Western UNIVERSITY · CANADA

Computer Science
Final Assessment Report & Implementation Plan
September 2022

Faculty / Affiliated University College	Faculty of Science	
Degrees Offered	MSc, PhD	
Date of Last Review	2014-2015	
Approved Fields	Artificial Intelligence, and Computer-Based Games Graphics, Image Processing and Computer Vision Distributed Systems Software Engineering and Human Computer Interaction Theoretical Computer Science Computer Algebra Bioinformatics and Biocomputing	
External Reviewers	Dr. Mario Nascimento, Faculty of Science University of Alberta	Mohammad Zulkernine, School of Computing Queen's University
Internal Reviewers	Dr. Laura Murray, Associate Dean (Graduate) Faculty of Health Sciences	Natasha Knier, Ph.D. Candidate, Medical Biophysics
Date of Site Visit	May 16, 2022	
Date Review Report Received	June 28, 2022	
Date Program/Faculty Response Received	Program July 25, 2022 Dean July 26, 2022	
Evaluation	Good Quality with Report Due September 2023	
Approval Dates	SUPR-G: October 17, 2022 ACA: October 26, 2022 Senate (for information only): November 11, 2022	
Year of Next Review	Year of next cyclical review: 2029-2030	
Date of Progress Report	June 2025	

Overview of Western's Cyclical Review Assessment Reporting Process

In accordance with Western's Institutional Quality Assurance Process (IQAP), the Final Assessment Report (FAR) provides a summary of the cyclical review, internal responses, and assessment and evaluation of the Computer Science Graduate Program delivered by the Faculty of Science.

This FAR considers the following documents:

1. the program's self-study brief;
2. the external reviewers' report;
3. the response from the Computer Science Program; and
4. the response from the Dean, Faculty of Science.

This FAR identifies the strengths of the program and opportunities for program enhancement and improvement and details the recommendations of the external reviewers – noting those recommendations to be prioritized for implementation.

The Implementation Plan details the recommendations from the FAR that have been selected for implementation, identifies who is responsible for approving and acting on the recommendations, specifies any action or follow-up that is required, and defines the timeline for completion.

The FAR (including Implementation Plan) is sent for approval through the Senate Graduate Program Review Committee (SUPR-G) and ACA, then for information to Senate and to the Ontario Universities' Council on Quality Assurance. Subsequently, it is publicly accessible on Western's IQAP website. The FAR is the only document from the graduate cyclical review process that is made public; all other documents are confidential to Western's Faculty of Science, the Computer Science graduate program, the School of Graduate & Postdoctoral Studies (SGPS), and SUPR-G.

Executive Summary

The MSc Computer Science Program has been offered since 1963, originally through the Mathematics and Computer Science Department. Since the founding of Computer Science as its own department in 1964, the MSc program has been offered in the Department of Computer Science. The PhD program in Computer Science began in 1986.

The Graduate Program in Computer Science has three different options for Master's degrees. The Thesis option requires four courses and a written thesis that makes an original contribution to a research area. The Project option requires six courses and a written project report that describes research in an area. The Coursework option requires eight courses, and a Directed Study milestone, where students work under a supervisor on a research project. All MSc programs are designed as four term programs and are also available as part-time programs. At the PhD level, students are required to complete a thesis that advances knowledge in a particular research area.

To inform the self-study for this program review, surveys were administered to faculty members in relation to the academic achievements of their former graduate students. Current graduate students were equally solicited for feedback via survey – 96 out of 119 students responded. In addition, a program retreat held in 2021 brought together program faculty and staff to discuss: program learning outcomes, recruitment strategy, unique and innovative features of the programs, professional development strategy, program design components, and program innovations and modifications since the last review.

The external reviewers shared a positive assessment of the Computer Science Graduate Program, however noted a need to develop a succession plan for both faculty and staff as well as research space. They offer eight recommendations for further enhancement.

Strengths and Innovative Features Identified by the Program

- The Graduate Program includes the options of collaborative programs in Artificial Intelligence (in conjunction with the Department of Electrical and Computer Engineering and the Vector Institute), Environment and Sustainability, Scientific Computing, and Machine Learning in Health and Biomedical Sciences.
    - Students associated with the Artificial Intelligence and Machine Learning programs gain access to scholarships through the Vector Institute, increasing funding to the MSc program.
- Many faculty members hold joint appointments which increases links to other Faculties. Together with a number of faculty members cross appointed to Computer Science, this feature expands the strength of collaboration with respect to teaching, supervision and research.

- The graduate students in Computer Science run an annual conference for student presentations, the University of Western Ontario Research in Computer Science conference (UWORCS). The conference is in its 27th year.

Concerns and Areas of Improvement Identified and Discussed by the Program

- There is a need for more/improved student collaboration space
- There is intense competition between universities for those domestic undergraduate computer science students seeking to study at the graduate level.

Review Process

As part of the external review, the review committee, comprising two external reviewers, one internal reviewer and a graduate student reviewer, were provided with Volume I and II of the self-study brief in advance of the scheduled review and then met virtually (due to pandemic restrictions) over two days with the:

- Vice-Provost of the School of Graduate & Postdoctoral Studies
- Associate Vice-Provost of the School of Graduate & Postdoctoral Studies
- Associate Vice-Provost, Academic Planning, Policy and Faculty
- Dean of the Faculty of Science
- Associate Dean, Graduate and Post-Doctoral Studies
- Department Chair
- Graduate Program Chair
- Graduate Executive Committee
- Associate University Librarian
- Graduate Program and Department Staff
- Program Faculty Members
- Graduate Students

Following the virtual site visit, the external reviewers submitted a comprehensive report of their findings, which was sent to the Program and Dean for review and response. Formative documents, including Volumes I and II of the Self-Study, the External Report, and the Program and Decanal responses form the basis of this Final Assessment Report (FAR) of the Computer Science Graduate Program. The FAR is collated and submitted to the SGPS and to SUPR-G by the Internal Reviewer with the support of the Office of Academic Quality and Enhancement.

Summative Assessment – External Reviewers' Report

External reviewers shared that "*In general, the department is strongly committed to providing a rich and valuable learning experience for graduate students."*

Strengths of the Program

- The department is an excellent academic unit producing world-class research and training graduate students and postdoctoral fellows. The faculty members are internationally recognized, and they are willing to provide an environment in which the students can succeed.
- Faculty members who have cross and joint appointments enhance the strength and opportunities of interdisciplinary research for faculty members, graduate students, and postdoctoral fellows.
- For a relatively small unit compared to other leading Computer Science departments across Canada, the expertise and breadth of topics covered is impressive.
- The high-quality and success of the graduate students show that the program's admissions requirements are effective.
- The Department offers a variety of specialized innovative programs. One of the innovative programs of the Department is the Collaborative Graduate Specialization in Scientific Computing.

Areas of Concern or Prospective Improvement

1. Both faculty members and students indicated the inadequacy of the current physical space and a clear need for more space.
2. Additional faculty members could be hired to deliver courses and conduct research in the area of machine learning and security.
3. The number of graduate students and external grants are lower than other comparable units in Canada. Almost half of the faculty members are not supervising PhD students.
4. The department can attract more high-quality graduate students, if programs are better advertised (e.g., publicize the availability of internships) through a better maintained website.

Summary of the Reviewers' Recommendations and Program/Faculty Responses

The following are the reviewers' recommendations in the order listed by the external reviewers.

Reviewers' Recommendation Recommendations requiring implementation have been marked with an asterisk (*).	**Program/Faculty Responses**
1. Increase/improve physical working environment * There is a need for more (and better) office space for faculty members and students alike as well as lab space, research collaboration space and socialization.	**Program:** The Department agrees that management of space is crucial as part of the ongoing growth in the Department. There is currently nearly 430 m2 of unused space in Middlesex College that needs essential renovations. The Department continues to advocate for funding to rehabilitate this space, which will be used primarily for graduate student lab and collaboration space. **Faculty:** The Faculty of Science does a regular inventory to assess space on campus and aims to ensure that space is allocated fairly and used efficiently. In recent years, Computer Science has received funds for updating classrooms and some offices. The Faculty of Science ensures that quality, safe and innovative space is available for faculty and grad students. As new faculty are hired, suitable faculty offices can be allocated in nearby buildings if none are available in Middlesex College. Any renovations requested by the Department of Computer Science would be subject to budgetary approval. The Faculty agrees that social and collaborative space would benefit Computer Science and provide a better environment for graduate student research rather than individual research labs for each faculty member (when specialized equipment is not required). Prior to investigating renovations, it will be imperative to assess how space is being used since the return to campus after the pandemic.
2. Increase the number of female faculty members and other equity seeking groups There are only three female faculty members. This percentage, to the best of our knowledge, is very low compared to the other computer science departments in North America.	**Program:** The Department is committed to improving diversity at all levels, including faculty complement. This year, it is conducting a search that prioritizes adding a new faculty member from an underrepresented group. This search is not restricted to any research area, and will add diversity to the department, likely as a female-identifying faculty member. Since the site visit took place, two jointly appointed faculty members, who identify as female, have now taken up their roles. This search is part of a longer-term commitment to improve EDI-D in the Department. Future searches will continue to use best practices and supplement recruitment activities (e.g., advertising venues) to attract top candidates from diverse backgrounds. The Department will continue to advocate for targeted searches for faculty members from under-represented groups. This includes changes to advertisement rules, which, with the current search, prevented advertising from being targeted exclusively at underrepresented groups. **Faculty:** The Computer Science Department is in the process of interviewing for two new faculty positions this year, and one is specifically for underrepresented groups. They also have the opportunity to hire 3 more faculty over the next year. Throughout the hiring process, the Faculty of Science follows a "Best Practices for Faculty Searches", which encourages diversity and minimizes biases at each step. For example, search committee members are diverse and always include a representative from the Dean's office, who has been trained in EDI. Job ads are constructed to welcome applicants from

	underrepresented groups, the ads are specifically placed to attract diverse applicants, and interview rubrics are written before applications are read to avoid bias in creating the questions. A more welcoming and inclusive environment will evolve as the department develops collaborative space, continues with diverse hires, introduces a student-run computing association, possibly introduces a common MSc course, and increases colleague interactions through reinstating PhD committee meetings (see suggestions below).
3. Externally funded positions Increase the number of CRCs and other research chair positions in emerging research areas – currently, there is only one jointly appointed Tier-1 CRC.	**Program:** The Department is in support of adding research capacity and new faculty positions, and will continue to advocate for new positions, especially research positions. The Department will pursue new calls for CRCs and other research positions in the University as they arise. Computer Science has welcomed one new faculty member in April 2022 who is applying for a CRC. This candidate is jointly appointed between Computer Science and CSD (FHS). We believe this adds further confirmation that joint appointments are important aspects of our Department's faculty complement (see response to Recommendation 4 below). **Faculty:** Although the Faculty does not control the number of CRCs allocated to it, each department is encouraged to advocate for CRC positions in annual budget requests. The Faculty of Science remains flexible to take advantage of any opportunity to recruit a CRC for the faculty. The diverse application of computational science among many disciplines increases opportunities to find suitable CRC candidates that can find a home in Computer Science particularly if their department can advocate that their search can meet the criteria for the cluster hires dictated by the university.
4. Maintain the number of joint appointments, but be mindful of additional overhead	**Program:** The Department has recently added more joint appointments, and currently has seven: two with Statistics, two with ECE (Engineering), one with CSD (FHS), one with FIMS and one with Biostatistics and Epidemiology (SSMD). Given the needs of the Department in terms of teaching expertise, as well as the interdisciplinary collaboration potential noted by the reviewers, the Department is in favour of continuing to use joint appointments, when available, to support the teaching and research missions of the Department. The Department will continue to be aware of overhead created by joint appointments, especially in graduate student recruitment and TA assignments. More attention to these areas by the Department will aid in reducing the overhead for staff members. **Faculty:** Joint appointments have worked successfully in Computer Science and other departments in Science. The extra work for processing tenure applications is outweighed by the value of interdisciplinary research and a more diverse faculty cohort. There would be little additional overhead if a new joint appointment was made between Computer Science and another department where they already share joint appointments with (e.g., Stats or ECE).
5. Implement revised funding package for TAs * More research assistantships should be provided from faculty	**Program:** The Department will engage in a review of graduate student funding packages, including the option of shifting funding from GTAs to research-based funding.

supervisors, instead of TAs. TAs complained about the workload and TA work not usually related to thesis work. The Department should hire undergraduate TAs to meet the TA requirements of the courses. TAs are not provided that many resources (e.g., solutions, marking scheme).	Hiring of undergraduate markers to meet TA needs in the Department would be advantageous to our budget, while allowing for great experiences for top undergraduate students. Unfortunately, the PSAC Collective Agreement limits the ways that the Department can employ undergraduate students. The Department will survey graduate students to determine where shortfalls in grading resources are occurring, and use this information to develop expectations for instructors in supervising TAs. **Faculty:** TA positions are unionized. The typical TA assignment is 140 hours per term (10 hrs/week) and this workload is uniform across campus. The union prohibits undergraduates from fulfilling the duties of a TA. Research assistantships are provided by research grants of supervisors. Future grants or internship programs like MITACS could provide higher salaries for graduate student. However, teaching as a TA is still a valuable part of a graduate student's training for PhD students and should not be eliminated.
6. Teaching and Supervision * a. There is no supervisory committee for PhD students – the committee should get student reports from the students on a yearly basis and should also provide feedback to the students. b. Create a common general research methods course required for all MSc students, and require them for PhD students who have not taken a similar one before. c. Increase the number of graduate courses being offered. d. Consider offering courses more aligned with the current job market. e. Requirements for a project in a project-based MSc should be clarified in order to manage expectations properly. Workload should consider project supervision more seriously so	**Program:** a. A supervisory committee for PhD students is a requirement in the Department of Computer Science. However, in past years, the committee has not been consistently established for all PhD students. The Department made it a goal in 2021 to ensure that all PhD students have supervisory committees. b. The Department will examine the potential for a common research methodology course for MSc students. There is some debate as to whether the course would expedite research (as the reviewers suggest) or impede it, as some faculty believe moving students to research quickly is critical. c. As faculty renewal continues, the program expects that new graduate courses will continue to be developed, which will improve the number of graduate courses offered. There has equally been conversation about an institutional graduate course calendar that could outline available course options offered in other departments/faculties. d. As new faculty members are added to the Department through ongoing hiring, we expect that new courses will be added that are aligned with the employment market. e. The Department agrees that more broad participation in supervision of non-thesis MSc students is crucial, especially as these programs grow. The Department does consider non-thesis graduate student supervision during Annual Performance Evaluation. Important discussions need to take place around other potential mechanisms for balancing non-thesis student supervision between faculty members. **Faculty:** a. In agreement with Program response. The Faculty will encourage the new graduate chair to track committee members and annual interviews using the Pathfinder software provided by SGPS. b, c, and d – the addition of new courses is at the discretion of the department taking into consideration how they want to achieve their program-level learning outcomes, teaching workloads, undergraduate teaching demand and the expertise of their new hires. The Faculty encourages the graduate committee to strategize their course offerings to meet demands of the job market.

that more faculty members get interested in project supervision.	e. The department could consider setting up the MSc project as a 1.0 course with a coordinator/instructor responsible for communicating expectations to students, maintaining quality control and encouraging all faculty to propose project ideas.
7. Student recruitment a. Increase the ratio of graduate to undergraduate students. b. Advertise Internship opportunities to attract more high-quality students.	**Program:** a. The Department has plans to continue to sustainably grow the course-based MSc program. This has the benefit of aiding in the progress of recommendation 6-c (increased graduate course offerings) as well. Thesis student growth is expected to increase through ongoing faculty renewal, as new faculty members begin research programs. However, increasing the ratio of graduate to undergraduate students is dependent on undergraduate enrolments, which continue to rise. b. Internship opportunities are lab specific, and supervisors use these opportunities within labs to recruit top candidates. **Faculty:** Addressed by the Program.
8. Funding and grad student life * a. There should be a graduate student computing association – this will help mitigate the lack of admin support for students, by creating "history" among students. This will also help with reinforcing EDI. Supporting a "women in computing society" may help attract more female students to the grad program. b. Reconsider the need for students to pay tuition after 4th year when there is no funding available to them. c. The funding level for Research Assistantships should be revised. d. There must be a succession plan for the grad assistant position, who seems to be the primary contact for graduate students, while at the same time some mechanism should be put in place to decrease dependence on that position.	**Program:** a. The Department will provide support for a graduate student group. A "women in computing" group is currently being organized by a group of undergraduate students – we will ensure that graduate students are welcome to join. b. Tuition fees are not the responsibility of the Department. However, our understanding is that very few if any units on campus waive tuition for 4th year PhD students. c. Funding levels are continually considered (they were last updated in April 2021). The Department and faculty members understand that higher funding levels are necessary not just from the perspective of cost-of-living increases, but to recruit top students in a competitive field. d. The Grad Assistant position will be filled with a new candidate in August 2022. This change in staff will encourage us to formalize many processes that have been handled by the current staff member for several years. **Faculty:** a. We support the formation of a graduate student computing association. The Faculty of Science can arrange student mentors from other departments who already organize similar groups for other programs. b. Graduate students across campus pay tuition every term they are enrolled regardless of whether they have exceeded their fundable period. c. Minimum funding levels for graduate students are set by the School for Graduate and Post Doctoral Studies (SGPS). Computer Science meets these minimum levels. Higher pay would benefit current students and help with recruitment of quality students, but ultimately Research Assistantship amounts are limited by faculty research grants and is not under the control of the Dean's office. However, we will work with the new graduate chair to review their TA funding needs.

	d. Most departments the size of Computer Science have only one administrator for the graduate program. However, we recognize there is a huge volume of graduate applications processed by this office. Updates to the web site may help relieve some of the work and some tasks could move to the grad chair/committee.

Implementation Plan

The Implementation Plan provides a summary of the recommendations that require action and/or follow-up. In each case, the Graduate Program Chair, in consultation with the SGPS and the Dean of the Faculty is responsible for enacting and monitoring the actions noted in Implementation Plan.

The number of recommendations prioritized for implementation has been reduced as some are outside the scope of the IQAP (#3) or are already being actioned (#4, #7 and #8bc) as described in the program and faculty responses above. As a result, the recommendations not appearing in the implementation table are recommendations #3, #4, #7 and #8bc.

Recommendation	Proposed Action and Follow-up	Responsibility	Timeline
Recommendation #1: Increase/improve physical working environment.	- Examine how departmental space is currently used and identify specific needs. - As needed, draft a plan for the creation/transformation of space. - Discuss with Faculty leadership.	Department Chair Graduate Chair Office of the Dean, Faculty of Science	By Sept. 2023
Recommendation #2 and #8a: Develop an actionable and comprehensive approach to enhancing gender equity and EDIAD within the Computer Science Program, in alignment with Western's commitment to EDIAD.	- Develop a strategic plan aimed at enhancing EDIAD and gender equity within computer science, including faculty members and graduate students in this initiative.	Department Chair Graduate Chair Office of the Dean, Faculty of Science	By Sept. 2023
Recommendation #5: Revise funding package for TAs and review resources to support their work.	- Review current graduate student funding packages, including the option of shifting funding from GTAs to research-based funding. - Survey graduate students to determine where shortfalls in grading resources are occurring and what needs exist. - Develop expectations for instructors in supervising TAs and circulate these to both instructors and students.	Graduate Chair	Review of funding model – by September 2023. Survey of TAs by April 2023.

	- For large classes, consider assigning a lead-TA to help guide and support a team of TAs, and to help monitor their workload. - Work with the Centre for Teaching and Learning to identify resources to support TAs and Graduate students, more broadly.		
Recommendation #6: **Teaching and Supervision**: a. Ensure that there are supervisory committees for PhD students. b. Create a common general research methods course required for all MSc students, and require them for PhD students who have not taken a similar one before. c. Increase the number of graduate courses being offered. d. Consider offering courses more aligned with the current job market. e. Requirements for a project in a project-based MSc should be clarified in order to manage supervisions expectations.	a. - Track committee members and annual interviews using the Pathfinder software provided by SGPS. b. - Examine the potential for a common research methodology course for MSc students. c. and d. - Review and strategize course offerings to meet the needs of the program, the interests of the students and the demands of the job market. - Work toward the development and administration of an institutional graduate course calendar. e. - Determine mechanisms for balancing non-thesis student supervision between faculty members. - Consider setting up the MSc project as a 1.0 course with a coordinator/instructor responsible for communicating expectations to students, maintaining quality control and encouraging all faculty to propose project ideas.	Graduate Chair Graduate Committee	a. Immediate and Ongoing – the Department will increase prompt uptake of supervisory committees early in PhD programs by September 2023 b. Complete departmental review by September 2023. c. and d. Complete review and draft strategy by September 2023. e. Review and revise non-thesis component expectations – September 2023.

Recommendation #8a and #8d: Grad student life and support: a. Support the creation of a graduate student computing association – in particular a "women in computing society". d. Develop a succession plan for the grad secretary position.	a. Arrange student mentors from other departments who already organize similar groups for other programs. Support the communications of the departmental groups. d. With the onboarding of the new incumbent, formalize roles, responsibilities, and task lists. Consider how updates to the web site may help relieve some of the work.	Department Chair Graduate Chair Office of the Dean, Faculty of Science	a. By April 2023 d. By April 2023