

FINAL ASSESSMENT REPORT
Evaluation of Graduate Programs

Department of Mathematics and Statistics
Faculty of Science
University of Ottawa

School of Mathematics and Statistics
Faculty of Science
Carleton University

Cycle: 2016–2017
Date: 2021-12-08

I. Programs

- Master of Science Mathematics and Statistics Concentration in Mathematics
- Master of Science Mathematics and Statistics Concentration in Statistics
- Doctorate in Philosophy Mathematics and Statistics

II. Evaluation Process (Outline of the visit)

- The Final Assessment Report for the evaluation of the aforementioned programs was based on the following documents: (a) the self-study brief produced by the academic unit, (b) the report produced by the external evaluators following their site visit, and (c) the comments from the leadership of the programs on the aforementioned documents—at the University of Ottawa: Dean of the Faculty of Science, Louis Barriault, Department Chair, Paul-Eugène Parent, Director of the program, Gilles Lamothe, and Former Director of the program, Benoit Dionne; at Carleton University: Interim Dean of the Faculty of Science, Maria DeRosa, School Director, Paul Mezo, and Director of the program, Colin Ingalls.
- The visit was conducted virtually due to the SARS-CoV-2 pandemic. The reviewers were provided a comprehensive self-study brief that had been previously presented and discussed by the Ottawa-Carleton Institute in Mathematics and Statistics on December 16, 2019. The virtual visit included Claude Laguë from the Faculty of Engineering, University of Ottawa, and Michael Hilderbrand from the Faculty of Health Sciences, Carleton University, as internal delegates.
- The site visit, which took place on February 16–17, 2021, was conducted by Xikui Wang from the University of Manitoba and Dmitry Pelinovsky from McMaster University.
- During the site visit, the external evaluators met with the Vice-Provost, Graduate and Postdoctoral Studies, uOttawa, Claire Turenne-Sjolander, the Dean, Faculty of Graduate and Postdoctoral Affairs, Carleton, Patrice Smith, the Dean of the Faculty of Science, uOttawa, Louis Barriault, the Dean of the Faculty of Science, Carleton, Chuck MacDonald, the Vice-Dean of Graduate Studies, uOttawa, André Beauchemin, the Vice-Dean of Research and Infrastructure, uOttawa, Marc Ekker, the Department Chair, uOttawa, Paul-Eugène Parent, the Director of the Program, Gilles Lamothe, uOttawa, Former Director of the program, uOttawa, Benoit Dionne, School Director, Carleton, Paul Mezo, the Director of the program, Carleton, Colin Ingalls, the library representative, uOttawa, from both institutions: members of the support staff, regular professors and graduate students.

III. Summary of Reports on the Quality of Programs

This section aims to inform the unit on the strengths and weaknesses observed during the evaluation process in order to improve its programs.

EMPHASIZING THE STRENGTHS AND IDENTIFYING CHALLENGES

Strengths

- Joint Institute between the two universities gives students access to a wide array of courses and expertise.
- Well-established departments of international renown in several fields of mathematics and statistics; especially in algebra and analysis.
- The recent changes for the funding of graduate students at the University of Ottawa are seen as very positive and can have a positive impact on recruiting and retaining international students.
- Challenging and rewarding experiences for graduate students.

Challenges

- There is a need to better inform students about potential careers and develop professional skills.
- Lack of communal space at uOttawa (e.g. lunch area for graduate students and professors).
- Although the collaboration between the two universities has been largely collegial and positive, increased collaboration should be sought.

IV. Program Improvement¹

The programs under evaluation are in conformity with the standards of the discipline. The following recommendations aim at maintaining or increasing the level of quality already achieved by the programs.

1. Program Objectives, Learning Outcomes, Mandate and University Plan

Recommendation 1.1: Increase the level of collaboration between the two departments in the joint Ottawa-Carleton Institute of Mathematics and Statistics.

2. Curriculum and Structure

Recommendation 2.1: Reform the basic comprehensive examination so that it is more consistent.

Recommendation 2.2: Standardize some graduate courses so that students' background is relatively consistent

3. Teaching, Learning and Evaluation Methods

4. Student Experience and Governance

Recommendation 4.1: Improve the communal space for both faculty and students to enhance the sense of belonging and encourage collaboration.

Recommendation 4.2: Further enhance student experience by organizing professional development workshops, research and grant writing workshops, and improving the visibility of graduate programs.

¹ Based on the External Evaluators Report.

5. Physical Spaces and Resources

Recommendation 5.1: Discuss the departmental plan on new faculty hiring.

Recommendation 5.1: Review the administrative support offered to the Department of Mathematics and Statistics at the University of Ottawa.

V. List of courses not offered for more than three years and the reasons

The following courses have not been offered in recent years, and should be removed from the catalogue.

- MAT 5106 Combinatorial Optimization;
- MAT 5506 Optimisation combinatoire;
- MAT 5121 Introduction to Hilbert Space;
- MAT 5521 Introduction aux espaces hilbertiens;
- MAT 5127 Complex Analysis;
- MAT 5527 Analyse complexe;
- MAT 5146 Rings and Modules;
- MAT 5546 Anneaux et modules
- MAT 5147 Homological Algebra and Category Theory;
- MAT 5547 Algèbre homologique et théorie des catégories;
- MAT 5148 Groups Representations and Applications;
- MAT 5548 Représentation de groupes et applications;
- MAT 5150 Topics in Geometry;
- MAT 5155 Differentiable Manifolds;
- MAT 5555 Variétés différentielles
- MAT 5162 Mathematical Foundations of Computer Science;
- MAT 5167 Formal Language and Syntax Analysis;
- MAT 5567 Langages formels et analyse syntactique;
- MAT 5168 Homology Theory;
- MAT 5568 Homologie;
- MAT 5169 Foundations of Geometry;
- MAT 5173 Stochastic Analysis;
- MAT 5175 Robust Statistical Inference;
- MAT 5176 Advanced Statistical Inference;
- MAT 5576 Inférence statistique;
- MAT 5177 Multivariate Normal Theory;
- MAT 5577 Analyse multivariée normale;
- MAT 5197 Stochastic Optimization;
- MAT 5597 Optimisation stochastique;
- MAT 5304 Nonlinear Optimization;
- MAT 5309 Harmonic Analysis on Groups;
- MAT 5709 Analyse harmonique sur les groupes;
- MAT 5315 Advanced Design of Surveys;
- MAT 5715 Planification des sondages;
- MAT 5990S M.Sc. Séminaire / Seminar M.A.;
- MAT 5990T Séminaire / Seminar.

The following courses are topics courses that have not been offered in recent years. However, they should remain in the catalogue to allow a course to be offered in that topic in the future.

- MAT 5172 Topics in Stochastic Processes;
- MAT 5572 Processus stochastique : Chapitres choisis
- MAT 5308 Topics in Algorithm Design;
- MAT 5312 Topics in Topology;
- MAT 5712 Topologie : Chapitres choisis;
- MAT 5325 Topics in Information and Systems Science;
- MAT 5329 Topics in Analysis;
- MAT 5728 Analyse : Chapitres choisis;
- MAT 5328 Topics in Analysis;
- MAT 5729 Analyse : Chapitres choisis;
- MAT 5361 Topics in Mathematical Logic;
- MAT 5761 Logique mathématique : Chapitres choisis.

VI. Conclusion

The Ottawa-Carleton Institute of Mathematics and Statistics (OCIMS) offers high quality graduate training in a variety of fields. The two constituting departments have a well-established international reputation in fundamental fields of mathematics and statistics, with renowned researchers in several areas of mathematics and statistics; especially in algebra and analysis. The program objectives and learning outcomes are well articulated and meet the degree-level expectations set by the Ontario Universities Council on Quality Assurance (OUCQA). “OCIMS is overall strong, vibrant and collegiate.” “The OCIMS is a unique model in the Canadian mathematical and statistical communities.” The joint institute gives students access to a large array of courses “and graduate students likely have the best chance of learning from the best experts from the two universities”. Suggestions for improvement are largely constructive in nature that is the comments focused on improving an already successful program, rather than indicating that fundamental changes are required.

Considering this positive assessment, the committee members would like to thank all participants for the evaluation of the programs. They congratulate the unit on the rigour of the work accomplished and on the quality of the self-study report, as well as that of the report produced by the external reviewers.

Schedule and Timelines

A meeting will be organized with the program chairs, the Faculty Dean and Vice-Dean following the reception of the Final Assessment Report so that a plan of action can be put in place along with deadlines particular to each recommendation. A progress report that outlines the completed actions and subsequent results will be submitted to the evaluation committee on a date agreed upon at the time of the meeting regarding the action plan.

The next cyclical review will take place in no more than eight years, in 2024–2025. The self-study brief must be submitted no later than June 2024.

Unit Response to the External Review Report and Action Plan

Faculty of Science

Department of Mathematics and Statistics (University of Ottawa) / School of Mathematics and Statistics (Carleton University)

Programs evaluated: MSc in mathematics and statistics, PhD in mathematics and statistics

Cyclical review period: 2010 -2020

Date: 30/04/2021

Note: This document is submitted to the Senate, as well as the Quality Council, and will be published on the University Web site.

General comments:

On March 20, 2021, the Ottawa-Carleton Institute in Mathematics and Statistics (OCIMS) was made aware of the External Review Report produced in the context of the cyclical programs evaluation. We were extremely pleased with the positive evaluation of our graduate programs. We were particularly pleased to hear from the external evaluators that “The Department of Mathematics and Statistics has a well-established international reputation in some of the fundamental fields of mathematics and statistics with renowned researchers in algebra, analysis, and number theory.” Furthermore, they added that “The OCIMS and the individual Department/School of Mathematics and Statistics enjoy a very positive reputation within the Canadian mathematical and statistical communities, for their strong faculty and vibrant research culture, good research funding and active student population.” They external evaluators have also concluded that our graduate programs in mathematics and statistics have clear degree objectives and expected learning outcomes that meet the degree-level expectations by the Ontario Universities Council on Quality Assurance (OUCQA). Overall, the conclusion of the external evaluators is that “The OCIMS is overall strong, vibrant and collegiate.”

The report makes seven recommendations with some considered high priority. We take all of the recommendations seriously and feel confident that by addressing them, our graduate programs will be even stronger. The recommendations and our response, produced jointly by the unit and the Faculty, are included below.

FOCUS AREA #1: OBJECTIVES					
Recommendation 1: Increase the level of collaboration between the two departments in the joint Ottawa-Carleton Institute of Mathematics and Statistics.					
Unit response	Priority Level*	Actions to be undertaken	Assigned to	Timeline	Curriculum change?
	Important	<ul style="list-style-type: none"> The Institute will reactivate the join colloquiums. The Institute will resume the annual barbecue and other social activities. The Institute will provide parking passes to colleagues from Carleton University attending scientific and administrative activities at the University of Ottawa. 	<ul style="list-style-type: none"> Two professors, one from Carleton University and one from the University of Ottawa, would be mandated each year to organize join colloquiums. The directors of the graduate programs in Math and Stat at both universities should organize the annual barbecue in September, and other social activities. The Chair of the Department of Math and Stat will negotiate with the Faculty of Science the access to parking passes for colleagues from Carleton University. 	The join colloquium and the barbecue could start after the end of the pandemic.	

* PRIORITY LEVEL : 1. URGENT-IMMEDIATE ACTION REQUIRED 2. IMPORTANT-ACTION REQUIRED WITHIN 18 MONTHS (MAXIMUM) 3. ADVISED: DEVELOPMENT AND STRATEGY-ACTION TO BE DISCUSSED AND MUST BE IN PLACE BY MID-CYCLE (WITHIN 4 YEARS)

FOCUS AREA #2: CURRICULUM AND STRUCTURE					
Recommendation 1: Reduce the course load for PhD students and reform the basic comprehensive examination so that it is more consistent					
Unit response	Priority Level*	Actions to be undertaken	Assigned to	Timeline	Curriculum change?
<p>The Institute agrees with the external evaluators about the urgency to modify the structure of our basic comprehensive exams. However, reducing the number of courses for the PhD program goes against the principle of the Institute to provide a broad knowledge of mathematics and statistics to its students. The requirement of 6 courses for the PhD in mathematics and statistics is within the normal range in Ontario¹.</p>	Urgent	<ul style="list-style-type: none"> The Institute will reform its basic comprehensive exam to adopt a system of basic comprehensive exams similar to the one found in all other universities in Ontario. The Institute will promote among our PhD students the importance of getting a broad knowledge of mathematics and statistics before graduating. The Institute will review the level of its courses, and publicize more clearly the expectations for each of them. The Institute will examine the possibility of offering graduate courses during the spring / summer term according to the demand of the students and the availability of instructors 	<ul style="list-style-type: none"> The Institute curriculum committee will be mandated to reform the basic comprehensive exams by following the models used in other universities in Ontario. The Institute curriculum committee will have the responsibility to review the course outcomes, and promote a broader education among PhD students. The Chairs of the Department of Math and Stat and the School of Math and Stat will study the feasibility of offering graduate courses during the spring / summer term; in particular, to offer graduate courses to the students in the course-based MSc. 	<p>The new structure for the basic comprehensive exams should be in place for the new cohort of students in September 2022. The review of the courses should be completed by September 2023.</p>	<p>The content of the basic comprehensive exam may have to be modified. There will probably be curriculum changes for several courses.</p>

¹ The University of Toronto requires 6 courses. The University of Waterloo requires 4 courses for the PhD in mathematics and 5 courses for the PhD in statistics. Queen's University requires 9 courses for their PhD program. Only McMaster, the home university of one of the evaluators, requires only 2 courses for the PhD program.

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FOCUS AREA #2: CURRICULUM AND STRUCTURE					
Recommendation 2: Standardize some graduate courses so that students' background is relatively consistent.					
Unit response	Priority Level*	Actions to be undertaken	Assigned to	Timeline	Curriculum change?
At this point, we offer only an MSc with concentration in mathematics and one with concentration in statistics. It should be easy to select two compulsory courses for the students in the concentration in statistics. However, to select two compulsory courses for the concentration in mathematics will be a real challenge. We will need several pairs of courses to accommodate each main area of studies. The large number of compulsory courses to offer every year risks to impose a too heavy burden on the resource of the Institute.	Advised	The Institute will investigate this recommendation and see if the goals of this recommendation could be reached otherwise.	The Institute curriculum committee will be responsible for studying this recommendation and providing means to reach the goal intended by the recommendation.	The Institute curriculum committee will start working on this proposal in the fall 2021 with an objective to submit a feasibility report by September 2022.	Following the recommendations of the Institute curriculum committee, this may require modifications of the requirements for the MSc programs, and modifications of the course outline for several courses.

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FOCUS AREA #4: STUDENT EXPERIENCE AND GOVERNANCE					
Recommendation 1: Improve the setting of office spaces for both faculty and students to enhance the sense of belonging and encourage collaboration.					
Unit response	Priority Level*	Actions to be undertaken	Assigned to	Timeline	Curriculum change?
As pointed out by the external evaluators, the lack of a common space for Math and Stat at the University of Ottawa is something seriously affecting the sense of belonging of the students and professors at the University of Ottawa. It should be pointed out that there is a common lounge for students and professors at Carleton University. The School of Mathematics and Statistics at Carleton University is well aware of the lack of office space for its graduate students ² .	Urgent	<ul style="list-style-type: none"> • The Department of Math and Stat at the University of Ottawa will prioritize the creation of a lounge exclusively for students and professors from the Department. • The School of Math and Stat at Carleton University will inform its new graduate students of the existence of the lounge. • The School of Math and Stat at Carleton will continue to collaborate with the Faculty of Science to find office space for all the graduate students. 	<ul style="list-style-type: none"> • The chair will request space and funding from the Dean of the Faculty of Science for the creation of a lounge for the Department of Math and Stat. • The Director of graduate studies at Carleton University will inform all new graduate students of the services, including the lounge, available to them. 	The request for a lounge at the University of Ottawa will be made right away.	

² There are plans to redesign and reconfiguration of current shared (non-faculty) spaces and common areas to maximize their usefulness.

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FOCUS AREA #4: STUDENT EXPERIENCE AND GOVERNANCE					
Recommendation 2: Further enhance student experience.					
Unit response	Priority Level*	Actions to be undertaken	Assigned to	Timeline	Curriculum change?
	Important	<ul style="list-style-type: none"> The Institute will ensure that students have access to workshops to develop their professional skills. The Institute will promote more vigorously the formation in teaching provided by TLSS. 	<ul style="list-style-type: none"> Two professors, one from each university, would be mandated to find the existing workshops addressing the student needs. The Assistant Chair Research at the University of Ottawa will provide workshops on writing scholarship and grant applications. 	These initiatives should start in the academic year 2021-2022.	

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FOCUS AREA #5: RESOURCES					
Recommendation 1: Discuss the departmental plan on new faculty hiring.					
Unit response	Priority Level*	Actions to be undertaken	Assigned to	Timeline	Curriculum change?
The external evaluators are recommending to offer more courses and hire new faculty members in emerging areas of mathematical science (data science, financial math, ...) The Institute is aware of the new trends. The Department of Mathematics and Statistics at the University of Ottawa has a hiring plan that members of the Department review every year. Priorities in hiring are determined in a collegiate way during departmental meetings.	Important	<ul style="list-style-type: none"> The two units that form the Institute will take into consideration the hiring recommendations of the external evaluators in their review of their hiring plan. The Institute will strongly support any request to create new courses in the new areas of mathematical science. 	<ul style="list-style-type: none"> The Departmental Teaching and Personnel Committee (DTPC) at the University of Ottawa will update of the hiring plan. The curriculum committee will help professors who want to create new courses in the new areas of mathematical science. 	This will be implemented in the academic year 2021-2022.	

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FOCUS AREA #5: RESOURCES					
Recommendation 2: Review the administrative support offered to the department of Math and Stat					
Unit response	Priority Level*	Actions to be undertaken	Assigned to	Timeline	Curriculum change?
<p>This is not a recommendation of the external evaluators but it is an issue that has been raised by them. According to them, the current administrative resources are inadequate and the support staff are overworked. The administrative staff has little time left to give to the graduate students and researchers after they have completed the work required to manage the undergraduate programs This has a negative impact on graduate students experience and funding (delay), and on the research activity.</p>	Urgent	<p>An official review of the workload and the duties of the personnel in the departmental office should be conducted right away before the situation deteriorate too much.</p>	<p>This review should be done by the Faculty of Science at the University of Ottawa and/or HR.</p>	<p>This should be done early in the fall 2021 to coincide with the hiring of another new senior administrative officer.</p>	

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