



## Introduction

The main goal of a successful Ph.D. is not so much a thesis, but rather (and much more importantly), it is to train a researcher and prepare him or her for further professional development. One aspect of this training is to ensure that the individual has a broad and deep knowledge of Computer Science. The starting point for this aspect is the completion of our Ph.D. course and breadth requirements. However, course work is, by design, limited to relatively narrow and well-defined assignments, projects and exams. To be a successful Ph.D. student, the candidate needs a much broader set of skills, including the maturity as a researcher to cope with significantly more

uncertainty than is typically seen in course work. Additional skills include the abilities to evaluate the current literature, to select promising directions for future work, and to follow some of those directions through to the nuggets of new contributions. In our experience with our own students we typically see these skills develop slowly, continuing through to their graduation from our Ph.D. program. However, our expectation is that the foundations for these skills should already be in place and evident by the beginning of the second year of Ph.D. studies.

Specific skills that we expect to be developed by a Ph.D. candidate include:

- a) The ability to **apply the basic tools of the field** in potentially new ways, along with the self-understanding of what they themselves know and what they have yet to learn.
- b) The ability to **select significant research contributions** from a larger set of published papers, and justify that selection (for example, on the basis of significance of the results or the novelty of the approach).
- c) The ability to **relate the papers to one another**, and to other research in the literature.
- d) The ability to **critique the research methods** used in these papers, including the strengths and weaknesses of these methods and likely threats to validity, whether these are acknowledged in the papers or not.
- e) The ability to **identify limitations of the results** (and possibly errors) reported in the papers, along with their implications.
- f) The ability to **suggest alternative approaches** to answering the research questions posed in these papers.
- g) The ability to **identify and prioritize lines of investigation for further research**, based on an understanding of significant limitations of the research described in the papers and/or important

open problems that the papers fail to answer, and also on the likelihood of being able to make progress on such issues.

This document provides the program requirements for the Ph.D. program in Computer Science. These requirements are meant to ensure that: a) our students receive regular assessment and feedback on their progress toward these goals; and b) our graduates meet these expectations.

## Ph.D. Programs in Computer Science

DCS has three Ph.D. programs that are appropriate for students with different backgrounds. Students are assigned to one of these Ph.D. programs upon admission. The end result of these programs is the same, namely a Ph.D. in Computer Science.

1. [Ph.D.] Students who entered the Ph.D. program after having completed their M.Sc. program in our department.
2. [Ph.D.-M] Students who have completed the M.Sc. degree in Computer Science elsewhere and have entered the Ph.D. program.
3. [Ph.D.-Direct] Students who have completed a B.Sc. and have entered directly into the Ph.D. program. Also denoted as the Ph.D.-U program

As described below, the degree requirements vary across these three programs due to differences in the student's prior education.

## Ph.D. Course Requirement

The **course requirement** covers the minimum number of courses required by a degree program. In order to obtain credit for a course, the student must obtain a mark of B- or higher. Students in the Ph.D. and Ph.D.-M programs are required to complete four graduate half courses, while students in the Ph.D.-Direct program must complete eight graduate half-courses.

The only exception to this is for students who obtain a transfer credit for graduate courses which were completed but never used toward the requirements of another degree, diploma, certificate, or any other qualifications, (either at UofT or elsewhere), or as a Non-Degree Special Student. Students may transfer up to 1.0 Full Credit Equivalents (maximum two half-credit courses) to their current degree program.

For students who have completed the MSc program here in DCS, any graduate half-courses completed beyond the MSc course requirement (i.e., taken while the student is registered as an MSc student in DCS) can be used towards the Ph.D. course requirement.

## Ph.D. Breadth Requirement

The breadth requirements for our degree programs ensure that students complete courses from a sufficiently wide range of topics within Computer Science. The Ph.D. program requires breadth in different **research areas** of Computer Science.

CS courses are classified into four methodologies and fifteen research areas based on their content. **Methodologies** are core problem-solving approaches and/or techniques and general tools emphasized in the course material, while **research areas** are aligned with the activities of the various research groups in the department.

The list of courses in each of the 15 research areas is available on the CS website.

Courses not listed do not qualify for breadth credit, unless this has been approved and/or is explicitly noted in the course schedule posted by the Graduate Office. Students may request an assessment of breadth for courses from other departments by submitting evidence of the course content (e.g., a syllabus or copies of course notes) and the problem-solving approach or technique used in the course (e.g., copies of assignments or exams).

The details of this Ph.D. breadth requirement depend on whether the student is in the Ph.D., Ph.D.-M or Ph.D.-Direct program:

- [Ph.D.] For the case of a Ph.D. student who is following on from an MSc degree in our department, the eight graduate half-courses taken over their MSc and Ph.D. must include courses from at least four different research areas and three methodologies. In this sense, courses taken during the student's MSc are counted both for achieving methodological breadth and for research area breadth.
- [Ph.D.-M] Students who completed a master's degree elsewhere are required to submit a Plan of Study and Breadth Assessment form at the beginning of their first term in order for the Associate Chair, Graduate Studies to assess which breadth credits can be transferred to their Ph.D. program here. Including these breadth credits, these students must complete courses from at least four different research areas.
- [Ph.D.-Direct] Ph.D. students who are entering the program directly from a bachelor's degree are required to take a total of eight graduate half-courses. These must include courses from at least four different research areas and three methodologies.

Graduate courses taken in fulfillment of a bachelor degree's course requirement (even graduate courses from our department) **do not count** towards the breadth requirements.

Graduate courses that were completed (either at UofT or elsewhere) **may qualify** for breadth credits. Students in this situation should submit a Plan of Study and Breadth Assessment form to the Graduate Office to seek the necessary approvals.

## Time Limit to Degree Completion

There are two program time limits. The **departmental** time limit refers to the amount of time a student can receive guaranteed funding from the department. **SGS** time limits refer to the amount of time a student can register in their program.

Program	Departmental Guaranteed Funding period	SGS Time-limit for degree
Ph.D.	43 months : 3.5 years	72 months : 6 years
Ph.D. – M.	48 months : 4 years	72 months : 6 years
Ph.D. – U.	60 months : 5 years	84 months : 7 years

In exceptional circumstances, a Ph.D. student who does not complete all the requirements for the degree within the SGS time limit may be considered for a maximum of four (4) one-year extensions, bringing the final limit to 10 years for the Ph.D. & Ph.D.-M. programs and 11 years for the Ph.D.-U. program.

Students who have serious health problems or personal circumstances that prevent them from making satisfactory progress are entitled to take a leave from graduate studies. Such a leave effectively stops the clock for funding and time to degree completion; on return, the student is entitled to resume at the point where they left, without penalty.

## Student Supervision

Every Ph.D. student will be assigned a supervisor(s) prior to registration. The supervisor advises on course selection, thesis topic selection, and provides continuing help during the conduct of research. All students are required to consult frequently with their supervisors throughout their graduate studies, to report on their progress, ask questions and to obtain advice regarding their research.

To be the primary or sole supervisor of a Ph.D. student a faculty member must hold a full membership in the School of Graduate Studies, with a specific graduate faculty appointment in the Department of Computer Science (i.e., a CS-SGS membership).

Faculty with an emeritus appointment in CS-SGS can also supervise Ph.D. students, but require approval from the Graduate Office before taking on any new supervisory role. When a Ph.D. student is co-supervised, at least one of the co-supervisors must be identified as the primary supervisor (aka supervisor of record), and this faculty member must have a full, or emeritus membership in CS-SGS.

Occasionally the student-supervisor match is not productive. Any student who finds him or herself in such a situation should discuss difficulties or concerns with the current supervisor. In many cases the reason for wanting the change is an issue which might be resolved by talking it out. If no resolution can be found, students who feel a need to change supervisor are welcome to seek advice from the Associate Chair, Graduate Studies. That said, the ability to switch supervisors depends on the availability of another faculty member to serve in this role. A Supervisory Committee Composition

Form must be submitted to seek approval for change of supervision.

An excellent guide for making the most of the relationship between a student and their supervisor is provided by SGS. Take note of the checklists for both students and supervisors provided in Appendices 2 and 3 of the document. The Department of Computer Science supports the expectations stated in this guide and we encourage students to discuss these checklists with their supervisor.

<http://www.sgs.utoronto.ca/Documents/Supervision+Guidelines.pdf>).

## **Ph.D. Supervisory Committee**

The purpose of the student's Ph.D. supervisory committee is both to aid the student by providing timely advice and to evaluate the student's progress towards a Ph.D. thesis.

By the end of their **16<sup>th</sup> month** of program registration, each Ph.D. student must form a Ph.D. supervisory committee consisting of at least three members, including the supervisor and, if applicable, co-supervisor. Besides the supervisor, or co-supervisor, the other committee members must be associate or full members of SGS (although not necessarily in CS-SGS).

In addition, external experts can also serve on a supervisory committee as "advisors" (this term is not synonymous with "supervisor"). Advisors can take part in all the student's committee meetings with the following exceptions: a) they do not contribute to a quorum, and b) they cannot vote in the student's Final Oral Examination (FOE), although they are permitted to attend the FOE.

The request for an external expert to serve as an advisor on a Ph.D. committee can be made by e-mail to the Associate Chair, Graduate Studies, [gradchair@cs.toronto.edu](mailto:gradchair@cs.toronto.edu), accompanied by a brief rationale and C.V.

Students should notify the Graduate Office of the formation of the Ph.D. supervisory committee, and of any changes to that committee using the Supervisory Committee Composition Form.

## **Dropping down to the M.Sc. program from a Ph.D. program**

Students in the Ph.D.-Direct program may choose to drop down to the MSc program, in which case they are required to complete the standard M.Sc. program requirements (namely, the M.Sc. course breadth requirements along with the M.Sc. research paper). Similarly, students in the Ph.D. program who do not have a previous M.Sc. degree in Computer Science can drop down to our M.Sc. program. In either case, the student's guaranteed funding period will be reduced to 17 months, the limit for the M.Sc. program. If the student has been funded for more than 17 months, their funding will be terminated. A Program Transfer form must be submitted to make the switchover official.

## Timeline

Months in program	<p style="text-align: center;"><b>Program Progress</b></p> <p>Note that this time-line reflects progress through your program within the period of guaranteed funding.</p>
<p>1 to 2 months</p> <p>(The Grad Office will announce the submission deadline at the start of each term for newly admitted students).</p>	<p>Submit <b>Breadth Evaluation and Plan of Study Form</b> to Department Graduate Office outlining:</p> <ol style="list-style-type: none"> <li>1. Intended course enrollment and the breadth areas these course will satisfy.</li> <li>2. Any requests for transfer of breadth credits from a University of Toronto program or program elsewhere. Note: If approved a transfer of breadth credit does not reduce you program’s course requirement.</li> <li>3. Requests for transfer of course credits (that reduce the number of courses you are required to take for your program) should be included on your Plan of Study form, however the official request must be submitted using the SGS transfer credit request form obtained from the SGS website.</li> </ol> <p>This document must be signed by you and your supervisor or faculty group representative.</p>
<p>12 months</p>	<p><b>Supervision Confirmation:</b> Supervisory Committee Confirmation/Change form must be submitted within 12 months from the start of your program confirming your initial supervisory relationship, or any changes.</p>
<p>16 months</p>	<p>Form <b>Ph.D. supervisory committee Literature Review</b> (a.k.a. <b>QUALIFYING ORAL EXAM*</b>).</p>
<p>At least annually following formation of supervisory committee</p>	<p><b>Yearly Progress Review***</b> in a Ph.D. supervisory committee meeting</p>
<p>12 months following completion of Qualifying Oral Exam (Literature Review)</p>	<p><b>Achieve Candidacy:</b></p> <ul style="list-style-type: none"> <li>• complete all required course work, including breadth requirements</li> <li>• hold supervisory committee approval of the <b>THESIS TOPIC**</b></li> </ul>
<p>40 Ph.D. 45 Ph.D. -M 57 Ph.D. -U</p>	<p><b>Departmental Thesis Examination</b> A minimum of 8 weeks is suggested between the passing of the Departmental Thesis Exam and the FOE.</p>
<p>42 Ph.D. 47 Ph.D. -M 59 Ph.D. -U</p>	<p><b>Final Oral Examination</b> at the School of Graduate Studies Students are required to be registered until the submission of the final and corrected thesis is submitted. <b>Students will receive 1 month to submit Minor modifications</b> and up to 3 months to submit Major modifications following the actual FOE.</p>
<p>43 Ph.D. 48 Ph.D. -M 60 Ph.D. -U</p>	<p>Final thesis submitted where Minor Modifications are required.</p>

## Opting-In to the New System for Ph.D. Supervisory Committee Meetings

Ph.D. students who enrolled in their program before Sept. 1, 2015 and are maintaining regular meetings with their supervisory committees will be able to continue with the previous Ph.D. checkpoint system. Alternatively, they can opt into the new system for supervisory committee meetings, as described above. However, if a student under the previous checkpoint system fails to have a committee meeting for 18 months or more, then they will be placed into the new system.

Ph.D. students who enrolled in their program before Sept. 1, 2015 will be asked to complete progress monitoring reports prior to each checkpoint. These reports will be reviewed by the student's supervisory committee. This replaces the previous progress monitoring system.

## Deadlines

Students who fail to meet the deadlines for the Qualifying Oral exam, or the Yearly Progress Review will not be considered to be making satisfactory academic progress. Details on those two milestones are provided in the sections below. Students who anticipate being unable to schedule a committee meeting before the deadline should contact the Graduate office as soon as possible. See also General Regulations, section [9.0 Graduate Student Supervision](#); [Degree Regulations, section 13.0 Doctoral Degrees](#); and specific program requirements in the [Programs by Graduate Unit](#) section.

Students must notify the Graduate Office of all scheduled committee meetings **at least two weeks in advance** of the meeting.

## Unsatisfactory Academic Progress

The status of being considered to be making unsatisfactory academic progress can have serious consequences. For example, if the student fails a subsequent qualifying oral or supervisory committee meeting while they have this status, or if the student misses a second consecutive deadline, then they will be told to either withdraw from the program or have their registration terminated. (see <http://www.sgs.utoronto.ca/facultyandstaff/Pages/Termination-Student-Info.aspx>).

## Appeals

Graduate students may appeal the decisions made by their Ph.D. supervisory committee, or a course instructor. The procedures for such an appeal are described in the SGS Calendar (see [SGS Academic Appeals Policy](#)).

## **\*Qualifying Oral Exam (Literature Review)**

**This exam must be held within 16 months of the start of the Ph.D. program.** Note that the student must have formed the Ph.D. supervisory committee and have had it approved at least several weeks in advance of this exam.

Working with their supervisor, the student should have selected 5-10 research papers to be emphasized at their qualifying oral. These should be important papers in one research area of relevance to CS. This research area need not correspond to the student's eventual choice of Ph.D. topic. Students do not have to be committed to a thesis topic prior to this committee meeting. In relation to the selected papers, the student will be examined on the points (a) through (e) listed in the introduction above. It is expected that students will have read and understood more than just the selected papers, but it is not expected that the student master the majority of the relevant literature at the time of this exam.

In order to help focus the initial questioning, the student will prepare a short position paper (less than 10 pages, double spaced, in a reasonable font) on points (c-e) above. If the student has begun to investigate this area themselves, then s/he is welcome to briefly describe his/her progress so far. In addition, it is the student's option to discuss the expected overall scope of the questioning with his/her supervisory committee several weeks prior to the exam.

At the beginning of the Qualifying Oral, the student will be asked to give a 15-minute talk to introduce her/his position on the research described in the selected papers. This will be followed by one or more rounds of questioning by the supervisory committee. During this questioning it is critical that the student demonstrates an understanding of CS tools and techniques that are relevant to pursuing research in the area.

The supervisory committee will provide written feedback to the student (through the DCS Graduate Office), and the student will be invited by the Graduate Office to respond to this feedback. In addition, one of the following examination results will be provided:

1. Pass.
2. Conditional Pass. The student is given one or more concrete tasks to complete by a specific deadline (no further than a year later). The tasks and the deadline are also communicated to the Graduate Office. The chair of the qualifying examination must report to the Graduate Office whether or not the student has cleared the conditions by the deadline. If the student fails to clear the conditions by the deadline, then they will be considered to be making unsatisfactory academic progress.
3. Fail (with the option to repeat). The student is considered to not be making satisfactory academic progress, and must retake the exam within 6 months. The student will not be given a third chance to pass the exam.
4. Fail (no option to repeat). Student must either withdraw from the program or have their registration terminated. This option only applies to students who were not considered to be making satisfactory academic progress at the time of the exam. The Associate Chair, Graduate Studies will review such a recommendation.



## **\*\*Candidacy**

**SGS requires that Ph.D. students achieve candidacy within the first 36 months of their program (48 months for Ph.D.-Direct students).** Achieving candidacy involves a) completing all course & breadth work and b) having a thesis topic approved by their Ph.D. supervisory committee. We recommend that students have a thesis topic approved within 12 months of completing their Literature Review meeting (i.e. within 28 months of starting their Ph.D. or Ph.D. –M program, or 36 months for Ph.D.-Direct students. Delaying this step until the SGS deadline for candidacy will make it difficult to complete the thesis within the guaranteed funding period.

When ready to be considered for candidacy, Ph.D. students must arrange a committee meeting and contact the Graduate Office to at least two weeks prior to the meeting date.

Students must also prepare the following:

### **1. Thesis Topic Approval**

To obtain this approval the student needs to submit a written description of their thesis topic to the Graduate Office at least two weeks in advance of their yearly progress review meeting. This document needs to describe:

- a) the scope of the proposed research,
- b) explain its context with respect to the current literature (see items e-g In the Introduction to this document; page 1), and
- c) provide an initial research plan.

The thesis topic needs to be sufficiently broad to form the basis for a thesis, and it should be plausible that the student be able to complete a thesis on this topic within two years. A student may still decide to switch thesis topics after achieving candidacy. This won't affect their candidacy. However, the student will need to clearly describe their new thesis topic to their committee members during their next annual review.

### **2. Thesis Proposal**

The primary purpose of a thesis proposal is approval from the supervisory committee for the overall scope of the eventual thesis. The student must submit a written proposal to the supervisory committee that:

- a) outlines both the completed and anticipated the results of the thesis
- b) demonstrates that a substantial portion of research has been successfully completed, and
- c) provides a clear plan for completing the remaining research

Ideally, a thesis proposal is a draft of a substantial portion of the thesis itself, along with a clear description of the remaining work to be completed. The supervisory committee assesses the scope and relevance of the problems the student has to solve in the proposed Ph.D. thesis. The thesis proposal is typically completed six months to a year prior to the Departmental Thesis Defense.

### **\*\*\*Yearly Progress Review**

Yearly progress reviews are for students who have passed their Qualifying Oral Exam, but are not yet ready for their Departmental Thesis Defense.

**Deadline:** Yearly progress reviews must be held at minimum, every 12 months following the successful completion of their Qualifying Oral Exam. If the student is expecting to schedule their Departmental Thesis Defense shortly after this deadline has passed, then they can contact the Graduate Office to request a One (1) term extension.

**Purpose:** To assess the student's research progress since the previous committee meeting and to provide feedback on the student's research plans for the coming year.

**Student Preparation:** The student must complete a progress report and submit this to the Graduate Office. The student may also submit their own papers, or drafts that they are working on.

**Committee Recommendations:** After a yearly progress review the supervisory committee will provide written feedback to the student (through the Graduate Office) and the student will be invited by the Grad Office to respond to this feedback. In addition, the following examination results will be provided:

1. Pass. A pass may be accompanied by constructive feedback and/or suggestions for activity in the next term(s).
2. Conditional Pass. The student is given one or more concrete tasks to complete by a specific deadline (no further than a year later). The tasks and the deadline are also communicated to the Graduate Office. The meeting chair is responsible for reporting to the Graduate Office whether or not the student has cleared the conditions by the deadline. If the student fails to clear the conditions by the deadline, their progress will be considered unsatisfactory.
3. Fail (with the option to repeat). The student is considered not to be making satisfactory academic progress and must hold another Ph.D. supervisory committee meeting within 6 months.
4. Fail (no option to repeat). Student must either withdraw from the program or have their registration terminated. This option only applies to students who were not considered to be making satisfactory academic progress at the time of the current meeting. The Associate Chair, Graduate Studies will review such a recommendation.

## **Departmental Thesis Examination**

The student defends the thesis before the supervisory committee. Outside members are also invited. A draft of the thesis should be available to the committee members three to four weeks in advance of the departmental thesis examination. Each member of the committee is expected to read the thesis in sufficient detail to form a judgment about its acceptability. The committee may approve the thesis as is, or on condition that minor corrections be made under the supervisor's supervision, or require the student to repeat the Departmental Thesis Examination.

## **Final Oral Exam at the School of Graduate Studies**

Upon the successful defense of the thesis at the Departmental Thesis Examination, the candidate will be ready to go forward to the Final Oral Examination (FOE). Eight weeks prior to the proposed date of the examination the student should notify the Graduate Office of the intention to book an FOE. All forms and instructions are available on the DCS internal web page or from the Graduate Office. Full FOE details and regulations can be found on the [SGS website](#).

It is important to allow yourself and the Graduate Office plenty of time to organize the necessary steps and follow the required procedures in setting up your Ph.D. Final Oral Examination. The School of Graduate studies is under no obligation to find an FOE chair if a minimum of six weeks' notice is not provided.

## **Graduation**

Following the completion of the Final Oral Exam and the submission of the final thesis, SGS will submit a Recommendation for Degree and the student's name will be added to the convocation roster.

A graduation package will be sent to the student from the Convocation Office regarding convocation dates, tickets, etc.