Final Assessment Report

Computer Science
Graduate and Undergraduate Programs
(reviewed 2018-19)

A. Summary

1. The Department's Self Study was considered and approved by the Senate Academic Review Committee on November 7, 2018.
2. The Review Committee consisted of two external reviewers: Marcus Santos (Ryerson) and Ali Ghorbani (University of New Brunswick) and an internal reviewer, Ernest Biktimirov (Brock University).
3. The site visit occurred on March 12-14, 2019.
4. The Reviewers' Report was received on April 5, 2019.
5. The Department's response was received on April 30, 2019.
6. The Senate Undergraduate Program Committee response was received on April 30, 2019
7. The Senate Graduate Studies Committee response was received on May 10, 2019.
8. The Dean of Graduate Studies response was received on May 16, 2019.
9. The Dean of Mathematics and Science response was received on May 23, 2019.

This review was conducted under the terms and conditions of the IQAP approved by Senate on May 25, 2016.

The academic programs offered by the Department of Computer Science which were examined and rated as part of the review were:

Program(s)	Excellent Quality	Good Quality	Good Quality with Concerns	Non-Viable
MSc		X		
BSc (Honours)		X		
BSc (Honours) co-op			X	
BSc (Honours) combined		X		
BSc (Honours) combined co-op			X	
BSc (Honours) Computing and Network Communications	*The quality of the courses offered by the Sheridan college are unknown.*			
BSc (with Major)		X		
BCB Computing and Business	*The details of the Business component of the program were not included in the review, nor we met course instructors from the Goodman School of Business.*			
Minor in Applied Computing		X		

B. Strengths of the Program

The reviewers noted the following strengths:

- The curriculum provides solid fundamentals for Programming, Intelligent Systems, Programming Languages, and Algorithms. Similarly, Systems fundamentals bring together cross-cutting systems concepts that can serve as a foundation for more advanced work in a number of areas.
- The undergraduate programs remain a priority area for the department and its faculty.
- There is a very collegial atmosphere in the department.
- For its size and the number of eligible faculty, the faculty is doing reasonably well in the NSERC grant competitions.
- The teaching loads are typical of Canadian Computer Science departments and allow the faculty members to supervise graduate students and pursue research programs.
- Two out of eleven current faculty members are female, which provides some role models for students.
- The graduate program is now well-established and enhances the experiences of the undergraduate students and provides opportunities to be exposed to current research.
- Approachable faculty; student centred environment; student body actively involved in peer led team learning.
- The department is well-supported by a relatively small number of staff members.
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There has been a significant increase in undergraduate registrations (125% increase from 2011/12 to 2017/18 based on Table 10.1 of the Self-Study report) and in MSc applications (60% increase from 2011 to 2017 based on Table 10.2 of the Self-Study report) , which provides an indirect external indication of the quality of the programs.

C. Opportunities for Improvement and Enhancement

Recommendation #1

The de facto admission average needs to be raised to 80%.

In its response, the Department stated:

The current admission average of 70% is too low, and the result is low retention rates in our program. The Department's retention rate has been one of the lowest in the Faculty for this reason. It is very unlikely that incoming students with low averages will survive. The positive effect of raising the minimum entrance average will be a substantial increase in retention rates. Another effect will be in recruitment – the program will be seen as higher quality and more competitive with other programs in Ontario and beyond.

The Faculty Dean stated that:

The Deans' Office would like to refer this matter to the Senate.

The Dean of Graduate Studies stated:

This is aimed at undergraduate admissions, however, to the extent that raising the admission average provides a better prepared pool of potential graduate students, I am in support of this recommendation.

The Senate Undergraduate Program Committee stated:

We support the consideration of recommendation 1

ARC Disposition of the Recommendation

ARC considers the recommendation to be not accepted. The de facto admission average is not under the sole control of the Department and cannot be set at a certain level in contradiction to provisions in the Faculty Handbook or university enrolment targets. ARC encourages the Department to investigate other measures (such as 2nd year entry) to address concerns of competitiveness and student quality as well as retention and student success.

Implementation Plan

Recommendation not accepted.

Recommendation #2

Infusion of PLO 3b across program courses

In its response, the Department stated:

> From the self-study document:
> *PLO 3b Identify and apply appropriate resources*:
> *Identify—both from past experience and through new inquiry—computing techniques, technologies and tools appropriate to the development or maintenance of software systems.*
>
> Upon examining Table 3.3a BSc Curriculum Map, it is clear that PLO 3b does not appear to be incorporated into many courses. However, most of the course bank are composed of non-AI courses, and thus this concern as described in the above recommendation is relevant only to the following small subset of the course bank dealing with artificial intelligence topics:
>
> - COSC 3P71 Introduction to Artificial Intelligence
> - COSC 4P76 Machine Learning
> - COSC 4P78 Robotics
> - COSC 4P80 Artificial Neural Networks
> - COSC 4P81 AI Programming
>
> In Table 3.3a in the self-study document, PLO 3b is in fact included in 4P76 Machine Learning and 4P80 Neural Networks, which are both AI courses. COSC 3P71 Introduction to AI is a compulsory survey course, and advanced problem solving using existing AI resources is inappropriate for that course. COSC 4P78 uses prescribed robotics hardware and programming environments, and PLO 3b is therefore irrelevant. Finally, COSC 4P81 should certainly involve PLO 3b when it is eventually offered (it has not been offered yet).
>
> The Department will keep this issue in mind when new artificial intelligence courses are introduced in the future, especially as new AI-research faculty are hired in coming years.

The Faculty Dean stated that:

> The Dean's Office agrees with the departmental response.

The Dean of Graduate Studies stated:

> This is aimed at undergraduate courses, however, infusion of POL 3b at the undergraduate level may strengthen both student background and teaching experience that may support graduate courses. So, I am in support of this recommendation.

ARC Disposition of the Recommendation

ARC considers the recommendation to be accepted and in the process of implementation. The Committee believes the Department is best-positioned to determine how to incorporate PLO 3b across program courses.

Implementation Plan (2nd Priority)	
Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Mathematics and Science to report by the end of academic year 2020/21

Recommendation #3

Inclusion of a required "Communication Skills for the Computer Scientist" workshop course

In its response, the Department stated:

> The Department supports this recommendation, but feels it may not be possible to implement. Additional exposure to communication techniques is certainly of great value to students.
>
> Unfortunately, it might be difficult to enforce completion of a mandatory workshop course into the curriculum. We will investigate whether it might fit into one of our core courses as a requirement. Currently, some 4Pxx courses have seminar components, and recently, COSC 1P50 Integrity and Literacy in the Information Age involved student presentations. A compromise may be to advertise such a course to the student body, and encourage them to take it. Those who desire this additional workshop would be free to participate.
>
> The Department will investigate this recommendation further. The Department will contact the A-Z Learning Centre at Brock to see if there are workshops that students can take with respect to communication skills. They offer many courses for student advancement and development.

The Faculty Dean stated that:

> The Dean's Office recommends that the department keep this recommendation under active consideration and implements it whenever (and perhaps with help from the Learning Services) it becomes feasible.

The Dean of Graduate Studies stated:

> I would also support this recommendation for graduate students. I encourage the department to seek out campus partners (e.g., A-Z learning, CCEE, etc.) to assist with this.

The Senate Undergraduate Program Committee stated:

> We … strongly support recommendation 3.

ARC Disposition of the Recommendation

ARC considers the recommendation to be accepted for consideration. The Committee believes the Department is best-positioned to determine how to incorporate communication skills into the curriculum, in conjunction with relevant campus resources.

Implementation Plan (2nd Priority)	
Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Mathematics and Science to report by the end of academic year 2020/21

Recommendation #4

Hiring of new faculty members

In its response, the Department stated:

The department strongly supports this recommendation.

Our Strategic Hiring Plan specifies that we will have 6 faculty hired in the coming 3 years (including 2019-20): 3 hires in year 1, 2 in year 2, and 1 in year 3. We are pleased that the administration approved 3 hires for year 1. Unfortunately, due to budgetary cutbacks in 2019, one of these hires is postponed until next year (at which time a 4th faculty member will retire). We hope that our hiring plan will be fully supported in the next few years.

Should the hiring plan not be followed, it be impossible for the department to grow in terms of student numbers and new program offerings, and quality will definitely suffer.

The Faculty Dean stated that:

The Dean's Office will keep the recommendation under consideration and defer any decision until required resources become available.

The Dean of Graduate Studies stated:

This is beyond the purview of the Dean, Faculty of Graduate Studies. However, for graduate programs to continue to evolve and provide timely access to new material (particularly, in a rapidly evolving area such as AI), faculty renewal is an important component.

ARC Disposition of the Recommendation

ARC considers the recommendation to be not accepted as it lies outside of the Committee's jurisdiction. The Committee expects that the Department will proceed through normal channels of advocacy for these faculty resources.

Implementation Plan

Recommendation not accepted.

Recommendation #5

Renovation of the department's teaching lab space, equipment, and software.

In its response, the Department stated:

The department strongly supports this recommendation.

Resource acquisition and long-term planning has been a historic problem for the department. Recently, our students have been very vocal in criticizing the unsatisfactory resources and work environments, such as lab spaces and hardware. Over the years, thanks to a conscientious system administrator, a last-minute end-of-fiscal-year strategy is necessary in order to replace the oldest hardware requiring renewal (although the budget bottom line only permits limited replacements at best). This is far from ideal, and can be more expensive in the long term due to catastrophic failure of old computer hardware. If further growth is to happen, additional lab and office space will be necessary.

The Department would especially like to revamp our student labs in order to make them more contemporary and accommodating as work environments. For example, desks and furniture conducive to group collaboration, as well as laptop stations (power outlets) have been a wish of the department for many years. However, with the current (new) Faculty-directed budget model at Brock, this does not seem feasible.

It should also be noted that computer science students pay a professional fee above and beyond the tuition paid by other students (Business students also pay this fee). With our current student numbers for 2018/19, these fees alone amount to over $1 million in revenue to Brock. However, the Department has never seen any of this revenue over the years, and hence the poor state of our facilities. The university needs to invest in our department (also see point#7).

The Faculty Dean stated that:

The Dean's Office recognizes the importance of this recommendation and will make attempts to implement it in several (possibly three) steps with the help from the Office of the Provost and Vice President Academic. The Dean's Office also suggests that the department work with the University Development Office to raise the funds needed towards this goal.

The Dean of Graduate Studies stated:

This is not directly within the purview of the Dean, Faculty of Graduate Studies, however, access to up-to date lab space, equipment and software is important to the student experience (both at the undergraduate and graduate level). I would encourage the department to work with the Dean of the Faculty of Mathematics and Sciences on this recommendation.

The Senate Undergraduate Program Committee stated:

> Recommendations 5, 9 and 10 are consistent with UPC's desire to see more flexibility and more collaboration between departments and enchanced experiential learning.

ARC Disposition of the Recommendation

ARC recognizes the necessity of ongoing renovation of lab space, equipment and software, however the Committee considers the recommendation to be not accepted as it lies outside of its jurisdiction. The Committee expects that the Department will proceed through normal channels of advocacy for these resources.

Implementation Plan

Recommendation not accepted.

Recommendation #6

Development of a comprehensive plan for graduate training, research, and funding opportunities.

In its response, the Department stated:

The Department supports much of this recommendation.

Firstly, the current graduate program is more than adequate in terms of graduate training, and the department sees no need for improving that aspect of the program. Our graduate students are exposed to many aspects of research methodologies, public speaking (course seminars, MNK conference, thesis seminars, and international conference presentations when appropriate), and research paper publication. Their experience is equivalent to, if not better than, that of graduate students at other institutions.

It is important for the Department's strategic plan to align with those of the Faculty and University. On the other hand, the University's strategic plan and SMA 2 often highlight research disciplines outside of computer science (and science in general), which disadvantages departments, faculties, and centres outside of the focus of the SMA 2. Of course, that is the purpose of the SMA, as it is to create differentiation between universities, and hence within universities. Nevertheless, SMA 2 supports our new PhD proposal (co-hosted with the Dept of Mathematics and Statistics), and we are always hopeful that future initiatives will have support as well.

The Department has always been, and will continue to be, open to new funding opportunities and industry partnerships. However, such initiatives **must** be relevant to the research agendas of faculty. This means that there will be research content that corresponds to faculty research interests and expertise, with the possibility of publishable research results. Historically, this has frequently not been the case. Furthermore, individual faculty members always have the final say on what research projects and funding opportunities they wish to pursue.

Finally, new MSc streams and increased graduate enrollments are strictly contingent upon increased resources. Growth in faculty hires is required for new programs and increased student numbers. At present, the department cannot increase graduate student numbers, with the current faculty numbers. We expect that this will improve in the coming years as new faculty are hired.

The Faculty Dean stated that:

The Dean's Office supports the recommendation and suggests that one of the ways of implementing it would be via fund-raising efforts coordinated with the Office of the University Development.

The Dean of Graduate Studies stated:

> I strongly support this recommendation. I encourage the department to think strategically.

The Senate Graduate Studies Committee stated:

> Recommendations # 6 and 8: SCGS agrees that the University should encourage and support the Department and the Faculty to offer a Ph.D. program in Computer Science. [They] should also consider allocating targeted resources towards developing a comprehensive plan for graduate training, innovating MSc streams and graduate student recruitment. As pointed out by the reviewers (5.7.3), the MSc program is somewhat theoretical, thus future plans should be focused on developing an applied MSc field in the field of Computing.

ARC Disposition of the Recommendation

ARC considers the recommendation to be accepted and in the process of implementation.

Implementation Plan (1st Priority)	
Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Mathematics and Science to report by the end of academic year 2019/20

Recommendation #7

Highlighting the strategic importance of Computer Science

In its response, the Department stated:

The department strongly supports this recommendation.

Computer science is of strategic importance to Brock University, as it should be to any modern comprehensive university. This is partially evident in the inclusion of the PhD in the SMA 2 document, as well as administrative support for new programs such as the BSc in Game Programming, and the proposed BSc in Data Science. However, Brock's new budget model ties department budgets with their parent Faculty, and this can be a disadvantage (see point #5).

With respect to faculty renewal, please see our response to point #4.

With respect to lack of strategic funding for the Department, see point #5.

The Faculty Dean stated that:

The Dean's Office fully recognizes the strategic importance of Computer Science, and will support the faculty renewal plan to the extent possible under the fiscal constraints.

The Dean of Graduate Studies stated:

I support this recommendation.

ARC Disposition of the Recommendation

ARC considers the recommendation to be accepted and in the process of implementation. The Committee also recognizes the reviewers' recommendation in the contextual comments, to develop a long-term plan for faculty renewal. The Committee understands that advocacy for future faculty resources will need to proceed through normal channels.

Implementation Plan (1st Priority)	
Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Mathematics and Science to report by the end of academic year 2019/20

Recommendation #8

Grow the Department's graduate program

In its response, the Department stated:

The department strongly supports this recommendation.

Our current graduate program is at its maximum capacity given the current resources, and in particular, faculty numbers. Retirement replacement hires and growth hires are absolutely necessary for increasing enrollments and expanding program offerings.

The proposal for the PhD in Modelling and Data Science (jointly proposed with the Department of Mathematics and Statistics) is close to final submission. The Department is highly appreciative of the support of the Dean and upper administration, and the SMA 2.

The Department has no authority with respect to resource funding, including neither the amount or scheduling of resources allocated to it (please see points #5 and #7). The department is striving to maintain its current undergraduate and graduate programs. This has been very difficult during these times of fiscal austerity, record student enrollments, and faculty retirements.

The Faculty Dean stated that:

The Dean's Office recognizes that at the present level of resources there is no room for further growth of the department's graduate program.

The Dean of Graduate Studies stated that:

I support this recommendation and note the comments around considering a more applied than theoretical approach given that usefulness of applications appears to be driving much of the interest in computer sciences.

The Senate Graduate Studies Committee stated:

Recommendations # 6 and 8: SCGS agrees that the University should encourage and support the Department and the Faculty to offer a Ph.D. program in Computer Science. [They] should also consider allocating targeted resources towards developing a comprehensive plan for graduate training, innovating MSc streams and graduate student recruitment. As pointed out by the reviewers (5.7.3), the MSc program is somewhat theoretical, thus future plans should be focused on developing an applied MSc field in the field of Computing.

ARC Disposition of the Recommendation

ARC considers the recommendation be accepted and in the process of implementation. The Committee recognizes that a Program Proposal Brief for a new PhD program is in the final stages of development.

Implementation Plan (1st Priority)	
Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Mathematics and Science to report by the end of academic year 2019/20

Recommendation #9

CIPS accreditation

In its response, the Department stated:

> The Department does not support this recommendation at this time.
>
> Although CIPS (Canadian Information Processing Society) accreditation has been considered many times in the past, we believe that it is not critical.   Instead, we have designed our curriculum as closely as possible to the latest ACM (Association of Computing Machinery) computer science curriculum model. CIPS accreditation will not give students a significant competitive advantage when seeking employment. The fact that it reduces flexibility is reason enough to avoid it, at especially at this time when the department is trying to manage its program offerings with limited resources and faculty numbers, as well as manage new and future programs (BSc in Game Programming, BSc in Data Science, PhD in Modelling and Data Science).
>
> The department will reconsider CIPS accreditation in the future, after all resource and faculty hiring issues have been resolved, and after our new and future programs have become established.

The Faculty Dean stated that:

> The Dean's Office will leave this recommendation to the department to implement if and when it becomes feasible.

The Dean of Graduate Studies stated:

> This is aimed at undergraduates, however, seems like a good idea, especially if there are potential spinoffs for graduate students.

The Senate Undergraduate Program Committee stated:

> Recommendations 5, 9 and 10 are consistent with UPC's desire to see more flexibility and more collaboration between departments and enchanced experiential learning.

ARC Disposition of the Recommendation

ARC considers the recommendation to be accepted for consideration.

Implementation Plan (3rd Priority)	
Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Mathematics and Science to report by the end of academic year 2021/22

Recommendation #10

Intra-department collaborations.

In its response, the Department stated:

> The department supports this recommendation.
>
> Faculty members are always open to inter-department collaborations, and successful collaborations continue to happen (e.g. between COSC and BIOL). The CRC position is indeed an example of such continuing partnerships.
>
> That being said, research collaboration is only successful when there is mutual benefit to the research programs of all researchers involved (historically, this has often not been the case, which has torpedoed many possible collaborations). Academic freedom dictates that faculty members are free to pursue the research that is of interest to them.

The Faculty Dean stated that:

> The Dean's Office is satisfied with the present level of collaboration between the Computer Science and other departments with the Faculty/University and anticipates that the level of collaboration will grow significantly once the allocated CRC Tier 2 Bioinfomatics position is filled.

The Dean of Graduate Studies stated:

> I support this recommendation.

The Senate Undergraduate Program Committee stated:

> Recommendations 5, 9 and 10 are consistent with UPC's desire to see more flexibility and more collaboration between departments and enchanced experiential learning.

ARC Disposition of the Recommendation

ARC understands the recommendation to be referring to "inter" departmental collaborations from the context provided in the Reviewers' Report. The Committee considers the recommendation to be accepted and in the process of implementation. To an extent, this is already current practice as described by the Department in its response.

Implementation Plan (1st Priority)	
Responsible for approving:	Department
Responsible for resources:	Department
Responsible for implementation:	Department
Timeline:	Dean of Mathematics and Science to report by the end of academic year 2019/20

D. Summary of Recommendations:

First Priority:
Recommendations 6,7,8,10

Second Priority:
Recommendations 2,3

Third Priority:
Recommendation 9

Not Accepted:
Recommendations 1,4,5