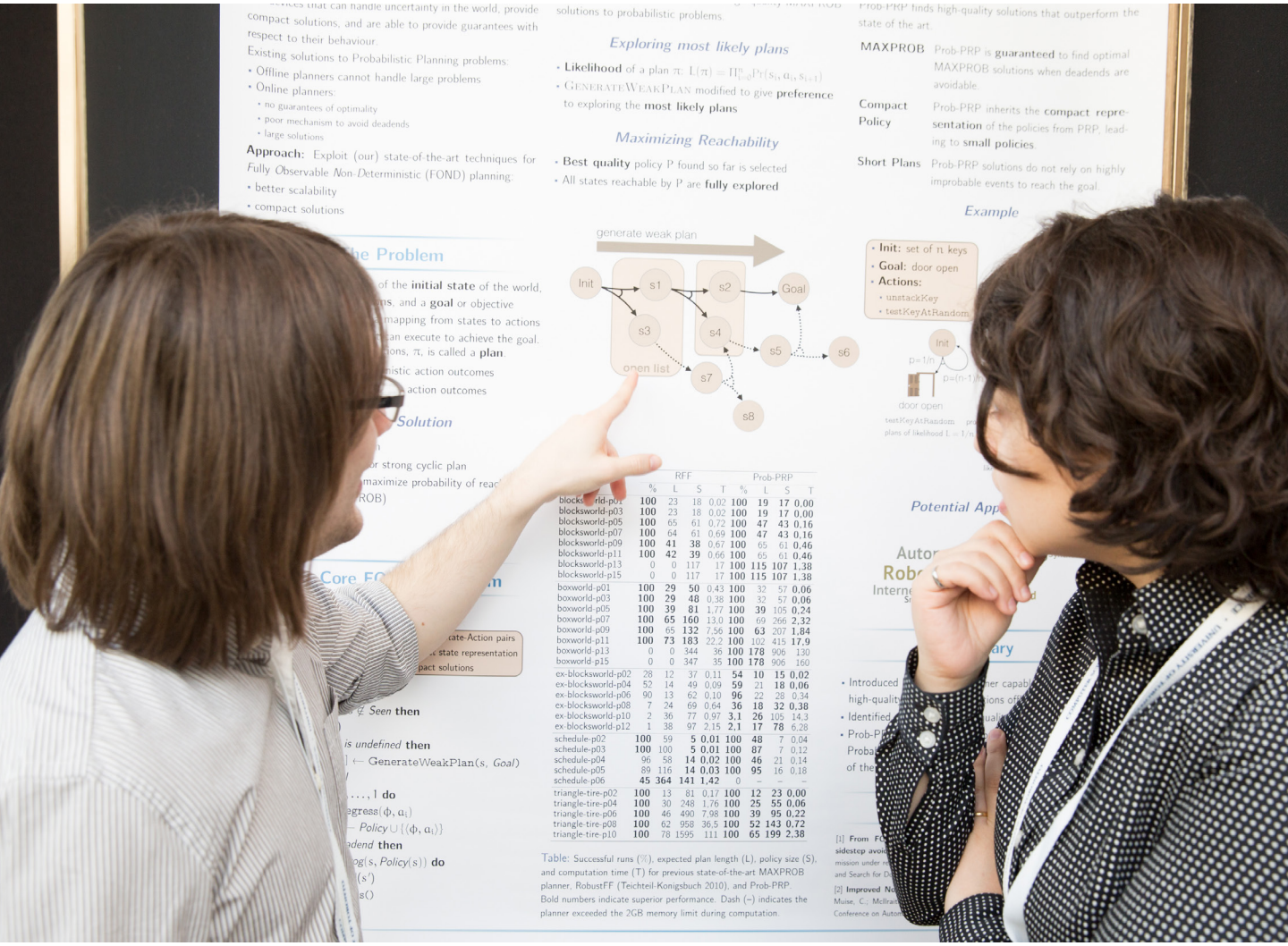
Computer Science
UNIVERSITY OF TORONTO



GRADUATE HANDBOOK 2016-2017

PHD PROGRAM

Introduction

The main goal of a successful PhD 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 PhD 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 PhD 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 PhD 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 PhD studies.

Specific skills that we expect to be developed by a PhD 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 PhD 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.

PhD Programs in Computer Science

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

1. [PhD] Students who entered the PhD program after having completed their MSc program in our department.

2. [PhD-M] Students who have completed the MSc degree in Computer Science elsewhere and have entered the PhD program.

3. [PhD-Direct] Students who have completed a BSc and have entered directly into the PhD program. Also denoted as the PhD-U program

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

PhD 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 PhD and PhD-M programs are required to complete four graduate half courses, while students in the PhD-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 U of T 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 PhD course requirement.

PhD 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 PhD 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 in **Appendix B** of the **Graduate Student Handbook: Overview of Programs**.

Courses not found in the Appendices 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 PhD breadth requirement depend on whether the student is in the PhD, PhD-M or PhD-Direct program:

• [PhD] For the case of a PhD student who is following on from an MSc degree in our department, the eight graduate half-courses taken over their MSc and PhD 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.

• [PhD-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 PhD program here. Including these breadth credits, these students must complete courses from at least four different research areas.

• [PhD-Direct] PhD 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 U of T 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.

PhD Program Requirement

1. Completed Plan of Study within 60 days of start of program, outlining courses the student intends to take, the breadth areas that will be satisfied, request for any transfer course/breadth credits for a University of Toronto program or program elsewhere. This document must be signed by you and your supervisor or faculty group representative.

2. Graduate Skills Seminars, in addition to taking courses and working on your research, there are other factors that are just as important to your success in grad school and in your future career. These include:

- Knowing and Overcoming the challenges of doing research
- Planning your career path
- Networking with researchers in your community
- Efficient Time Management
- Interacting with your Supervisor
- Effectively Presenting your work

These seminars are designed to provide you these crucial skills. Attendance is a mandatory component of your program, and will be checked. Besides presentations and talks, the seminar also gives you a chance to ask questions and get feedback on any topic you have regarding your graduate program experience. It is also an important community activity that connects graduate students in separate buildings, allowing for an exchange of experiences and ideas.

3. Supervisor Committee Confirmation/Change form within 12 months from the start of your program.
If you were admitted with a primary supervisor identified, this document will confirm the supervisory relationship. If you were admitted to a group, this document will confirm the identity of your primary supervisor and committee composition.

Student Supervision

Every PhD 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 PhD 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 PhD students, but require approval from the Graduate Office before taking on any new supervisory role. When a PhD 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.
uoft.me/SupervisionGuidelines

PhD Supervisory Committee

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

By the end of their 16th month of program registration, each PhD student must form a PhD 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 PhD committee can be made by e-mail to the Associate Chair, Graduate Studies, gradchair@cs.toronto.edu, accompanied by a brief rationale and C.V.

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

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
PhD	43 months : 3.5 years	72 months : 6 years
PhD – M.	48 months : 4 years	72 months : 6 years
PhD – U.	60 months : 5 years	84 months : 7 years

In exceptional circumstances, a PhD 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 PhD & PhD-M. programs and 11 years for the PhD-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.

Dropping down to the M.Sc. program from a PhD program

Students in the PhD-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 PhD 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.

Opting-In to the New System for PhD Supervisory Committee Meetings

PhD 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 PhD 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.

PhD 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.

Timeline

MONTHS IN PROGRAM	PROGRAM PROGRESS *Note: This time-line reflects progress through your program within the period of guaranteed funding.*
1 to 2 months	Submit **Breadth Evaluation and Plan of Study Form** to Department Graduate Office.
12 months	**Supervision Confirmation:** Submit this document as a confirmation of your supervisory relationship(s).
16 months	Form **PhD supervisory committee** **Literature Review** (a.k.a. **QUALIFYING ORAL EXAM***).
At least annually following formation of supervisory committee	**Yearly Progress Review***** in a PhD supervisory committee meeting
12 months following completion of Qualifying Oral Exam (Literature Review)	**Achieve Candidacy:** • complete all required course work, including breadth requirements • hold supervisory committee approval of the THESIS TOPIC**
40 PhD 45 PhD-M 57 PhD-U	**Departmental Thesis Examination** A minimum of 8 weeks is suggested between the passing of the Departmental Thesis Exam and the FOE.
42 PhD 47 PhD-M 59 PhD-U	**Final Oral Examination** at the School of Graduate Studies Students are required to be registered until the submission of the final and corrected thesis is submitted. **Students will receive 1 month to submit Minor modifications** and up to 3 months to submit Major modifications following the actual FOE.
43 PhD 48 PhD-M 60 PhD-U	Final thesis submitted where Minor Modifications are required.

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.

*Qualifying Oral Exam (Literature Review)

This exam must be held within 16 months of the start of the PhD program. Note that the student must have formed the PhD 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 PhD topic. Students do not have to be committee 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 PhD students achieve candidacy within the first 36 months of their program (48 months for PhD-Direct students). Achieving candidacy involves a) completing all course & breadth work and b) having a thesis topic approved by their PhD 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 PhD or PhD –M program, or 36 months for PhD-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, PhD 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 PhD 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 PhD 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.

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 uoft.me/Termination-Student-Info

Appeals

Graduate students may appeal the decisions made by their Ph.D. supervisory committee. The procedures for such an appeal are described in the SGS Calendar (see SGS Academic Appeals Policy).

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.