FINAL ASSESSMENT REPORT

PERIODIC PROGRAM REVIEW (PPR)
Bachelor of Science
Computer Science
Faculty of Science

In accordance with the Institutional Quality Assurance Process (IQAP), this final assessment report provides a synthesis of the external evaluation and the internal response and assessments of the undergraduate Computer Science Program. This report identifies the strengths of the program, together with opportunities for program improvements and enhancements, and it sets out and prioritizes the recommendations that have been selected for implementation.

This report also includes an Implementation Plan that identifies who will be responsible for approving the recommendations set out in the final assessment report; who will be responsible for providing any resources entailed by those recommendations; any changes in organization, policy, or governance that will be necessary to meet the recommendations, who will be responsible for leading those recommendations; and timelines for acting on and monitoring the implementation of those recommendations.

SUMMARY OF THE PERIODIC PROGRAM REVIEW OF COMPUTER SCIENCE

The Computer Science Program offers a degree with the designation Bachelor of Science (Honours) in Computer Science. It is offered as a full-time, four-year program; full-time, five-year co-op program; and a part-time, first-year entry program. To obtain the degree, a student must complete 40 credits, where one credit corresponds to a one-term course. The courses are as described in the Undergraduate Calendar (and outlined in section 1.1.3.1): 21 specific courses, along with 1 from a Science group, 4 from the Open Elective Table, 8 from the Core Elective Table I, and 6 from the Liberal Studies tables). In addition to completing the specified 40 credits, in order to graduate a student must have a clear standing (at least a C- overall average, i.e., CGPA 1.67), and must complete the requirements within a certain time span.

This document comprises the Faculty of Science's Dean's response to the Peer Review Team (PRT) Report and the School's response, in accordance with the directions of the 2016 and 2020 Periodic Program Review (PPR) Manuals and with Section 8.2 of Senate Policy 126, Periodic Program Review of Graduate and Undergraduate Programs. The site visit by the external PRT for the Periodic Program Review was carried out between September 23 and 24, 2024. The School of Computer Science submitted a list of potential Peer Review Team (PRT) candidates to the Office of the Dean, who then selected

Dr. Yuanzhu Chen, Undergraduate Chair in the Department of Computer Science, Queen's University
Dr. Ken Pu, Undergrad Program Director in the Department of Computer Science, University of Ontario Institute of Technology

Overall, the PRT felt the Computer Science program at TMU is thriving in terms of demand while delivering appropriate education compared to Ontario and other Canadian institutes. This growth should be met with commensurate HR input to be sustainable. The PRT pointed to several areas of focus in their feedback. They felt that the planned search and hiring of both faculty and supporting staff should be executed strategically and urgently, acknowledging that this may involve additional recruitment and marketing efforts. Co-op and industry connections continue to be the strong points of the TMU CS program. They deserve continuous support at all levels: from the department to the university. Lastly, given the clear evidence of the high level of students' interest in senior-level computer science courses, additional concentrations would be worth considering.

The PRT Report offered the following three critical recommendations, and the School has responded thoughtfully to each to generate their Implementation Plan. The Dean's Office is in full support of the School's responses to the PRT recommendations.

The School of Computer Science has submitted its response to the PRT report to the Dean of the Faculty of Science, to which the Dean responded on November 6, 2024.

The Academic Standards Committee completed its assessment of the School of Biomedical Science on February 6, 2025. The Committee indicated that a thorough, analytical and self-critical program review was conducted. The program provided a detailed plan for future growth and support for development.

The Academic Standards Committee recommends that the program continue, as well as provide a one-year follow-up report, as follows:

The mandated One-Year Follow-up Report be submitted by June 30, 2026 to include:
1. A report on how EDI is being implemented into curriculum development plans
2. A progress report on the program's current periodic program review cycle
3. An update on hiring plan as presented in recommendation 4 of the Implementation Plan

Presented to Senate for Approval: March 4, 2025

Start date of next Periodic Program Review: 2025/26

SUMMARY OF THE REVIEWERS' RECOMMENDATIONS WITH THE PROGRAM'S AND DEAN'S RESPONSES

RECOMMENDATION 1: Curriculum Adjustment
   a. Consider making room in Year 1 and 2 to introduce one more industry relevant course. An excellent choice is Data Science (CPS 521).

b. It's worth considering merging Computer Organization I & II (CPS 213 and 310). Students in CS are not likely to suffer from a reduced emphasis on hardware level knowledge. If they are interested in Computer Organization, they can use the open electives on CPS 606. (R11)

c. Functional programming (FP) is largely covered by Comparative Programming Languages (CPS 506, Haskell) and Data Structures (CPS 305, Common Lisp). It is worth consideration to create a dedicated course to the functional programming paradigm. This allows a more thorough coverage of intermediate topics such as macro programming in Lisp, code as data, and monadic types. If Lisp is used, it would also help students to transition to CPS 305 more gently.

d. Consider organizing the upper year electives into areas. This not only helps students make their senior course intentions, but also makes it possible to introduce breadth requirements to address the concerns over meeting program level learning outcomes. (R1, R3)

PROGRAM'S RESPONSE:

The program has not made any significant change in several years (partially in anticipation of this PPR), so this is a timely recommendation. Recommendations 1a, 1b, and 1c are to the base structure of the program, affecting the first 2 years. As such they will require careful consideration. However, they are thoughtful and timely recommendations, so the Undergraduate Curriculum Committee will address them, with a goal of proposing curriculum changes early in winter 2025.

Recommendation 1d is something that has been considered in the past. Currently there is a single "Concentration" available to students: that of "Software Engineering". Several other concentrations have been proposed over the years, and it is time for the Undergraduate Curriculum Committee to look again at how we might structure the latter year options to provide more guidance to the students, as well as to address the breadth concerns. The UCC will give this recommendation due consideration, again with a target for recommendations of early winter 2025.

DEAN'S RESPONSE:

1a. Incorporation of CPS 521, or another industrially relevant course into the second year of the curriculum will require the Undergraduate Curriculum Committee to complete an assessment of the curriculum structure, will potentially require moving other core program courses currently in second year to earlier terms and will require a re-evaluations of the curriculum prerequisite structure.

1b and c. The Computer Science Undergraduate Curriculum Committee is encouraged to consider the recommended curriculum changes are best incorporated into the program as either core courses or core electives.

1d. The Dean agrees that creation of formal concentration (or information suggested pathways) will be beneficial to student planning and selection of upper year core electives.

RECOMMENDATION 2: Staff and faculty hiring
a. Initiate faculty search in the coming academic year (R2). Due to the large number of faculties to be hired in relatively short time, the search will be challenging. There will be a trade-off between

filling the urgently needed positions and selecting high quality candidates. Hiring can be more creative and strategic for better success, such as cluster hire, industrial chair, open rank, etc. We believe the quality of the department should be compromised during the search process. In particular, the department should reflect on the upper year courses and learning outcomes and institutional strategic research plan, and gender balance to identify key areas of growth and recruitment strategies. (R2, R4)

b. Improve staffing level for administrative staff to meet the student advising needs (R6).

c. Improve staffing level for IT support. The current IT staffing level has not been increased for over two decades. But with the increased student body, we observed that IT staff, while highly efficient and technical, is overwhelmed by supporting students' computing needs. This means the main infrastructure and server upgrades may not be receiving the necessary level of attention. The recommendation is to hire additional IT support staff dedicated to provide student support, and thus freeing up highly skilled personnel to tend to the server infrastructures (for undergrad and graduate level education and research).

PROGRAM'S RESPONSE:

None of this recommendation is a surprise. The department is experiencing unprecedented growth in its undergraduate program, and is struggling to meet the resulting demands.

The challenges in staffing are not simply a question of headcount. To support staffing growth we need office space and, in the case of faculty, graduate students and research space. Without commitments in these areas, increased headcount is moot.

R2a reflects many of the challenges of growth in the faculty complement faced by the DHC and the Chair. We have been taking a broad approach to hiring, but the current DHC is planning to create more targeted ads. We do not believe we have had any issue with the "quality" of the hires we have made in recent years, but we have been very limited in our ability to hire mid-career academics with established research records.

R2b is already in the departmental plan: we currently have 2 Departmental Assistants (DAs), 1 Administrative Assistant (AA), 1 Graduate Program Assistant (GPA), and an additional contract DA. We are proposing replacing that contract DA with a full-time Undergraduate Program Assistant (UPA). (An aside from the perspective of this PPR, but we will also create a parallel UPA for the Cyber Science program that will come onstream in 2026.) The UPA will provide better and more consistent academic support for students, as well as for the beleaguered Undergraduate Program Director and Coop Program Director.

R2c is a useful recommendation, partly in the way it characterises the need for support. We created the Student Skills Facilitator (SSF) position 4 years ago, and it has been a very successful initiative, with plaudits from students, faculty, and staff. We have been considering adding a second SSF. Arguably, the existing IT staff is adequate for the maintenance of the infrastructure - for which they do an excellent

job. Perhaps the part of the job that currently bogs them down could be better supported by offloading some of the tasks (resetting student passwords, facilitating online exams, etc.) to the SSF. We will commence discussions with the IT and SSF staff to explore how best to address the concerns identified in R2c. While thinking about restructuring of the IT area, it also seems like a good time to consider a MAC position in charge of the IT group - rather than the status quo of them all reporting to the Chair.

DEAN'S RESPONSE:

2a. The Dean agrees with the idea of creative approaches being used in the recruitment of new faculty members (within the rules outlined in the Collective Agreement) and supports the efforts of the Department in their search for hiring a mixture of early career and mid-career researchers to fill the approved faculty positions they need to fill. However, the Dean disagrees that there should be a compromise on the quality of candidates that are offered positions. The long-term success of the Computer Science program will be tied to the strength of the successful candidates being recruited. Moreover, the department should undertake a space assessment based on measurable usage. There is significant space available and vastly underutilized in the Atrium on Bay, for example.

2b and 2c. The Department is encouraged to do a needs assessment to establish what gaps there may be in the current level of student support and to propose what additional positions are needed to properly support student success so that any required resources can be properly identified so that a feasible timeline for resourcing and implementation can be developed.

RECOMMENDATION 3: Establish research units with Computer Science and recruit senior group leaders

a. The TMU CS department has grown steadily with a relatively homogeneous structure. One can anticipate that this type of structure will face challenges in rapid growth (as planned for the next hiring cycle).

b. TMU should consider creating research intensive positions in Computer Science to attract senior faculties and establish research academic units (e.g. research groups or centres of excellence). These establishments can further attract early career candidates, fulfilling the needs of rapid increase in faculty count as well as maintaining research quality.

PROGRAM'S RESPONSE:

This is a very important strategic recommendation. The department has been growing very quickly, and resources have been stretched, which has not left as much space for contemplation of strategic thinking. R3a raises a relevant concern.

While the department doesn't generally support differentiating between teaching and research faculty positions, it certainly endorses R3b in the sense of creating more consolidated research groups and centres of excellence. This is probably best facilitated by hiring of strong mid-career faculty in targeted areas.

Unfortunately, this is compromised by several factors:

1. the salary level we have been able to offer is barely competitive (I would say "not", except that we have hired many excellent junior faculty) - particularly for Toronto living expenses; we have lost hires because the salary is not adequate;
2. we have not been offered CRC positions (the only one in the last decade was for Cybersecurity, but it was a multi-department target, and in the end we lost an excellent mid-career researcher because Computer Science's recommendation was ignored - and it appears the CRC was not successful); CRCs are an excellent way to create research focus, but Computer Science has not received any love in this area;
3. we have an insufficient allocation of graduate students (we do not even have enough allocation to support 4 graduate students per new hire, and a "high quality" mid-career researcher would typically have about 3 times that number (which would use about 20% of our department allocation)) - and our creative proposals to address this limited allocation have been rebuffed;
4. as mentioned in section R2, our ad structure may not have attracted the "best" applications, and in particular may have precluded excellent foreign candidates.

The DHC will be addressing these issues to the degree possible.

DEAN'S RESPONSE:

3a and 3b. While there are arguably some ties between an increased number of research intensive faculty and the experiences of students in the undergraduate program (as the reviewers have suggested), this recommendation requires resource commitments beyond the assessment of the quality of the undergraduate programming offered in the Department of Computer Science. The Dean continues to support Departmental efforts to hire mid-career researchers as part of their ongoing recruitment efforts including lobbying for CRC allocation.

IMPLEMENTATION PLAN: SCHOOL OF COMPUTER SCIENCE

Priority Recommendation #1: Reassess the first year courses to identify how best to integrate another industry-relevant course, and a dedicated functional programming course.
Rationale: *PRT recommended we consider making room in Year 1 and 2 to introduce one more industry relevant course, and suggested Data Science (CPS 521). They also suggested that it is worth considering merging Computer Organization I & II (CPS 213 and 310), and creating a dedicated course to the functional programming paradigm.*
Implementation Actions: 1. Review of first year core required courses by Undergraduate Curriculum Committee (UCC) to identify gaps/redundancies and determine the best options for enhancement 2. Identify whether additional data collection is required to inform suggested changes. Coordinate data collection with PPR data collection in Fall term 2025.

3. Redesign CPS 213 to merge relevant knowledge and skills from CPS 310, as required
4. Design a new course focused on Functional Programming, as required
5. Remap first year courses, including newly created, redesigned or reorganized courses (e.g. CPS 521 Data Science)
6. Draft and complete major modification proposal

Timeline: Winter term 2026, in time to meet ASC's May 31, 2026 deadline for curriculum changes.

Responsibility for:

a) leading initiative: Chair of UCC

b) approving recommendation, providing resources, and overall monitoring:

Chair of Department

Consultation with Teaching Development on course redesign and development, as required
Consultation with Curriculum Quality Assurance on course mapping, as required

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Priority Recommendation #2 Organize upper year courses into thematic areas to provide guidance for students to be able to customize upper year electives

Rationale: *The PRT recommended we organize upper year courses into thematic areas to help students make their senior course intentions, and introduce breadth requirements to address the concerns over meeting program level learning outcomes.*

Implementation Actions:
1. Review of curriculum by UCC to identify how we might structure the latter year options to provide more guidance to the students, as well as to address the breadth of concerns
2. Develop guidelines for students to make senior course intentions
3. Identify potential courses for new concentration(s) and map to program learning outcomes to confirm coverage
4. Draft and complete major modification proposal, as required, for new concentration(s)

Timeline: Winter term 2025 for, in time to meet ASC's May 31, 2025 deadline for curriculum changes.

Responsibility for:

a) leading initiative: Chair of UCC

b) approving recommendation, providing resources, and overall monitoring:
Chair of Department
Consultation with Curriculum Quality Assurance on course mapping, as required

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Priority Recommendation #3 Increase Faculty and Staff complement to support program

Rationale: *PRT recommended to address understaffing:*
1) *Beef up, and accelerate faculty hiring*
2) *Improve administrative staff to improve student advising*

3) Improve technical staff support levels

Implementation Actions:
  1) Review and modify DHC hiring strategy somewhat to ensure top-tier faculty hires;
  2) Replace the contract DA with a full-time Undergraduate Program Assistant (UPA).
  3) Liaise with IT staff to assess challenges and identify how to address need in the short and long term.
  4) Liaise with Student Skills Facilitator (SSF) to explore option of reallocating minor IT tasks
  5) Explore option to create MAC position to manage the IT group

Timeline: The DHC will make every effort to fill the 6 open positions this year. However, that will not meet our faculty hiring needs, so that this will be a multi-year goal. The other actions should be complete by the end of the winter term.
Responsibility for: **a) leading initiative:** DHC Chair and Department Chair. **b) approving recommendation, providing resources, and overall monitoring:** Department Chair, Dean, VPFA, Provost

Priority Recommendation #4 Strategize PPR engagement, LO revision, and data collection to address flagged concerns with UDLE/LO coverage at a proficient level and data security coverage
Rationale: *A lack of coverage of the program LOs at the proficient level and coverage of UDLEs were identified in the curriculum mapping and map analysis in the self study, as was the coverage of data security. More data-security content has been added already, so remapping to the revised LOs will help to identify where gaps remain.*

Implementation Actions:
  1) Revise Program Learning Outcomes as a part of the PPR stage one process
    a) Ensure coverage of Data Security in revised LOs
  2) Remap UDLEs to revised Program LOs
  3) Remap core required and core elective courses to revised program LOs
  4) Identify any deficiencies in coverage and incorporate suggested changes into the recommendations for the next PPR self study

Timeline: Fall 2025 for remapping of courses; Winter 2026 for analysis in next self study
Responsibility for: **a) leading initiative:** Chair of the Department **b) approving recommendation, providing resources, and overall monitoring:** Chair of Department and PPR Team

Priority Recommendation #5 Improve EDI representation within the program
Rationale: *The representation of women and BIPOC students is significantly below societal numbers, and we would like to be more representative of our community, as noted in R4 of the PPR self study, and as is indicated by the university's student self-reported identification.*

Implementation Actions:

1) Continue discussions with Admissions and the FOS Dimensions Chair to explore ways of improving representation. Many of the issues appear to reflect broader societal trends, so are not particularly amenable to amelioration.

2) Continue prioritizing rectifying under-representation among our faculty (currently 38% women, and fairly representative in other dimensions apart from indigenous), as well as outreach to females who receive offers of admission.

Timeline: This is another long-term problem, but we are hoping for around 30% female 1st-year students in this admission cycle. We will review progress September 2025

Responsibility for:

a) leading initiative: Department Chair, Departmental Administrator, Student Skills Facilitator

b) approving recommendation, providing resources, and overall monitoring: Chair & Dean

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Priority Recommendation #6

Rationale: *Address student engagement issues from NSSE. While faculty have the best of intentions, with the current class sizes, it can be quite alienating.*

Implementation Actions: Explore the trends on this item in NSSE for the last several years. We are currently working to improve engagement among the faculty and staff, and working to hire more faculty and staff. We have brought in the Student Skills Facilitator, and anecdotally, this has helped, but the first students who experienced are only now getting to completing the senior NSSE. Trends with the SSF are also complicated by the huge class-size explosion.

Timeline: This is a long-term trend issue. We will examine the up-to-date NSSE data, and should have some trends by September 2025 as a part of the PPR data collection process, and will continue to monitor it.

Responsibility for:

a) leading initiative: Department Chair, Faculty

b) approving recommendation, providing resources, and overall monitoring: Department Chair

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Priority Recommendation #7 *Consider how to ease financial hardship, as it seriously affects students' ability to focus full-time on their studies.*

Rationale: From the discussion of UPO Tables 1 and 2 in Section 6.2.6 it is noted that, coupled with Question 1a from the NSSE ONT data, financial hardship is suggested as one of the reasons for full time students taking a partial load and also for so many students taking their computer science degree on a part time basis.

Implementation Actions: We continue to work with Advancement and Co-op employers to attract more funding

- Program Director, through the Chair and Dean, to approach the University to ensure that a bursary program or some such financial vehicle be extended to help ease this situation of financial constraints

Timeline: Winter 2025

Responsibility for:

a) leading initiative: Chair of Department, Dean, Advancement
b) approving recommendation, providing resources, and overall monitoring: Chair of Department

Priority Recommendation #8 Review the General Science requirement in first year to assess curricular relevance and utility
Rationale: *TMU has the only Computer Science program with a required Science course in first year. This is not a huge issue, except that it takes a slot in first year that perhaps could be better used with another topic.*
Implementation Actions: The UCC will examine the desirability of continuing this course requirement.
Timeline: In time to meet ASC's May 2025 deadlines for curriculum changes
Responsibility for: **a) leading initiative: Chair of UCC, Chair of Department** **b) approving recommendation, providing resources, and overall monitoring:**