

June 5, 2018

To: Quality Assurance Office

The Faculty of Mathematics endorses the May 2018, Two-Year Progress Report, Bachelor of Mathematics in Statistics, Statistics for Health, Actuarial Science, or Mathematics Finance (BMath).

Significant progress has been made to implement the recommendations of the reviewers, with many of the recommendations currently in progress or completed.

In particular, the department has -

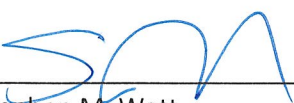
- Changed Statistics for Health into a Biostatistics program, which better serves the needs of our students (Recommendation 3).
- Provided an exit survey to outgoing undergraduate students (Recommendation 4).

Some projects that are currently ongoing are -

- Decrease class sizes (Recommendation 1). This will not be an easy or fast problem to solve.
- Find more space (Recommendation 2). This again will not be an easy or fast problem to solve.
- Implement a capstone course (Recommendation 5). This is currently implemented at a small scale. It is expected that this will slowly be increased over time, although to expand this to all students would require significantly more resources than the faculty has.
- Career paths for lecturers (Recommendation 6). This is something that faculty is very aware of, and very interested in, but has little control over. It is hoped with the re-write of Policy 76 that some of the issues will be resolved.

The recommendation to hire our own (Recommendation 7) was not implemented, as it was felt that the current policy was a good policy. This was mentioned in the initial response to the reviewers' recommendations.

The last recommendation, to diversity the undergraduate student body (Recommendation 8), is currently being worked on at the faculty level. Although some progress has been made, this is something that the faculty will continue to work on for the foreseeable future.



Stephen M. Watt
Dean, Faculty of Mathematics



Two-Year Progress Report

Bachelor of Mathematics in Statistics, Statistics for Health, Actuarial Science, or Mathematical Finance (BMath)

June 2019

Background:

The most recent BMATH (Actuarial Science/Mathematical Finance/Statistics/Statistics for Health) self-study was submitted July 20, 2016 and the site visit occurred August 9-10th, 2016. The review team's report was received on November 2, 2016, and the program's response and implementation plan were submitted on February 4, 2017.

The Dean of Mathematics indicated his endorsement of the plan on January 4, 2018. The Final Assessment Report was approved at Senate Undergraduate Council on September 11, 2018 and at Senate on October 15, 2018.

The program reviewers were very positive about our programs. We repeat the program reviewers' executive summary below.

"In summary, we find all four programs to be very impressive in delivering quality education to top caliber students and producing graduates in high demand. Common strengths among all programs included outstanding leadership, faculty members, administrative support, and students. In particular, Professor Stefan Steiner is doing an outstanding job as Chair of the Department of Statistics and Actuarial Science in leading and guiding the various programs to achieve excellence in teaching, research and administration. The programs provide the necessary breadth of foundational courses to help students prepare for many careers in industry, as well as those intending to do advanced studies. The co-op program, which provides students gainful practical industry experience, was itself very impressive with strong positive reviews from both the students and employers. This highly successful co-op program provides a fairly unique experience for the students enrolled in these four programs."

Progress on Implementation Plan:

Below are listed all of the reviewers' recommendations and the program's progress on implementation.

1. Large class sizes. This is a result of the increased popularity (which is a good thing) of the programs and courses. However, this inhibits the optimal learning experience in these programs as the large class sizes make it very difficult, if not impossible, for the students to do projects (and an appropriate amount of applied work) which is an essential part of these programs and helps to solidify the theoretical and methodological knowledge gained from the courses. The only solution we [the reviewers] can see to reducing class size-particularly critical at the fourth year level – is the hiring of additional tenure-stream faculty and lecturers. In so doing, the balance of these two will be important to keep in mind: It seemed fairly reasonable at present with 42 tenure-stream faculty and 9 lecturers.

Status: in progress

Details: In the last number of years we have been able to hire more faculty. In particular, including individuals we hired this year but who have not yet arrived, we have increased our tenure/tenure-track complement to 49 faculty. We have also hired an additional lecturer and now have 10 long-term lecturers. With this increase in teaching resources we have been able to make progress in reducing some of the large class sizes, especially at the the upper year level. Median class sizes in ACTSC and STAT labelled courses have decreased by about 20-25% when comparing 2018 and 2015 although we still have the largest median class sizes in the Math faculty. Looking at the data, we see the least improvement for STAT courses at the third year level, where the median class size is 113 for courses taught in 2018. As new resources become available, we plan to make reducing third year STAT class sizes a priority.

2. Space implications. As is common with many universities, space is limited and a valued commodity. The Department of Statistics and Actuarial Science is practically out of space. Given further expected growth, which is essential to the well-being of each program (and is currently planned), future space needs will have to be addressed urgently. These include both office space for new faculty members and suitably-sized classroom space.

Status: in progress

Details: Space is indeed very tight in the Department. Unfortunately, the hoped-for Math 4 building has not yet been approved. In the meantime, we have tried to make better use of our existing space and have also been allocated some offices in the MC building. We recently renovated some space we previously used for Master's students and created a versatile space for up to 16 visitors. In addition, we have moved some retired faculty into shared space and are in the process of creating a new office in an empty space in our M3 building. These

changes will allow us to accommodate our expected needs for the next year. Assuming we continue to grow in the years ahead, which seems reasonable given our growth in undergraduate student numbers and the university's new budget model, we will soon be at capacity again.

3. Re-evaluate the goals and mission of the Bachelor of Mathematics in Statistics for Health. As discussed earlier in the report, it would be good to reassess the currently under-enrolled program in Statistics for Health. The current emphasis is on healthcare systems and includes numerous business courses. A more popular emphasis might be to frame it as more of a 'biostatistics' program with standard statistics courses, specific methodological courses for health data (e.g., courses on analysis of survival and longitudinal data), a few public health courses (e.g., epidemiology), and maybe one or two 'biology' courses. This recommended change in program emphasis may help with the low enrollment and should not require the introduction of many (if any) courses: Many (if not all) of these needed courses are already in place and being offered by the department. Attention should also be given to the number of required courses, since presently that number is large.

Status: completed

Details: We redesigned the Statistics for Health program into a [Biostatistics program](#). The changes result in a new program that has a stronger technical foundation and should appeal to Math students. The new program admitted its first students in Fall 2018.

4. Exit and follow-up surveys for graduates. A powerful way to market programs is to 'advertise' successful student placements, whether it be attractive positions in industry or enrollment in top graduate programs. The current tracking and monitoring of graduating students appears inadequate. Implementation of a formal exit survey would be a good start. Such a survey might collect information on: student satisfaction with the program, ways in which the program might get even better, plans for after graduation (i.e., job position, graduate school enrollment), and sustainable contact information. The latter pieces of information could be kept in a database and updated going forward. This will have the dual benefits of 'advertising' the success of the graduates for these programs, which will help the continued recruitment of top students, and for development, including identification of donors for endowed fellowships, chairs, etc.

Status: completed

Details: We implemented this suggestion. Beginning at the end of the Winter term in 2017, all our graduating students are given an online exit survey.

5. Introduce capstone courses for all programs. Capstone courses would be an important and attractive addition to all three programs to partially offset the problem caused by large advanced undergraduate courses and to provide an important project-based (case study) course in a small class size setting. We do understand, however, that to undertake this initiative, additional faculty would need to be hired or a reallocation of current resources would be required given the large numbers of fourth-year students across the programs.

Status: in progress

Details: Starting in 2017 we now offer a capstone course ([ACTSC 468](#)) for students in our Actuarial Science program. This course has limited enrolment because it involves case studies and student presentations, etc. We are keen to also offer a capstone course for Statistics and Mathematical Finance students. However, the main constraint here, as pointed out by the reviewers, is the lack of resources, especially when many of our other 4th year courses often have enrolments of over 100 students. To date we have not been able to offer a capstone style course for Statistics or Mathematical Finance students. In the last few years we have instead used our new teaching resources to reduce class sizes for our existing courses especially those at the third or fourth year level.

6. Career paths for lecturers. In discussion with a subset of the lecturers, it was apparent that they feel that the process for promotion from a term-to-term hire to a permanent continuing position is unclear. Further orientation and support from the administration of the department for the lecturers on this issue would help to alleviate career tension for the Lecturers currently on a term-to-term basis. A model such as an initial 2-year appointment, a subsequent 3-4-year appointment, and then promotion to Continuing Lecturer would be worth exploring. Some consideration of reduced teaching when preparing new courses would also be worth discussing.

Status: in progress

Details: This is not an issue that is completely under the control of the Department or even the Faculty. There is a university committee looking at revising [Policy 76](#) surrounding appointments and lecturers. However, progress has been slow. In the meantime, within the faculty we have adopted an informal approach to provide lecturers with more clarity on career progression. We aim to follow the approach of tenure-track faculty as closely as makes

sense. In particular, for all our recently hired lecturers we have given them three year contracts that are eligible once for renewal. At the end of these two contracts (6 years) they will be considered for continuing lecturer status.

7. Consider hiring Waterloo Actuarial Science PhDs. For the Actuarial Science program, hiring top faculty is challenging given the small number of strong Actuarial Science graduate programs in existence. On top of this, many of the top PhD's come from the graduate program at Waterloo. The policy of not hiring one's own graduates, which in general is a good policy, may restrict the necessary growth and maintenance of strength of the Actuarial Science program going forward.

Status: incomplete

Details: It is challenging hiring in the area of Actuarial Science. The field is relative small and PhD graduates have good career prospects in industry. Our current policy prohibits hiring our own PhD students in either Statistics or Actuarial Science unless they have been away for at least two years. This is consistent with university guidelines as provided by the Provost and also the direction supported by the Dean of the Faculty of Mathematics. So, we are able to hire our own graduates but only after they have been away for some time. We feel this is a good policy both for us and for our graduating students who benefit from seeing how things are done at other universities. In the past, considering our own students immediately after graduation has caused internal divisions that took a long time to heal. In addition, since this policy has been in effect, we have made some excellent hires. Since we are one of the top universities in the world for actuarial science we are attractive to many of the best recent PhD graduates from all over the world.

8. Increase diversity in enrollments. International students are predominantly from China. To increase diversity and to reduce the risk of that one market diminishing, it will be important to tap other markets (e.g., the Indian subcontinent). The department should explore the best options to do this. For example, there may be opportunities to leverage current university programs/partnerships to target potential students from other countries.

Status: in progress

Details: The Faculty of Math is acutely aware of our lack of diversity in international students and actively recruits in a number of countries around the world. We recently engaged a full time recruiter for India. We hope that in the future, our recruitment in other countries will be more effective. The Statistics and Actuarial Science department does not directly control admission into our programs since they are all second year entry. All our students apply to

the Honours Mathematics program at the University of Waterloo. Only after they have proven their ability in first year can they enroll as a major in one of our programs. As such, we have much less control over recruitment than some other Math faculty programs.

Explain any circumstances that have altered the original implementation plan:

n/a

Address any significant developments or initiatives that have arisen since the program review process, or that were not contemplated during the review:

Together with the School of Computer Science we have developed a joint degree in Data Science. The first students enrolled in this program in Fall 2017.

Updated Implementation Plan:

	Recommendations	Proposed Actions	Responsibility for Leading and Resourcing (if applicable) the Actions	Timeline for addressing Recommendations
1.	Reduce class sizes, particularly in fourth year courses	Hire more faculty	Chair/Dean	In progress. 2017-future
2.	Address future space needs (i.e., office space for new hires and suitably sized classroom space)	New fourth Math building proposed	Dean	In progress. Groundbreaking possibly in 2020
3.	Reevaluate the goals of the Statistics for Health program	Change the program into a degree in biostatistics	Steve Drekcic, Assoc. Chair Undergraduate Studies	Complete. Program changes approved in time for Fall 2018 admission.
4.	A subcommittee of faculty who teach the relevant courses has been struck to review program and required courses	Design and implement survey for our graduating students	Carlos Mendes, Administrative Officer SAS	Complete. Started April 2017 and continuing
5.	Introduce capstone courses	Develop and offer capstone course for actuarial science students	Christiane Lemieux/David Landriault, Assoc. Chair Actuarial Science	In progress. First offering of capstone course for actuarial science students Winter 2017, scheduled for Winter term in future
6.	Further career path orientation and support from the administration of the program for lecturers	Develop two streams of lecturers – those with 3 year contracts that could lead to continuing lecturer positions and those with shorter 2 year contracts with no path to continuing lecturer	Chair, Dean	In progress. Implemented in an informal way. University policy review is underway, but completion time is not known.

7.	Consider hiring Waterloo Actuarial Science PhDs (Current university policy prohibits hiring our own PhD students in either Statistics or Actuarial Science unless they have been away for at least two years)	Current approach: Approach Waterloo Actuarial Science PhDs two years past graduation	Chair	Recommendation not supported by Dean and Provost. We plan to continue with our current approach.
8.	Increase diversity in enrollments (Statistics and Actuarial Science does not directly control admission into their programs since they are all second year entry. All students apply to the Honours Mathematics program at the University of Waterloo. Only after they have proven their ability in first year can they enroll as a major in one of our programs)	The Math faculty is working to increase diversity through recruiting trips to a variety of locations and through hiring a recruiting officer for India.	Serge D'Alessio , Math Faculty, Associate Dean Undergraduate Admissions and Outreach	In progress and ongoing.

The Department Chair/Director, in consultation with the Dean of the Faculty shall be responsible for monitoring the Implementation Plan.

Report on anything else you believe is appropriate to bring to Senate concerning this program:

N/A



2022-2023

Date of next program review: _____

Date

Signatures of Approval:

Steph Stea

May 15, 2018

Chair/Director

Date

SA

2018-06-15

Faculty or Administrative Dean

Date

Chris Coniglio

March 21, 2019

Associate Vice-President, Academic
(For undergraduate and augmented programs)

Date

Associate Provost, Graduate Studies
(For Graduate and augment programs)

Date

Checklist for SUC/SGRC Reviewer Feedback Quality Assurance Office

Two-Year Progress Report: Bachelor of Mathematics in Statistics, Statistics for Health, Actuarial Science, or Mathematical Finance (BMath)

Name of Reviewer: Katherine Acheson

Date: 5/23/2019

Does the Two-Year Progress Report:

- | | | |
|--|---|-----------------------------|
| 1. Clearly describe progress achieved on the various action items in the implementation plan? | <input checked="" type="checkbox"/> Yes | <input type="checkbox"/> No |
| 2. Explain convincingly any circumstances that would have altered the original implementation plan? | <input checked="" type="checkbox"/> Yes | <input type="checkbox"/> No |
| 3. For items that are behind schedule, propose an amended implementation schedule that is reasonable and credible? | <input checked="" type="checkbox"/> Yes | <input type="checkbox"/> No |
| 4. Address significant developments or initiatives that have arisen since the program review process, or that were not contemplated by the program review process? | <input checked="" type="checkbox"/> Yes | <input type="checkbox"/> No |

General Comments

This is a good report that reports good progress on all the proposals to address recommendations. It does seem a bit delayed, but that's not unusual.

Requested Revisions

In track changes in the document.