Change to Program/Graduate Diploma Academic Requirements Proposal Form

The following information is required for all proposals involving a minor modification to program/graduate diploma academic requirements. To facilitate the review/approval process, please use the headings below (and omit the italicized explanations below each heading).

1. Program/Graduate Diploma: M.A. in Mathematics and Statistics

2. Effective Session of Proposed Change(s): Fall 2017

3. Proposed Change(s) and Rationale
   The description of and rationale for the proposed modification(s) should provide information with respect to each of the following points:
   a) A description of the proposed modification(s) and rationale, including alignment with academic plans.

The course based M.A. in Mathematics and Statistics consists of:
   1. a 'stream' consisting of 4-5 required courses (currently there are 5 possible streams)
   2. 4 additional courses, 2 courses and a survey paper or a thesis
   3. a seminar requirement (waived for students in the applied statistics stream)

Our proposal is to add a 'data science' stream to our mathematics and statistics M.A. program and adjust slightly the 'applied statistics stream' (by one course). The streams of the program specify 4-5 required courses. We plan to retool a few of our statistics courses and add one new course to emphasize "big data" as an application of statistics. Both 'data science' and 'applied statistics' are courses in applied statistics and so by making this change, we are adjusting by at most one or two courses the classes a given student will be taking in applied statistics degree.

Our M.A. program currently has 5 streams and two of those are statistics based ('theoretical statistics' and 'applied statistics'). We wish to introduce a third statistics based stream to this list titled 'data science' to meet the demand of students who are interested in using statistics in their careers with a specific application.

We would also adjust the 'applied statistics' stream by one course, changing Math 6631: Applied Statistics II with the option of Math 6635: Bayesian Analysis or Math 6641: Survival Analysis and we would no longer offer 'Applied Statistics II' regularly (which had in previous years been offered annually).

To adjust our program, we wish to offer a new course 'Math 6650: Introduction to Statistical Data Science' (covering statistics on large data sets) and offer courses already on the books 'Math 6636: Data Mining' and 'Math 6644: Statistical Learning' more frequently. To maintain the same number of courses, we would less frequently offer the course 'Math 6631: Applied Statistics II.' The topics of this have been less clearly defined and we are replacing it with a more specific course of 'Data Science.' Other elective offerings in the program would be adjusted accordingly.
The name “Computer Science” appears in the calendar copy and it has been changed to reflect the current name of the department, “Electrical Engineering & Computer Science.”

b) An outline of the changes to requirements and the associated learning outcomes/objectives, including how the proposed requirements will support the achievement of program/graduate diploma learning objectives. Additionally, please append the graduate program’s existing learning outcomes as a separate document.

The new stream in ‘data science’ would consist of 5 required courses.
1. Math 6620 - Mathematical Statistics (offered F term)
2. Math 6622 - Generalized Linear Models (offered W term)
3. Math 6630 - Applied Statistics (offered F term)
4. a new graduate Math course Math 6650 - Introduction to Statistical Data Science (to be offered F term)
5. Math 6644 Statistical Learning or Math 6636 Data Mining (offered W term, in the past it has been offered once every other year, we would now offer annually)

In addition, students would be required to take 3 additional elective courses or 1 course and a survey paper and complete the seminar requirement as the other M.A. streams do.

The stream in ‘applied statistics’ would be adjusted to consist also of 5 required courses.
1. Math 6620 - Mathematical Statistics (offered F term)
2. Math 6622 - Generalized Linear Models (offered W term)
3. Math 6630 - Applied Statistics (offered F term)
4. Math 6635 - Introduction to Bayesian Statistics or Math 6641 - Survival Analysis or Math 6631 - Applied Statistics II or Math 6642 - Applied Longitudinal Data Analysis
5. Math 6627 - Practicum in Statistical Consulting (offered W term)

Requirement 4 is a change from the current required course Math 6631 - Applied Statistics II. Requirements 1,2,3 and 5 are unchanged.

The introduction of the data science stream may be viewed as a minor adjustment to the course requirements for the applied statistics stream. It is a recognition that the field of statistics is changing as are the applications and methods. We are making a corresponding adjustment in a few required applied statistics courses and replacing them with a few others adding a second applied statistics stream called ‘Data Science.’ Since ‘Math 6631 3.0: Applied Statistics II’ was just one possible course that would give students experience in applied statistics.

The required courses in both of these streams meet components of the learning objectives of “Depth and Breadth of Knowledge” as well as “Research and Scholarship” and “Level of Application of Knowledge.” Students meeting all 5 required course for either of the stream will have demonstrated that they met a specialization in either Data Science or Applied Statistics.

Remark: The overall effect of these changes is likely to be more ‘marketing’ than ‘substantial’ since the department offers roughly 8-9 statistics courses every year and students are required to take 4-5 courses and 8 courses in total. The typical student completing the data science stream is likely to take a similar set of courses to complete their requirements as a student taking the applied statistics stream.

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c) An overview of the consultation undertaken with relevant academic units and an assessment of the impact of the modifications on other programs/graduate diplomas. 
Where and as appropriate, the proposal must include statements from the relevant program/graduate diplomas confirming consultation/support.

This proposal was brought to and approved at the statistics section on their meeting of October 4, 2016. It was discussed and approved by the graduate executive on October 13, 2016. Finally it was circulated to all graduate faculty for discussion and approval by email on October 14, 2016.

The graduate program director of Electrical Engineering and Computer Science was consulted and changes to this document and the course proposal were made where appropriate.

d) A summary of any resource implications and how they are being addressed.
Attention should be paid to whether the proposed changes will be supported by a reallocation of existing resources or if new/additional resources are required. If new/additional resources are required, the proposal must include a statement from the relevant Dean(s)/Principal.

The introduction of the new data science course will be fit into the schedule by no longer offering Applied Statistics II regularly starting Winter 2018. Instead, a new course 'Math 6650: Introduction to Statistical Data Science' will be offered starting that term.

The courses 'Math 6636: Data Mining' and 'Math 6644: Statistical Learning' have been offered irregularly in the past. If this stream is approved they will be offered regularly (at least one per year) starting in 2017 and other elective offerings will be adjusted accordingly.

e) A summary of how students currently enrolled in the program/graduate diploma will be accommodated.

No students currently enrolled in the program should be affected. All required courses will be offered and there will be sufficient options for students who are in their second year to complete the program.

4. Calendar Copy
Using the following two-column format, provide a copy of the relevant program/graduate diploma requirements as they will appear in the FGS Calendar -
http://gradstudies.yorku.ca/current-students/regulations/program-requirements/
Please note: Senate requires that FULL Calendar copy be provided. Please include the entire graduate program/diploma section, not just text that is being revised.
Please clearly and visibly indicate how graduate program/graduate diploma information has been changed using strikethrough (left column), bold, underlining, colours, etc. (right column).

<table>
<thead>
<tr>
<th>Existing Program/Graduate Diploma Information (change from)</th>
<th>Proposed Program/Graduate Diploma Information (change to)</th>
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<tbody>
<tr>
<td>Insert program requirements from <a href="http://gradstudies.yorku.ca/current-students/regulations/program-requirements/">http://gradstudies.yorku.ca/current-students/regulations/program-requirements/</a></td>
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**MASTER OF ARTS PROGRAM**

**ADMISSION REQUIREMENTS**

An honours degree in Mathematics or Statistics (or equivalent background) normally with a B standing may qualify the student for admission as a candidate to a program leading to the MA degree. Applicants without the appropriate breadth in Mathematics or Statistics, but who have good standing, may be admitted on condition they take additional graduate and/or undergraduate courses. Faculty of Graduate Studies regulations regarding standing (see Grading System under Faculty Regulations) apply to these additional courses. Students whose first language is not English must demonstrate an acceptable command of English: at least 213 in the Test of English as a Foreign Language or 85 in the Michigan English Language Assessment Battery.

**DEGREE REQUIREMENTS**

**Master of Arts Degree—Regular Program**

Students in the regular program must choose one of three options.

**MA by Coursework**

Four 6000 level full courses (or equivalent), plus a seminar† (Mathematics & Statistics 6004 0.0).

**MA by Survey Paper**

Three 6000-level full courses (or equivalent), a supervised survey paper (Mathematics & Statistics 6001 0.0; students give one talk in a student Colloquium outlining the results of their papers), plus a seminar† (Mathematics & Statistics 6004 0.0).

**MA by Thesis**

Two 6000-level full courses (or equivalent), a thesis (students give two talks in a student Colloquium outlining the results of their theses), plus a seminar† (Mathematics & Statistics 6004 0.0). The thesis must be defended before an examining committee in accordance with the regulations of the Faculty of Graduate Studies.

†Students may substitute another half course for the seminar if they are pursuing their MA by Survey Paper or by Thesis. Students completing their MA by Coursework can replace the seminar requirement with another half course only if one of

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their four courses toward the degree is the practicum in statistical consulting (Mathematics & Statistics 6627 3.0).

Whatever option is chosen, no more than one-third of courses can be integrated, and all students must include among their courses one of the following sets:


v) **Applied Statistics**: Mathematics & Statistics 6620 3.0: Mathematical Statistics, Mathematics & Statistics 6622 3.0: seminar requirement with another half course only if one of their four courses toward the degree is the practicum in statistical consulting (Mathematics & Statistics 6627 3.0).

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v) **Applied Statistics**: Mathematics & Statistics 6620 3.0: Mathematical Statistics, Mathematics & Statistics 6622 3.0:
A full-time student will normally complete the MA program requirements within three terms. A part-time student normally takes one or two full courses in a 12-month period. Students may with permission use courses from other graduate programs such as Computer Science, Economics or Physics & Astronomy to meet the requirements.

Please submit completed forms and required supporting documentation by email to the Coordinator, Faculty Governance– mmenschif@yorku.ca