

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 Programs¹

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

1. 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.

Sections 2–6 provide the context and rationale for the subsequent recommendations

2. PROGRAM OBJECTIVES

- The program requirements and the associated learning outcomes are clearly described in the self-study report and aligned with each university's statement of degree-level expectations.
- The joint program's mission and identity are clearly stated and resonate well with the strategic plans of the University of Ottawa and Carleton University.
- There is a need to review the program objectives for the project-based master's degree, which is currently seen as having a dual role. On the one hand, for the better-achieving students in the course-based option, this is a possibility to further enhance their student experience. Whereas, for students with difficulties in the thesis-based option, this is seen as an "exit" solution.

3. CURRICULUM AND STRUCTURE

- Overall, the admission requirements are consistent with the learning outcomes of the MSc and PhD programs offered by the graduate programs.
- The external evaluation report argues that the number of required courses at the PhD level is high, with 6 × 3 credits. Compared to other programs in the Faculty of Science at both institutions, Carleton and uOttawa, 6 courses is an upper limit. In its response, the academic unit indicates that compared to other institutions in Ontario, including Toronto, Queens and

¹ Based on every document prepared during the assessment process, sometimes the information is extracted verbatim.

Waterloo, the number of courses appears to be average. More importantly, the institute strives to provide a broad knowledge of mathematics and statistics.

4. TEACHING, LEARNING AND EVALUATION METHODS

- The modes of delivery and evaluation appear to be “traditional”. However, these are deemed appropriate and effective to meet the graduate program’s learning objectives.
- The external reviewers have expressed concerns with the comprehensive examination. Namely, variations have been observed between evaluations, which could give the impression that the process is unfair.
- It was suggested to create at least one course that would be attended by PhD students only.
- Finally, some students have expressed the need for additional training in professional skills and career guidance.

5. STUDENT EXPERIENCE

- Interviews with the master students in the coop stream indicates a high level of satisfaction with the placement and employment opportunities after graduation.
- The number of students withdrawing from the program is low. When students do withdraw from the program, it is usually for personal reasons.
- There are concerns with the visibility of the program on the Web. Namely, to inform the students about the current research and the career opportunities.
- At uOttawa, the students interviewed would welcome the opportunity to take courses in the spring term.
- Greater variations in the funding of graduate students have been observed at Carleton.

6. PHYSICAL SPACES AND RESOURCES

- External reviewers recognize that both institutions have made significant efforts since the last cyclical review to enhance the physical and human resources.
- The external evaluation gives the impression that the workload of the administrative personnel at the University of Ottawa is high. Further assessment will be needed. Depending on the outcome, corrective measures should be in place before the student experience is negatively impacted.
- It was suggested that both institutions should find ways to increase the funding for international students to attract the best students.
- “The disciplines of mathematics and statistics normally do not require specific laboratory facilities and equipment, except for computing equipment and library resources, which seem adequate.”
- Finally, the external evaluation highlights the lack of common spaces for graduate students at the University of Ottawa.

IV. Program Improvement²

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.

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;

² Based on the External Evaluators Report.

- 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.