Students without a degree in a field closely related to CS will be given 2.5 years, but still only two attempts, to pass the TQE exam.

### 2.4.2 Research Qualifying Exam

The Research Qualifying Exam (RQE) is primarily given to determine the student’s ability to successfully conduct research in Computer Science. The RQE is an oral exam over a report written by the student that describes an original research project conducted by the student. The impact and scope of the result is not a primary factor in assessing the student’s ability. Instead, the exam

is intended to determine whether the student is able to work independently, think creatively, apply scientific principles, and to present and defend their work to the computer science community.

The RQE is conducted by three tenured and tenure-track faculty from the Department of Computer Science. A student may submit a list of suggested faculty for the RQE committee. The Director of Graduate Studies will ultimately assign an RQE committee taking into account the student's preferences, but also balancing faculty work loads and responsibilities. For students who have already formed a dissertation committee at the time of the exam, it is expected the CS faculty on the dissertation committee will also serve as the RQE examination committee.

**Report** The report should be in a format similar in content and scope to a conference or journal publication in the field. The report must be authored by the student and describe original research performed primarily by the student with input from the research advisor. The student may seek comments on the written report from the research advisor and from the MTU writing center. An MS thesis on research in computer science or a related field is an acceptable written report. The report must be provided to the RQE committee at least two weeks prior to the the oral examination.

**Letter** The student's research advisor should provide the examination committee with a letter that describes the manner in which the student conducted the research and give an appraisal of the quality of the research. The letter should contain an assessment of whether the advisor believes the student can successfully complete a PhD dissertation.

**Exam** The student will give a public oral presentation of the research results. The presentation must be announced two weeks prior to the exam. The committee determines the outcome of the exam and provides a written result to the student. The result can be *pass*, *conditional pass*, or *fail*. A *pass* indicates the student has completed the requirement. The committee may give a *conditional pass* when there are deficiencies that must be addressed. A conditional pass will be accompanied by a written list of conditions that must be met by the student in order for a *pass* to be awarded. A *fail* indicates that the student has failed the RQE. For students who complete their Masters thesis at MTU, it is expected that the RQE exam will be given at the same time as the thesis oral presentation.

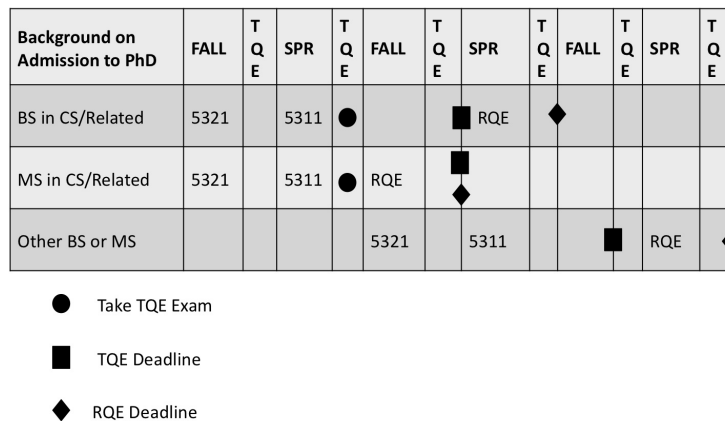


Figure 2: Expected Timeline to Completion of TQE Exam and RQE

For students who enter the PhD program without an MS, it is expected that the student will pursue the thesis option for the MS and the written document provided to the RQE committee will be the thesis. Students who enter without an MS may take up to nine credits of CS5990 to conduct research and develop a written report for the RQE.

**Deadline** A student who enters the PhD program with a BS in Computer Science or a related field has two years from the start of the first semester of enrollment in the PhD program to complete the RQE. A student who enters with an MS in Computer Science or a related field has one year and a semester to complete the RQE. A student with a BS or MS in an unrelated field has three years to complete the RQE.

Figure 2 gives the expected timeline to completion of the Technical Qualifying Exam and Research Qualifying Exam.

After completing both the Technical Qualification Evaluation and the Research Qualifying Exam, the student should submit the *Report on Comprehensives* form to the Graduate School.

## 2.5 Dissertation Proposal

The Dissertation Proposal Defense should be completed within 2 years of completing the Comprehensives and *must* be completed within 3 years of the Comprehensives. Requests for extensions to this limit must be submitted in writing to the Graduate Director.

### 2.5.1 Dissertation Proposal Defense

The Dissertation Proposal Defense involves preparing a written document and then presenting it orally in an open, public forum. The date and time of the proposal shall be announced at least two weeks in advance and the final version of the written proposal must be given to all Advisory Committee members at least two weeks in advance of the oral presentation. Furthermore, a copy of the proposal must be available in the CS Department office at least two weeks in advance of the oral presentation.

After the dissertation proposal is presented, the Advisory Committee must decide if the student is prepared to proceed to the dissertation research project. A 75% vote of *pass* is required for the student to pass the proposal. After passing the Dissertation Proposal Defense, the student should submit the *Approval of Dissertation Proposal* form to the Graduate School.

## 2.6 Dissertation Defense

### 2.6.1 Scheduling of the Final Oral Examination

Once the dissertation is written and the Advisory Committee's suggestions and comments have been incorporated by the student, it is time for the final oral examination. Four weeks prior to the final oral examination the student must give each member of the Advisory Committee a copy of the final dissertation. After each committee member has reviewed a copy of the dissertation and has determined that the copy is of oral exam quality, each should sign the *Scheduling of Final Oral Examination* form. This form and a copy of the dissertation are due in the Graduate School office two weeks before the final oral examination. After the *Scheduling of Final Oral Examination* form has been signed and at least two weeks before the final oral exam, a copy of the dissertation must be available in the CS Department office.

## 2.6.2 Final Oral Examination

The final oral examination is an open, public presentation of the student's research and research results. After the presentation, anyone in the general audience including members of the Advisory Committee may ask questions. Then, the general audience will be excused; those remaining will be Advisory Committee members or CS Faculty. Anyone in this restricted audience may ask questions. Finally, everyone is excused except the Advisory Committee and the student. Members of the Advisory Committee may ask further questions concerning the research and the student's Ph.D. program.

Finally, the student is excused, and the Advisory Committee must decide if the student passes or fails the final examination. A student passes the final oral examination if no more than one member of the Advisory Committee dissents and if the student addresses, in writing, the dissenting member's concerns to the satisfaction of the Advisor and the Dean of the Graduate School. The committee may make its passing contingent upon changes being made in the dissertation.

If the student fails, s/he may take the final examination a second time. A student must pass the final examination within two tries in order to continue in the program.

After passing the oral examination, the student submits to the Graduate School the *Report on Final Oral Examination*.

## 2.7 Timeline to Degree

Table 1 contains the timeline to the Ph.D. from entry into the program, by a student with an MS, assuming that no extensions are granted.

| Milestone  | Target Timeframe | Deadline  |
|--|------------------|-----------|
| Technical Qualifying Exam  | 1 year           | 1.5 years |
| Research Qualifying Exam   | 1 year           | 1.5 years |
| PhD Breadth Requirement<br>(Coursework for Technical Qualification Evaluation) | 2 years          | 3 years   |
| Proposal   | 3 years          | 5 years   |
| Dissertation   | 5 years          | 8 years   |

Table 1: Timeline to Ph.D.

## 3 Master of Science Policies and Procedures

### 3.1 Admission Requirements

The GRE is required of students who did not receive their degree from a U.S. institution. The GRE is strongly recommended for all other students. Minimum scores of 75% quantitative, 3.0 analytical writing and 50% verbal are required. A TOEFL score above 580 is required for international applicants whose native language is not English.



## 3.2 Course Work Requirements

All MS students must satisfy a theory and breadth requirement. The theory requirement is satisfied by successful completion of CS5311 and CS5321. The breadth requirement is satisfied by successful completion of two graduate or senior-level-undergraduate courses in each of Category A and Category B listed in the Table 2. Within each category, the courses must come from two different areas.

| Category   | Area                       | MTU Courses            |
|------------|----------------------------|------------------------|
| Category A | Languages & Compilers      | CS4121, CS4130, CS5130 |
|            | Operating Systems          | CS4411, CS5411, CS5441 |
|            | Computer Architecture      | CS4431, CS5431         |
|            | Networks                   | CS4461, CS5461, CS6461 |
|            | Performance Analysis       | CS5481                 |
| Category B | Parallel Algorithms        | CS4331, CS5331         |
|            | Computer Graphics          | CS4611, CS5611         |
|            | Software Engineering       | CS4710, CS4711, CS4712 |
|            | Artificial Intelligence    | CS4811, CS5811         |
|            | Security                   | CS4471                 |
|            | Database                   | CS4421                 |
|            | Human-Computer Interaction | CS4760, CS5760         |

Table 2: M.S. Breadth Requirement

Courses taken to fulfill requirements for an undergraduate degree may be used to fulfill the breadth requirement; however, the credits may not be counted toward the M.S. degree. For students who have received their undergraduate degree someplace other than MTU, courses taken at one's undergraduate university in the above areas may be used to complete the breadth requirement. The MTU faculty member whose expertise is in the area of the non-MTU course under consideration for the breadth requirement must approve the course as acceptable. Students wishing to count non-MTU courses toward the requirement must complete the "Breadth/Depth Requirement Form" that can be obtained from the Computer Science Graduate Secretary.

Any CS course not listed in Table 2 will not count for graduate credit without the permission of the Graduate Director. Note that students who are deficient in computation theory and are not prepared to take CS5311 may take CS3311 for graduate credit. Approval of the Graduate Director is required before signing up for CS3311. Courses outside the Department of Computer Science may also be counted towards the M.S. degree with the permission of a student's advisor and the Graduate Director.

### 3.2.1 Credit Transfer

Please refer to Section 2.3.2.

### 3.3 Degree Options

Students may select from among three options for completion of the MS degree: the thesis option, the report option, and the course work option. These options are described in detail below.

#### 3.3.1 Thesis Option

The CS Department allows up to 9 of the 30 hours of credit required for graduation to be in CS5990. In addition to completing the 30 hours of credit in approved courses (including CS5990 and up to 3 hours of CS5999 credit though not more than 9 total hours may be taken in CS5990 and CS5999), a student following the thesis option is expected to:

1. Prepare a written plan describing the thesis research.
2. Defend the research plan in an oral seminar presentation or meet with the advisory committee to discuss the research plan. The student and her/his advisor will determine whether the plan is to be presented in a department-wide seminar, or will be presented to faculty members individually.
3. Prepare a final thesis.
4. Defend the thesis in an oral seminar presentation.

The department recommends the following timetable for the milestones along the way to a thesis masters. (Note: items marked with a '+' are milestones; items marked with a '\*' are requirements.)

- + find a thesis advisor during the first year in the program.
- + present a thesis plan by the end of the 3rd semester in residence (not counting summers).
- \* provide a defensible thesis to the entire committee no later than two weeks prior to the thesis defense. In addition, make a copy available in the CS main office for other interested parties.
- \* defend the thesis in a public forum. This includes two question and answer sessions: the first consists of both students and faculty; the second being closed to the general audience consists of faculty only.

#### 3.3.2 Report Option

The report option allows up to 6 of the 30 hours of credit required for graduation to be in CS5990. In addition to completing the 30 hours of credit in approved courses (including CS5990 and up to 3 hours of CS5999 credit), a student following the report option is expected to: work on a project and present written and oral project reports at the conclusion of the project. Thus, the student should

1. Prepare a written project plan which describes any background work necessary for completion of the project and a project plan.
2. Present the project plan to the advisory committee.

3. Prepare a final report at the conclusion of the project.
4. Defend the project report in a public oral seminar presentation.

The department recommends the following timetable for the milestones along the way to a report masters. (Note: items marked with a ‘+’ are milestones; items marked with a ‘\*’ are requirements.)

- + find a major advisor during the first year in the program.
- + present a project plan by the end of the 3rd term in residence (not counting summers).
- \* provide a “defendable” project report to the entire committee no later than two weeks prior to the oral defense. In addition, make a copy available in the CS main office for other interested parties.
- \* defend the report in a public forum. This includes two question and answer sessions: the first consists of both students and faculty; the second being closed to the general audience consists of faculty only.

### **3.3.3 Course Work Option**

The course work option requires 30 hours of graded course work. None of the 30 hours of credit required for graduation may be in CS5990 and no more than 3 hours of CS5999 credit may be applied to the 30-hour requirement. Course work option students have the graduate director as their advisor.