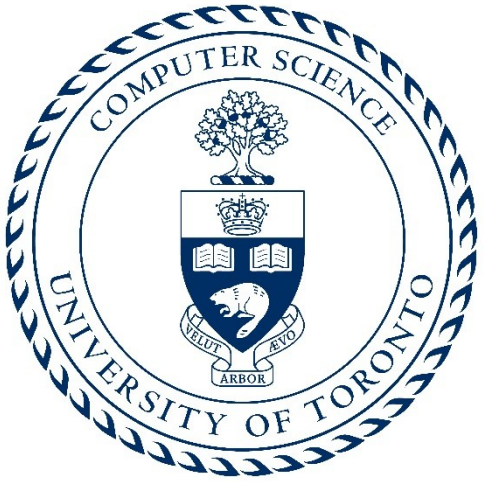
MASTER OF SCIENCE PROGRAM

2019-20 GRADUATE HANDBOOK

Computer Science
UNIVERSITY OF TORONTO



Introduction

This handbook describes the M.Sc. degree program of the Department of Computer Science. The program consists of four graduate-level half-courses, selected to satisfy the M.Sc. breadth requirement, and a major research paper. The major research paper should demonstrate the student's ability to:

a) carry out independent work in organizing existing concepts; and

b) suggest and develop new approaches to solving problems in a research area.

M.Sc. 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 M.Sc. program are required to complete **four** graduate half courses while registered in the program.

The only exception to this is for students who obtain a transfer credit for graduate courses that were completed but never used toward the requirements of another degree, diploma, certificate, or any other qualification (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.

M.Sc. Breadth Requirement

The breadth requirement for both the M.Sc. and Ph.D. degree programs ensures that students complete courses from a sufficiently wide range of topics within Computer Science. The Master’s degree requires breadth in **methodologies**.

CS courses are classified into four methodologies and sixteen 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 four methodologies are described in the next section below.

The list of courses in each of the four methodologies is available on the CS website. Courses that are 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.

To satisfy the M.Sc. breadth requirement the student must complete one course from at least three of the four methodology areas. As long as three of the methodology areas are satisfied, students may satisfy their fourth course requirement in various ways. Often, students choose to take a second course from one of the methodologies, leaving one methodology in which they take no courses. A student may also choose to take a graduate half-course from another department at UofT. Alternatively, students may choose one course from each of the four methodologies.

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

The Four Methodologies

Methodology 1: Analysis and Computation in Discrete Models
The courses in this grouping focus on analysis of and algorithms for discrete mathematical structures, such as graphs, formal logic, and formal models of computation. The grouping includes courses that analyze computational limitations and discrete computation. These courses study and apply techniques from areas like probability, combinatorics, algebra, mathematical programming, and formal logic.

Methodology 2: Analysis and Computation in Continuous Models
The courses in this grouping focus on analysis of and algorithms for continuous mathematical models. Topics include the derivation of mathematical models, their properties, and computational techniques for approximating their solution. These courses study and apply techniques from areas like probability and statistics, computer graphics, computer vision, numerical analysis and machine learning.

Methodology 3: Building Software and Hardware Artifacts
This grouping includes courses that study the design and implementation of specific software or hardware artifacts. These courses expose students to the

challenges in building artifacts such as computer-animated movies, computer aided design systems, databases, network protocols and devices, and simulations of large scale systems. Courses in this group typically have a significant project component where students build a substantial software or hardware artifact.

Methodology 4: Human-Centered and Interdisciplinary Computing
This grouping includes courses that study computational paradigms and methods within human-computer interaction and scientific domains outside traditional computational sciences. These courses typically have a cross-disciplinary component, involving fields such as the life sciences, linguistics, psychology, social sciences, and economics.

The 16 Research Areas

1. Algorithms and Discrete Math
2. Complexity and Crypotography
3. Computational Biology
4. Computational Linguistics
5. Computer Graphics
6. Computer Systems and Networks
7. Computer Vision
8. Database Systems
9. Distributed Computing
10. Human-Computer Interaction
11. Knowledge Representation
12. Machine Learning
13. Scientific Computation and Numerical Analysis
14. Software Engineering
15. Interdisciplinary Computer Science
16. Robotics

Student Supervision

Every M.Sc. student will be assigned a supervisor or research group prior to registration. The supervisor(s) will provide guidance on course selection, and

research topic selection. All M.Sc. 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 project.

To be the primary or sole supervisor of an M.Sc. student, a faculty member must hold an associate or 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 M.Sc. students, with approval from the Graduate Office before taking on any new supervisory role. When an M.Sc. student is co-supervised, at least one of the co-supervisors must be identified as the primary supervisor (a.k.a. supervisor of record), and this faculty member must hold an associate, full, or emeritus membership in CS-SGS.

Occasionally the student–supervisor match is not productive. Any student who finds themselves in such a situation should discuss difficulties or concerns with their current supervisor. In many cases the reason is an issue which might be resolved by talking it out. If no resolution can be found, students who feel a need to change their supervisor are welcome to seek advice from the Associate Chair, Graduate Studies. However, 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

Research Paper

An M.Sc. research paper hould demonstrate the student's ability to do independent work in reviewing the relevant literature, identifying a problem in a research area, organizing existing concepts, suggesting and developing new approaches to solving problems in a research area, and reporting the results.

The standard for this paper is that it could reasonably be submitted for peer-reviewed publication. Negative results are also acceptable given a reasonable prior hypothesis and a thorough analysis of the reasons for these negative results. A typical research paper is 30 – 60 pages, double spaced.

The completed research paper must have the written approval of two readers, one of whom must be the student's supervisor. The second reader must hold an associate, full, or emeritus membership in the graduate faculty at the School of Graduate Studies (in any UofT department). The readers should be given at least two weeks to review the paper. They will then submit their evaluation of the paper to Graduate Office for review and consideration by the Associate Chair, Graduate Studies.

If the research paper is unacceptable to either reader, they will provide the student with a list of required revisions, and the student is given an opportunity to improve the research paper. After improvement, the research paper is again submitted to two readers; normally they will be the same two readers but in exceptional circumstances, with the approval of the Associate Chair, Graduate Studies, the second reader may be different. Most papers go through at least one round of revision, and the student should allow plenty of time for this so that the final approval can be received by the program completion deadline (see "Time Limit to Degree Completion" below); missing this deadline incurs a significant financial penalty.

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.

1. For the M.Sc. program, the guaranteed funding period is 17 months, and the program is designed to be completed in this time.
   NB: Although funding is given for 17 full months, the SGS completion deadline typically falls in the third week of the 17th month, and the reader reports for research appers must be received in the Graduate Office at least two working days prior. Students who miss this deadline will be liable for fees for an additional term, a substantial expense that will not be covered by their funding. It is therefore important to watch out for this deadline and be sure that all course requirements, including final approval of the research paper, have been completed two days prior to this deadline.
2. The SGS time limit for the M.Sc. is 36 months. In exceptional circumstances, an M.Sc. student who does not complete all the requirements for the degree within the SGS time limit may be considered for up to three one-year extensions, up to a hard limit of 6 years for the M.Sc. program. The first two extension requests require the approval of the Associate Chair, Graduate Studies; the third requires approval from both the Associate Chair and the School of Graduate Studies.

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 leave effectively stops the clock for both funding and time to degree completion; on return, the student is entitled to resume at the point where they left, without penalty.

Program Completion

Students who have completed their course work and breadth requirement, and have their research paper ready for evaluation, should request a completion package from the Graduate Office, or download it from the CS website. Students must provide a reader evaluation form to each reader, who must then submit their assessment of the paper directly to the Graduate Office. The student must submit the completed Request to Convocation form directly to the Graduate Office.

Transitioning to the Ph.D. program

For an M.Sc. student to be allowed to transition to the Ph.D. program upon completion of the degree, both readers of the M.Sc. research paper must indicate in their evaluation that the paper achieves the standard expected for transition to the Ph.D. program and they must complete the corresponding section of the evaluation form.

One of the two readers must indicate on their evaluation form that they are interested in supervising the student's PhD studies. This may be either the student's present supervisor or the second reader. For transition to PhD studies with neither of these as supervisor, the new supervisor must also carry out an evaluation of the research paper.

Funding Information for Transitioning Students: Approved students will be allowed to transition to the PhD program without interruption in their departmental funding upon completion of their Master's. Forty-three additional months of departmental funding to complete the Ph.D. program is guaranteed. An exception occurs when a student is requesting dual registration, in which case PhD funding will commence only upon completion of Master's. Students may be dually registered (for a maximum of one term) in either the Fall or Winter sessions. Dual registration is not permitted in the summer term.

Timeline

Months in program	Program Progress
1 to 2 months (The Grad Office will announce the submission deadline at the start of each term for newly admitted students).	Submit **Breadth Evaluation and Plan of Study form** to Department Graduate Office outlining: 1. Intended course enrollment and the breadth areas these course will satisfy. 2. Any requests for transfer of breadth credits from a University of Toronto program or program elsewhere. *Note:* A transfer of breadth credit does not reduce your program's course requirement. 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. This document must be signed by you and your supervisor or faculty group representative.
12 months	**Coursework:** M.Sc. students should manage their time so that at least 3 half-credit courses can be completed within the first 12 months, leaving at most one half-course for the remaining 5 months **Research:** In addition to course work, M.Sc. students should select their research topic and begin their research within the first 12 months of their program. One way to achieve this is to take two half-courses in the first term, and one in your second term. The first two half-courses should provide you with more in-depth knowledge of possible research areas and, by taking only one half-course in your second term, you should have time to begin making progress on your research. **Supervision confirmation**: 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.
Middle of 17th month Prepare to **complete** the degree and to **transition** to PhD program if desired	**Coursework:** At least 4 graduate courses completed with a grade of B– or better, taken from at least 3 out of 4 methodologies. **Research paper:** Two reader reports must be submitted to the Graduate Office at least two days prior to the SGS deadline (which is usually in the third week of the month). **Request to Convocate form**: Must be submitted at least two days prior to SGS deadline.
Transition to Ph.D.** (Please speak with the grad office in Fall if you intend to transition)	**Ph.D. Supervisor**: At least one eligible reader must indicate that they will be the Ph.D. supervisor for M.Sc. students wishing to continue on to the Ph.D. program. **Reference letters**: Letters in support of the PhD transition should be sent directly to the Graduate Office. **Timeframe**: SGS allows students to change registration only at

	the start of each academic term (September, January, and May). **Ph.D. Program Application**: Upon approval for transition, a student must complete an SGS admission application and pay the application fee in order to register in the PhD program.

Unsatisfactory Academic Progress

The status of being considered to be making unsatisfactory academic progress can have serious consequences. For example, if a student has failed a course or is recommended for termination by their supervisor for a lack of progress, they will be offered the option to either withdraw from the program voluntarily (with the option to reapply to the program at a later date) or have their registration terminated. (see http://www.sgs.utoronto.ca/facultyandstaff/Pages/Termination-Student-Info.aspx).

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.

Appeals

Graduate students may appeal the decisions made by their supervisor or course instructor. The procedures for such an appeal are described in the SGS Calendar (see SGS Academic Appeals Policy).