

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 MS or PhD in Computer Science (CS) with an overview of the rules governing those programs. Students should also familiarize themselves with the degree requirements set forth by the Graduate School. The requirements set by the Graduate School supersede any policies contained in this handbook. The Graduate School requirements are given at <https://www.mtu.edu/gradschool/policies-procedures/requirements/>. 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 Admission Requirements

2.1 PhD 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).

The department anticipates that successful PhD program applicants will have a GRE Verbal score above the 50th percentile, a GRE Quantitative score above the 85th percentile, and a GRE Analytical Writing score above 3.0. There is no minimum GRE score for admission. A TOEFL score at least 79 (IBT) or 6.5 (IELTS) is required for international applicants whose native language is not English. A TOEFL score at least 94 (IBT) or 7.0 (IELTS) is required for financial support. All applicants whose highest degree is not from a university or college in the US *must* submit GRE test scores.

2.2 MS Admission Requirements

All applicants whose highest degree was not from a college or university in the US, *must* submit GRE test scores. The department anticipates that successful applicants will have a GRE quantitative score above the 75th percentile, an analytical writing score above 3.0 and a verbal score above the 50th percentile. There is no minimum GRE score for admission. A TOEFL score at least 79 (IBT) or 6.5 (IELTS) is required for international applicants whose native language is not English. A TOEFL score at least 94 (IBT) or 7.0 (IELTS) is required for financial support.

3 PhD Policies and Procedures

3.1 Advisor and Committee

Each student will have an advisor that is a member or affiliated member of the Department of Computer Science Faculty. Each student will have a committee composed of the advisor and at least three additional members. Two of the members must be on the Computer Science Department Faculty. At least one committee member must be from outside the Department of Computer Science. A member is considered outside the Department when one of the following holds:

- they do not have an academic appointment in the CS department,
- their academic appointment is less than 50% in the CS department,
- they are affiliated faculty in the Department of Computer Science, or

- they are adjunct faculty.

All committee members must be on the MTU 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 year of residence. Until the advisor is chosen, the student will be advised by the Director of Computer Science Graduate Programs.

3.2 Change of Advisor

Before initiating the process to change your graduate advisor, please consider all the options listed on the Graduate School's website for how to address difficulties in the student-advisor relationship (<https://www.mtu.edu/gradschool/resources-for/students/academic/succeeding/index.html>).

Once you have decided to change your graduate advisor, you must follow the steps listed below.

1. Meet with your graduate program director to initiate the process to change advisor. If meeting with the graduate program director is not feasible or appropriate, meet with the department chair.
2. Discuss the following with the graduate program director (or Chair) and, if appropriate, the current advisor:
 - Whether additional resources within or outside the department (such as the Ombuds office) could help resolve the situation.
 - The impact of the change of advisor on your time to complete the degree. Coursework, qualifying exam(s), and the research proposal examination are all factors that could be impacted with a change in advisor.
 - Your current and future funding.
 - Research already conducted. Whether this will be incorporated into the dissertation, thesis, or report, and if so, how.
 - Impact on immigration status (if any). Consult International Programs and Services (IPS), if necessary.
 - Record the agreement from the discussions in writing, including indications of agreement from all affected faculty advisors, and provide copies to the student, the graduate program director, and all affected faculty advisors.
3. File an updated Advisor and Committee Recommendation Form for approval by the Graduate School (<https://www.mtu.edu/gradschool/documents/policies-procedures/forms/advisor-committee.pdf>).
4. If the student and the graduate program director are unable to reach agreement on the advisor change, contact the assistant dean of the Graduate School to determine additional steps to resolve the situation.

3.3 Coursework Requirements

The PhD student must complete

- C1) an approved MS program in computer science,

C2) a PhD credit requirement, and

C3) a PhD breadth requirement.

To complete the MS program requirement, the student may complete one of the options listed in Section 4 or complete an approved MS at another university.

To complete the PhD credit requirement a student must complete a total of 30 credits of regular course work and/or *CS6990: Dissertation Research* beyond the MS program requirement. These courses must be approved by the Advisory Committee. It is recommended the student complete the Graduate School PhD Degree Schedule form and discuss the form with the advisor during the first year. Note that the form is not submitted to the Graduate School until the semester prior to moving to full time research mode or before the final oral defense.

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

3.3.1 PhD Breadth Requirement

To complete the PhD Breadth requirement, each PhD student must satisfactorily pass CS5311, CS5321, three courses from three separate areas out of areas B, C, D, E, given in Table 1, and two specialty courses recommended by the student's advisory committee. The specialty course can be from the same area listed in Table 1. A graduate-level course not listed in Table 1, including a non-CS course, can be counted as a specialty course with the student's advisory committee and the graduate director's approval. Satisfactory completion of the PhD Breadth requirement requires an average GPA of 3.5 across the seven breadth and specialty courses.

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. The PhD Breadth requirement must be completed before a student can enter research-only mode.

3.3.2 Credit Transfer

A maximum of six course credits taken as a graduate student at other colleges or universities may be accepted for graduate credit towards PhD/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 student's first semester on campus. Transfer credits must be

- approved by a CS faculty member who teaches an equivalent course and by the graduate director, or by the graduate committee and by the student's advisory committee;
- within 10 years of the student's first semester at Tech; and
- completed with a grade of B or better.

Transfer credit may be used to satisfy the PhD or MS Breadth Requirement. A request for transfer credit should be made to the graduate director.

A: Theory and Algorithm	CS5311: Computational Theory
	CS5321: Advanced Algorithms
	CS5331: Parallel Algorithms
	CS5341: Quantum Computing
B: Systems	CS5130: Compiler Optimization
	CS5431: Advanced Computer Architecture
	CS5411: Advanced Operating Systems
	CS5441: Distributed Systems
	CS5461: Mobile Networks
	CS5481: System Performance Analysis
	CS5496: GPU and Multi-core Programming
	CS5811: Advanced Artificial Intelligence
C: AI/ML/Data Analysis	CS5841: Machine Learning
	CS5821: Computational Intelligence
	CS5831: Advanced Data Mining
D: Graphics/HCI	CS5611: Advanced Computer Graphics
	CS5631: Data Visualization
	CS5641: Immersive Virtual Environments
	CS5760: User Interfaces and HCI
	CS5770: Affective Computing (shelved)
E: Cybersecurity	CS5471: Computer Security
	CS5472: Advanced Topics in Computer Security
	CS5740: Development of Trusted Software

Table 1: List of Breadth Courses

3.4 Qualifying Examination

The Qualifying Examination identifies whether a student has the general knowledge appropriate to the student’s program, as well as the student’s ability to use this knowledge. The exam has two parts: the Coursework Requirement and the Research Qualifying Exam (RQE).

After completing both parts of the Qualifying Examination, a student should submit the *Report on Qualifying Examination* form to the Graduate Secretary for the Department of Computer Science.

3.4.1 Coursework Requirement

The coursework requirement is met by completing the PhD breadth requirement described in Section 3.3.1.

3.4.2 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

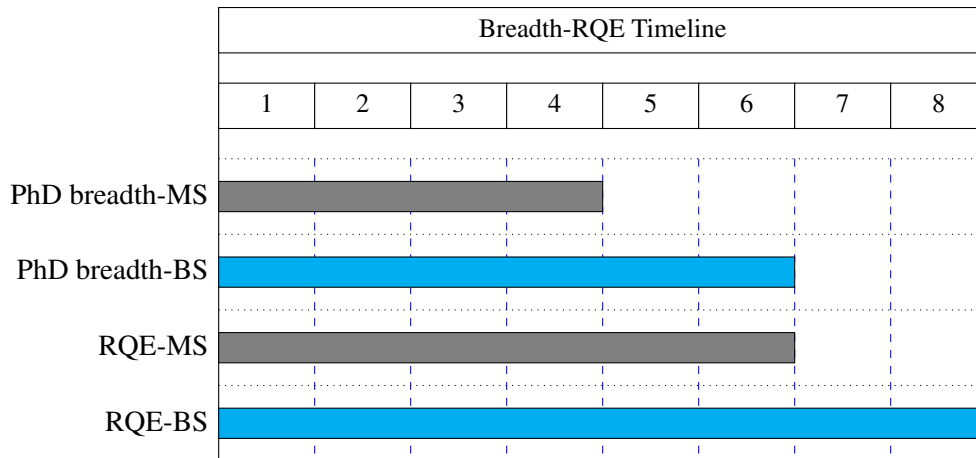


Figure 1: Timeline For Completion of PhD Breadth Requirement and Qualifying Examination

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.

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. 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.

Report The report should be in a format similar 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.

Exam The student will give a public oral presentation of the research results. The presentation must be announced two weeks prior to the exam. Section 6.1 describes the expected process for scheduling an oral presentation.

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.

3.5 Coursework and Qualifying Exam Timeline

This section describes deadlines for completing the PhD Breadth Requirement and the Research Qualifying Examination. Requirements are given for students with a BS or MS in CS or a closely related field. Other students should work with the Graduate Director during the first term of enrollment to identify the required timeline for completion of the Qualifying Examination.

These deadlines mark the **maximum acceptable time** for completion. Failure to meet one of these deadlines may result in removal from the program.

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.

Coursework Students with an MS in CS or a closely related field must complete the PhD breadth requirement within 2 years of enrollment in the PhD program. Students with a BS in CS or a closely related field must complete the PhD breadth requirement within 3 years from the first semester of enrollment.

RQE Students with an MS in CS or a closely related field must complete the RQE within 3 years of enrollment in the PhD Program. Students with a BS in CS or a closely related field must complete the RQE within 4 years from the first semester of enrollment in the PhD program.

Figure 1 depicts the timeline for completion of the PhD Breadth Requirement and the Research Qualifying Examination. It shows the number of semesters (excluding summer) of enrollment after which each of the requirements (Breadth, RQE) must be met. The MS and BS suffixes respectively denote PhD students entering with an MS and PhD students entering with a BS in CS or a closely related field.

3.6 Dissertation Proposal

3.6.1 Dissertation Proposal Defense

The purpose of the dissertation proposal and defense are:

- for the student to isolate and formulate a particular problem or a small set of particular, related problems whose solution is important to the research community and whose solution is significant enough to merit being called doctoral research,
- for the student to assimilate background information to demonstrate understanding of the research that has been done on the problem(s) and how to proceed,
- for the Advisory Committee to decide if the student has done the first two items sufficiently well,
- for the Advisory Committee to make suggestions as to
 - additional background information which should be considered
 - how the research problem(s) should be modified, and/or
 - how the proposed methods of investigation should be modified,

and

- for the Advisory Committee to decide, if the proposed research goes as planned, will the results be worthy of doctoral research.

The first two items are, of course, interrelated. A student needs to do background studies to isolate and formulate research problem(s) and learn which research methods are appropriate to potentially (help) solve the proposed research problems.

The Dissertation Proposal Defense involves preparing a written document and then presenting it orally in an open, public forum. At least two weeks prior to the oral examination, the student will:

- announce the date, time and location of the proposal to the Department of Computer Science faculty and graduate students (e.g. by email),
- give a final version of the written proposal to all the Advisory Committee members, and
- make a copy of the proposal available to all faculty and graduate students in the Department of Computer Science.

The report can be distributed electronically or a hard copy may be made available. An oral defense may be cancelled if these requirements are not met. Section 6.1 describes the expected process for scheduling an 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 complete and submit the departmental *Report on Research Proposal Examination* form.

3.6.2 Timeline

The Dissertation Proposal Defense should be completed within 1 year of completing the Qualifying Examination and *must* be completed within 2 years. Additionally, the Dissertation Proposal Defense should be completed within four years of entering the PhD program and must be completed within five years. Requests for extensions to this limit must be submitted in writing to the Graduate Director.

3.7 Candidacy

A student should petition to enter candidacy after completing all regular coursework, the Breadth Requirement, the Research Qualifying Examination, and the Dissertation Proposal Defense. Upon entering candidacy, a student may register for research credits at the research mode rate. A student enters candidacy after completing the Petition To Enter Candidacy form available from the Graduate School.

3.8 Dissertation Defense

3.8.1 Research Review

At least three months before the (planned) final oral defense or examination, the student and the Advisory Committee are **encouraged** to meet for a research review. The research review may be done at the request of the student or the student's Advisory Committee. The research review is an opportunity for the student to present the PhD dissertation research to the committee. Though the student may very well obtain additional

research results between the research review and the oral defense, research presented at the research review should be sufficient for a PhD dissertation. The purposes of the research review are to:

- force the student to bring all the research together in a unified form,
- allow the Advisory Committee to see the research as a unified whole,
- give the Advisory Committee members the opportunity to make suggestions for good ways of organizing and presenting the results in the dissertation, and
- give the Advisory Committee the opportunity to raise any concerns they have regarding the research and proposed presentations in the dissertation.

In preparation for this review the student should prepare an outline of the research accomplishments. This outline should be given to all committee members at least one week prior to the research review.¹ However, not all results may be sufficiently or properly written for inclusion in the eventual dissertation. For some types of research, the results are written up as the research progresses. However, for other types of research, the experiments are performed and the research data are gathered before any results can be written up.

It is hoped after the research review that the substance and quality of the research will be sufficiently evident so that there is little question of the research being “doctoral research”. However, this does not guarantee that the student will pass the oral examination. Advisory Committee members have the responsibility to raise questions about the research whenever they discover problems or concerns. However, since a primary focus of the research review is to anticipate potential difficulties, the Advisory Committee should make every effort to identify any potential problems at the research review. Of course, if and when an Advisory Committee member does discover a problem, s/he should mention this to the student as soon as possible.

Further, since the passing or failing of the final examination may in part be determined by the presentation of the research, the student and Advisory Committee should during the research review discuss the dissertation format and how the research will be presented in the dissertation. It should, of course, be mentioned that the research itself is more important than its presentation, but the presentation is important. In fact, the understanding of the research and its significance are affected by the presentation.

There is no passing or failing of the research review, but the student should try to ensure that each committee member is satisfied with the student’s research. Any questions in the student’s mind should be resolved with the appropriate committee member(s). Further, any committee questions concerning the research should be resolved with the student at this time. Questions from both the student’s side and the committee members’ sides should be resolved before the student prepares the final drafts of the dissertation.

3.8.2 Writing the Dissertation

After the research review the student’s main efforts should be directed towards writing the dissertation itself. The level of Advisory Committee involvement should be agreed upon by the Advisory Committee and the student at the research review.

In some cases, the student may send drafts of individual chapters to each Advisory Committee member. In others, the student may share several complete dissertation drafts with the advisor, incorporating the advisor’s suggestions and comments, *before* the rest of the Advisory Committee sees any part of the dissertation.

¹The student may have much of the dissertation written, but for the research review s/he should prepare an outline of results. The student is, of course, welcome to give committee members research that has been written in addition to the outline.

No matter what model of interaction is agreed upon, however, the student should realize that substantial time might be required to incorporate the suggestions and comments of the Advisory Committee.

3.8.3 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 planned 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, the student should schedule the oral defense. At least two weeks prior to the oral defense, the student must:

- announce the date, time and location of the dissertation to the Department of Computer Science faculty and graduate students (e.g. by email),
- complete the scheduling of final oral examination through <https://mymichigantech.mtu.edu>, and
- make a copy of the dissertation available to all faculty and graduate students in the Department of Computer Science.

The dissertation can be distributed electronically or a hard copy may be made available. An oral defense may be cancelled if these requirements are not met. Section 6.1 describes the expected process for scheduling an oral presentation.

3.8.4 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 PhD 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* form.

3.8.5 Dissertation Defense Timeline

The dissertation should be completed within five years of entering the PhD program and must be completed within eight years.

3.9 PhD Student Annual Review

The purpose of the PhD student annual review procedure is to encourage and motivate PhD student research, and provide additional mentoring for graduate study.

The PhD review procedure consists of the following main steps:

1. An annual progress report and other materials completed by the PhD student and advisor (if one exists) will be requested. Dates vary by year, but the deadline is typically in the middle of the spring semester.
2. Review of the progress report by the Graduate Committee (Note, this is separate from an advisor's evaluation/grade for research credit submitted each semester.)
3. Notification letter to the student and advisor by early April.

3.9.1 Review Criteria

At a minimum, students must comply with all academic rules, regulations, and timelines set forth by the Graduate School and the Department of Computer Science. These include, but are not limited to,

- maintaining an acceptable cumulative grade point average (GPA),
- forming an advisory committee,
- passing Research Qualifying Exam (RQE),
- completing the PhD breadth requirement,
- submitting a dissertation proposal, and
- passing the dissertation oral defense.

The requirements must be met within maximum time limits specified in Sections 3.5, 3.6.2, and 3.8.5, and set forth by the Graduate School.

It is important for students to stay on track during their PhD study. The annual review attempts to identify when a student is deviating from the expected timelines and performance, and is at risk of failing to meet the minimum requirements above. The review then considers a student's performance to be *Satisfactory* when the performance aligns with faculty expectations. In particular, students are generally expected to complete each milestone significantly earlier than the maximum allowed time. Additionally, students are expected to publish the results of their research in respected peer-reviewed venues prior to their dissertation defense and to gain significant experience giving technical presentations of their own research and the research of others.

To provide guidance to students and faculty, descriptions of ranges of *Satisfactory* progress for students entering with a related Bachelor's degree or with a related Master's degree are provided in Table 2 and Table 3, respectively. Entry $D+x$ indicates steps expected to be completed by students entering with degree D (B for BS, M for MS) during year X in the program.

The graduate committee, in consultation with a student's major advisor, will rate the student based on the above criteria. A student will likely be rated *Needs Improvement* if they fall below these ranges, and they will likely be rated *Unsatisfactory* if they fall significantly below these ranges. It is important to note however, that the ranges provided are only guidelines and they should be adjusted accordingly based on each student's

B+1	The student is expected to find an advisor.
B+2	The student is expected to complete the PhD breadth requirement.
B+3	The student is expected to complete the RQE. The student should make significant progress toward their dissertation proposal.
B+4	The student should complete the dissertation proposal. The student should make significant progress towards completion of the PhD dissertation. The student should submit, in the annual review report, a research plan including the goal of publications before dissertation defense, which is agreed their advisory committee. There should be evidence that the candidate has produced original, significant research contributions. Lack of publications is an indicator of inadequate progress.
B+5	The student should complete and defend their dissertation.

Table 2: Satisfactory progress guidelines for students entering with a related Bachelor's degree

M+1	The student should find an advisor and have (nearly) completed the PhD breadth requirement. Progress in research should be documented (for instance, substantial work targeting a conference or journal submission).
M+2	The student is expected to have completed the PhD breadth requirement and the RQE. The student should have tangible research results, such as refereed publications in recognized outlets.
M+3	The student should complete the dissertation proposal. The student should have made substantial progress towards completion of the PhD dissertation. There should be evidence that the candidate has produced original, significant research contributions. Lack of publications will be an indicator of inadequate progress.
M+4	The student is expected to complete and defend their dissertation.

Table 3: Satisfactory progress guidelines for students entering with a related Master's degree.

individual circumstances. For example, a student may join in mid-year, a student may come with a different background and need additional foundation courses, a student may initially focus on research and defer course work, a student may carry significant teaching duties, or a student may go on an internship. The actual evaluation will take into account all the information available to the graduate committee.

A student who has been a graduate teaching assistant (GTA) will also be evaluated based on their GTA performance. An *Unsatisfactory* rating by the students in their classes or the faculty mentor might lead to an *Unsatisfactory* rating in the annual evaluation.

3.9.2 Student and Advisor Reports

The student is required to prepare and file the materials listed below by the announced deadline, typically in the middle of the spring semester. Failure to submit the required materials will result in a rating of *Unsatisfactory* for that year. Complete and accurate documents are critical for a successful PhD review.

- An annual progress report describing in detail the student's progress towards their PhD degree in the last year, or since the date the student entered the PhD program, whichever is more recent. It includes

documenting progress on required milestones, e.g., passing RQE, completing PhD breadth requirement, submitting dissertation proposal, passing dissertation oral defense. In addition, this report must include a list of the papers that have been published, accepted or submitted to conferences or journals, teaching and service activities, limited to the period covered by the annual report. Acceptance ratios or percentages and the total number of submissions should be included for conference papers.

- The student's advisor, if they have one, will provide their evaluation of the student's performance as *Satisfactory*, *Needs Improvement*, or *Unsatisfactory* and will provide written comments and attach to the student's annual progress report.
- A current curriculum vitae (CV). The CV must include a complete listing (all years) of all the student's published, accepted or submitted conference and journal papers. Acceptance ratios or percentages should be included for conference papers.

A student annual progress report form and an advisor annual progress report form are distributed by email annually. The information above should be submitted through these forms.

3.9.3 Graduate Committee Review and Notification Processes

All PhD students will be evaluated by the graduate committee. After the graduate committee evaluation, each student will receive a rating (*Satisfactory*, *Needs Improvement*, or *Unsatisfactory*) and additional feedback regarding their degree progress. The Graduate Director, on behalf of the graduate committee, will send a written memo to the student and the advisor(s). The memo will include specific feedback explaining the evaluation. In case that a student receives a *Needs Improvement* or *Unsatisfactory* rating, the memo will state which expectations were not met and will provide follow-up actions the student can take to improve to *Satisfactory* performance before the next PhD Student Annual Review. If a student disagrees with their rating, they may provide a written response that will be placed in their departmental record. This statement may include whatever justification or explanation of extenuating circumstances that the student may wish to provide. This statement will be available during future annual PhD reviews.

If a student disagrees with their rating and plans to appeal, they are suggested to follow an internal procedure before starting a formal academic grievance process. They should first consult with their advisor. If both the student and the advisor disagree with the rating, the student and the advisor may meet with the graduate committee to resolve the issue. If the student does not feel that a satisfactory explanation or resolution has been reached after the meeting, they may initiate a discussion with the department chair. If the disagreement cannot be resolved at that time, the student may file a written grievance following the University's academic grievance guideline.

3.9.4 Consequence of an Unsatisfactory or Needs Improvement Rating

A student with an *Unsatisfactory* rating will in general not be eligible for departmental support until all tasks specified in the improvement plan have been successfully completed. A student with a *Needs Improvement* rating will be ranked lower for consideration of departmental support.

Students who are rated as *Needs Improvement* or *Unsatisfactory* must complete the following improvement process (IP) within four weeks of the date when notification of PhD review results was handed out. This deadline applies even if the student is away from campus, e.g., on an internship. Students will complete the improvement process with a mentor. If the student has an advisor, then their mentor will be their advisor.

The Graduate Director will be the mentor for students that have not yet identified an advisor. This process can be completed remotely using email and/or conference calls as necessary if the student or their advisor is out of town. All improvement process materials should be submitted to the graduate committee and included in the their departmental record.

1. The student should develop a performance improvement plan with their identified IP mentor. This plan must include steps and a timeline for achieving *Satisfactory* progress over the next year.
2. After the performance improvement plan is approved by the IP mentor, an appointment for the student and their IP mentor will be scheduled to meet with the Department Chair, or designate, to discuss the student's performance and the plans for improving it.
3. The student will be reviewed again in October. In this review, the student will submit the regular materials required for the annual performance review before Oct. 15. The student will also submit a description of the improvement plan and describe their progress toward completion of the plan. The student will discuss the improvement plan with their IP mentor and have the mentor sign the description.
4. The materials will be submitted to the graduate committee.
5. The committee will review the materials and provide written feedback.
6. Before the next annual Spring review, the student will meet with the Department Chair to discuss progress on the improvement plan. The Chair, together with the graduate committee, will decide whether and when all tasks in the improvement plan of a student are successfully completed. The recommendation by the IP mentor will be taken into account for this decision.

3.9.5 Performance Evaluation and Department Support

The graduate committee reports students' performance to the department chair. The chair makes GTA support decisions using students' performance as a key reference. A *Satisfactory* rating does not guarantee continuation of department support.

It is the normal policy of the Department not to support students who are beyond five years of PhD study. Exceptions to this policy require a plan demonstrating likelihood of timely degree completion that is approved by the student's advisor, the graduate committee and the department chair.

4 Master of Science Policies and Procedures

4.1 Choosing an Advisor

Each student will have an advisor that is a member or affiliated member of the Computer Science Faculty. Until an advisor is chosen, the student will be advised by the Director of Computer Science Graduate Programs. It is allowed for coursework students to have the Director of Computer Science Graduate Programs as their advisor through graduation. Students in the thesis and report options must select an advisor.

Students in the thesis and report options will have an advisory committee consisting of the student's advisor and at least two additional members. At least two members of the committee must be members of the Department of Computer Science Faculty. All advisory committee members must be members of the Michigan

Tech Graduate Faculty. The advisory committee members will be selected by the advisor in consultation with the student.

4.2 Course Work Requirements

All MS students must satisfy a core and breadth requirement, which are described below.

4.2.1 Core Requirements

The core requirement is satisfied by successful completion of undergraduate courses in both theory and algorithms (CS3311 and CS4321) and a graduate course in theory (CS5311) or algorithms (CS5321). The requirement to take CS 3311 or CS 4321 may be waived if a student has taken an equivalent course before entering the program.

Students wishing to count non-MTU courses toward the requirement must complete the “MS Course Requirement Waiver” form that can be obtained from the Computer Science Graduate Secretary. Note that CS 3311 does not count toward the 30 credits required for the MS degree.

Courses outside the Department of Computer Science may also be counted towards the MS degree with the permission of a student’s advisor and 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 should be attained prior to registering for CS3311.

4.2.2 Breadth Requirement

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 4. Within each category, the courses must come from two different areas.

Category	Area	MTU Courses
Category A	Computer Architecture	CS4431, CS5431
	High Performance Computing	CS4496, CS 5331, CS5496
	Languages & Compilers	CS4121, CS4130, CS5130
	Networks	CS4461, CS5461
	Operating Systems	CS4411, CS5411, CS5441
	Performance Analysis	CS5481
	Security	CS4471, CS5471, CS 5472
Category B	Artificial Intelligence	CS4811, CS5811, CS5821
	Computer Graphics and Visualization	CS4611, CS5611, CS5631, CS5641
	Data Analysis and Machine Learning	CS4821, CS5831, CS5841
	Human-Computer Interaction	CS4760, CS5760, CS5770
	Software Engineering	CS4710, CS4711, CS4712, CS 4740, CS 5740, CS 5751

Table 4: MS Breadth Requirement

Courses not given Table 4 require approval from the Graduate Committee in order to be applied to the 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 MS degree. For students who did not receive their undergraduate degree at MTU a waiver is required in order to count the course taken elsewhere. The waiver is obtained from the MTU faculty member whose expertise is in the area of the non-MTU course. The Students wishing to count non-MTU courses toward the requirement must complete the “MS Course Requirement Waiver ” that can be obtained from the Computer Science Graduate Secretary.

4.2.3 Credit Transfer

Please refer to Section 3.3.2.

4.3 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. All three options require 30 hours of course work. At most one course with a grade of BC may be counted toward the degree. Otherwise grade of B or better must be attained in all courses.

The options are described in detail below.

4.3.1 Thesis Option

Under the thesis option, the CS Department allows six to nine of the 30 hours of credit required for graduation to be in CS5990. A student must take at least six credits of CS 5990. Students in the thesis option may take up to three hours of CS 5999, but the total hours of CS 5999 and CS 5990 cannot exceed nine hours. Note that CS 5999 work should not be in the area of the thesis.

In addition to the coursework, 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.

Oral defenses (research plan and thesis defense) must be announced to the Department of Computer Science faculty and graduate students at least two weeks prior to the defense. The written plan and thesis must also be distributed two weeks in advance of the oral defense. A defense may be cancelled if these requirements are not met. Section 6.1 describes the expected process for scheduling an oral 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, or no later than the second, semester in the program.
- + Present a thesis plan during the second or third semester in residence (not counting summers).

- * Provide a defensible thesis to the entire committee no later than two weeks prior to the thesis defense. Make the thesis available to the Department of Computer Science faculty and graduate students.
- * 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.

After passing the thesis defense, the student submits to the Graduate School the *Report on Final Oral Examination* form.

4.3.2 Report Option

Students in the report option will complete a project under the supervision of their advisor. The report option allows three to six of the 30 hours of credit required for graduation to be in CS5990. A student must take at least three credits of CS 5990. Students in the report option may take up to three hours of CS 5999. Note that work for the CS 5999 should not be in the area of the report.

In addition to completing the required coursework, the student is expected to:

1. Prepare a written project plan which describes any background 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 final oral defense must be announced to the Department of Computer Science faculty and graduate students at least two weeks prior to the defense. The written report must also be distributed two weeks in advance of the oral defense. A defense may be cancelled if these requirements are not met. Section 6.1 describes the expected process for scheduling an oral 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 two semesters in the program.
- + Present a project plan to the advisory committee during 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. Make the report available to the CS department faculty and graduate students.
- * 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.

After passing the report defense, the student submits to the Graduate School the *Report on Final Oral Examination* form.

4.3.3 Course Work Option

The course work option requires 30 hours of graded course work. None of the 30 hours required for graduation may be in CS5990. Three hours of either CS5999 or ENT5950 but not both may be applied to

the 30-hour requirement. The ENT5950 hours must be from an approved enterprise or approved project. Current approved enterprises are:

- Humane Interface Design Enterprise (HIDE), and
- Husky Game Development (HGD) Enterprise.

To request enterprise project approval from another enterprise, submit a request to the CS graduate director. Request for project approval should include:

- Applicant name,
- Date,
- Enterprise Name,
- Enterprise advisor name and contact information,
- a one paragraph project description, and
- a one paragraph description of applicant's expected role in the project.

4.4 Review

All graduate programs at the university provide constructive written feedback to students who are completing a report, thesis, or dissertation, at least annually. Following is the process for yearly evaluation of students that have chosen the thesis or project options for their MS degree.

Before the start of the fourth week of classes in the Fall semester, each student that has chosen the thesis or report options will complete a yearly progress report for MS Thesis students. (See Appendix A.) The student will complete the report and submit it to their advisor. The advisor will complete the form and meet with the student to discuss the student's progress. The student will then submit the form to the graduate director by email as a PDF and in hard copy.

If deficiencies are identified in a student's performance, the student will receive written feedback from the graduate committee specifically addressing the area(s) of deficiency, timeline for making up the deficiency, and consequences for continued unsatisfactory performance. From this point, the student must complete the evaluation form each semester of enrollment until there is a satisfactory review.

5 Professional Development

Success in graduate school and in a career depends on factors outside of coursework. The following link identifies a range of resources available to help students succeed in graduate school and beyond. <https://www.mtu.edu/gradschool/resources-for/students/professional/>.

5.1 Career Counseling

In addition to the resources identified above, it can be helpful to get advice on professional development specific to a career area. Students are encouraged to contact a faculty advisor in their chosen area to help with coursework selection and career advice.

5.2 Individual Development Plan

An Individual Development Plan encourages a student to reflect on career goals and how best to use the resources and time available during graduate study in order to meet those goals. Students in the MS Report, MS Thesis and PhD programs are especially encouraged to complete an Individual Development Plan.

Many IDP forms are available online. Michigan Tech has created the form linked here <https://www.mtu.edu/gradschool/resources-for/students/professional/documents/mtu-gs-idp.docx> for this purpose. Students are encouraged to use any form they find useful. More information on IDPs is available from the graduate school at: <https://www.mtu.edu/gradschool/resources-for/students/professional/idp/>.

6 Additional Requirements

6.1 Oral Presentation Scheduling

Following are the steps for scheduling an oral presentation.

1. Reserve a room through the site: <https://www.mtu.edu/registrar/students/room-schedule/>.
2. Create a Google Calendar invitation including the presentation location, an abstract and a link or copy of the report, proposal, thesis or dissertation. Send the invitation to the Graduate Assistant. Note that the Graduate Assistant should be able to invite others.
3. The Graduate Assistant will distribute the invitation to the Department of Computer Science faculty and graduate students.

The oral presentation for an MS thesis, a Dissertation Proposal, or a Dissertation is expected to be given during the department seminar time. This facilitates attendance by all faculty and graduate students in the Department of Computer Science.

6.2 Department Seminars

All students are encouraged to attend Department seminars. Students that are supported as a GTA by the Department of Computer Science are required to attend Department seminars.

6.3 Forms and Deadlines

Forms and Deadlines for the Graduate School are available at: <https://www.mtu.edu/gradschool/policies-procedures/forms-deadlines/>.

Personalized requirements for each student are maintained at <https://mymichigantech.mtu.edu>.

Students are responsible for keeping track of form due dates and ensuring the required forms are submitted on time.

A MS Student Annual Progress Report

MS Student Annual Progress Report Sep 1 (YEAR) - Aug. 31 (YEAR+1)

Student Name:

Advisor(s):

Semester you entered the MS program:

Degrees attained prior to entry to MS program:

Milestones

Please fill in the dates you have reached, or expect to reach the following milestones. Work with your advisor for the expected dates.

	Planned Completion Date	Actual Completion Date
Written plan approved		
Oral plan defended (thesis only)		
Written report approved		
Oral defense		

Comments on milestones:

Research Activities

Write a short summary of your research activities. If you have any papers that have been published, accepted or submitted to conferences or journals, list these. Also list other research activities such as software infrastructure development in this section.

Professional Development/Service Activities

Indicate any service activities you have engaged in. Include service to the department, the profession or the community. Examples include "gave campus tours on preview day", "participated in a poster session for undergraduates", etc.

Advisor's Comments

In your opinion, the student's progress toward degree in the past year is

- Satisfactory
- Needs improvement
- Unsatisfactory

Please explain your rating and comment on the student's progress toward graduation, and his/her plan for future milestones.

Signatures:

Advisor: _____

Date: _____

Co-advisor: _____

Date: _____

Student: _____

Date: _____