Office of the Provost

New Degree or Credit-Bearing Certificate Proposal Form

Title of Degree or Credit-Bearing Certificate (e.g., Bachelor of Arts in History):
MA and PhD in Statistics

1. Please provide the name, title, email address, and phone number of the primary contact person for this academic program:

Tasso Kaper, Professor and Chair, Department of Mathematics and Statistics, e-mail: tasso@bu.edu Tel: 1-617-353-2560

2. Please briefly describe the proposed new degree:

The current MA and PhD degrees in Mathematics have two tracks, one in Pure and Applied Mathematics and the other in Statistics. This proposal is to separate the Statistics track in both the MA and PhD programs into their own degrees, the MA and PhD in Statistics. This would leave the existing Pure and Applied Mathematics track as the MA and PhD in Mathematics. We are not proposing any changes to any of the current curriculum or degree requirements.

3. Please provide a rationale for the proposed new degree:

The Mathematics and Statistics faculty believe that having separate degrees in statistics would be advantageous for students in the department. A degree in statistics will make graduates more competitive with those graduating from stand-alone departments of statistics. Many statistics students go on to careers as statisticians outside of academia. Having their degree in statistics rather than mathematics will emphasize the applied and practical aspects of their training at Boston University. Furthermore having separate degrees in statistics will make it easier to recruit students into these programs. These changes will have no impact on students currently in the pure and applied mathematics tracts as neither the curriculum nor degree title will change.

The Mathematics and Statistics faculty feel that the proposed change will only enhance the collaborative environment and the joint research and teaching missions of the department. The
proposed change retains the advantages of having two disciplines within the one department while providing graduates with more appropriately labeled degrees.

4. **Please describe how the proposed new degree advances the Strategic Plans of the department, school/college, and University:**

These changes are fully consistent with goals 4 and 5 of the Strategic Plan of the College and Graduate School of Arts and Sciences

4. We will offer *leading doctoral, postdoctoral, and masters programs* within and across traditional disciplinary boundaries.

5. We will promote *pioneering research and scholarship* within and across traditional disciplinary boundaries.

5. **Please list the program requirements for the proposed new degree (denote new courses in bold print):**

<table>
<thead>
<tr>
<th>Current program</th>
<th>Revised program</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>MA in Mathematics, Statistics Track</strong></td>
<td><strong>MA in Statistics</strong></td>
</tr>
<tr>
<td>CAS MA 575: Linear Models (4cr)</td>
<td>Same</td>
</tr>
<tr>
<td>CAS MA 576: Generalized Linear Models (4cr)</td>
<td>Same</td>
</tr>
<tr>
<td>CAS MA 581: Probability (4cr)</td>
<td>Same</td>
</tr>
<tr>
<td>CAS MA 582: Mathematical Statistics (4cr)</td>
<td>Same</td>
</tr>
<tr>
<td>CAS MA 583: Introduction to Stochastic Processes (4cr)</td>
<td>Same</td>
</tr>
<tr>
<td>Three elective courses (12cr)</td>
<td>Same</td>
</tr>
<tr>
<td>Comprehensive Examination</td>
<td>Same</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>PhD in Mathematics, Statistics Track</strong></th>
<th><strong>PhD in Statistics</strong></th>
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</thead>
<tbody>
<tr>
<td>GRS MA 779: Probability Theory I (4cr)</td>
<td>Same</td>
</tr>
<tr>
<td>GRS MA 780: Probability Theory II (4cr)</td>
<td>Same</td>
</tr>
<tr>
<td>GRS MA 781: Estimation Theory (4cr)</td>
<td>Same</td>
</tr>
<tr>
<td>GRS MA 782: Hypothesis Testing (4cr)</td>
<td>Same</td>
</tr>
<tr>
<td>GRS MA 750: Nonparametric and Semiparametric Data Modeling (4cr)*</td>
<td>Same</td>
</tr>
<tr>
<td>GRS MA 751: Statistical Machine Learning (4cr)*</td>
<td>Same</td>
</tr>
<tr>
<td>Total of 64 credits</td>
<td>Same</td>
</tr>
<tr>
<td>Reading Proficiency in a Foreign Language</td>
<td>Same</td>
</tr>
<tr>
<td>Qualifying Examination</td>
<td>Same</td>
</tr>
<tr>
<td>Dissertation and Final Oral Examination</td>
<td>Same</td>
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</tbody>
</table>

*Titles of GRS MA 750 and 751 were recently updated. Course content was not changed.*
6. Please list program learning outcomes:

No changes are proposed to the learning outcomes for these degrees. They are:

Students graduating with an MA in Statistics are expected to:
1. Demonstrate a mature understanding of the theoretical underpinnings of statistics, including probability theory, mathematical statistics, and stochastic processes.
2. Demonstrate a practical understanding of classical statistical methods, including linear and generalized linear modeling theory.
3. Demonstrate a breadth of knowledge in topics related to advanced statistical theory and practice.

Students graduating with a PhD in Statistics are expected to:
1. Produce and defend an original and substantial contribution to the field of statistics.
2. Demonstrate mastery of core graduate subject matter in at least two of the following three areas: probability theory, mathematical statistics, and applied statistics.
3. Be able to effectively communicate statistical ideas and results through contexts such as seminars, teaching, outreach, publications, and cross-disciplinary work.
4. Understand and adhere to the ethical research standards of the discipline.

Students graduating with an MA in Mathematics are expected to:
1. Demonstrate an advanced understanding of the core mathematical disciplines of algebra and analysis.
2. Demonstrate a breadth of knowledge in topics pertaining to advanced pure and applied mathematics.

Students graduating with a PhD in Mathematics are expected to:
1. Produce and defend an original and substantial contribution to the field of pure or applied mathematics.
2. Demonstrate mastery of core graduate subject matter in pure and applied mathematics, as well as of a number of advanced graduate topics in mathematics.
3. Be able to effectively communicate mathematical ideas and results through contexts such as seminars, teaching, outreach, publications, and cross-disciplinary work.
4. Understand and adhere to the ethical research standards of the discipline.

7. For master’s or professional doctorate degrees, please describe what this program prepares students for after they have graduated:

The MA in Statistics prepares students either for entering PhD programs in statistics or for entering the workforce as a statistician.

8. Please describe how the proposed new degree relates to existing programs at the University:

These degrees already exist as tracks within the degrees in Mathematics. Making them into separate degrees will not affect any existing programs at the University.
9. **Please place the proposed program in the context of comparable programs at peer institutions:**

Our main competitors are the top 20 departments in statistics, all of which are stand-alone departments in statistics, and hence give degrees in statistics. This change will allow us to compete on a more level footing.

10. **Please list the program’s faculty:**

Luis Carvalho, Assistant Professor of Mathematics and Statistics

Ralph D’Agostino, Professor of Mathematics and Statistics, Biostatistics, and Epidemiology

Solesne Bourguin, Assistant Professor of Mathematics and Statistics

Uri Eden, Associate Professor of Mathematics and Statistics

Ashis Gangopadhyay, Associate Professor of Mathematics and Statistics

Yinxiao Huang, Research Assistant Professor of Mathematics and Statistics

Thomas Kepler, Professor of Microbiology

Eric Kolaczyk, Professor of Mathematics and Statistics

Mark Kon, Professor of Mathematics and Statistics

Asya Lyass, Research Assistant Professor of Mathematics and Statistics

Kostas Spilopoulos, Assistant Professor of Mathematics and Statistics

Lisa Sullivan, Professor of Biostatistics

Murad Taqqu, Professor of Mathematics and Statistics

Daniel Weiner, Associate Professor of Mathematics and Statistics

Ting Zhang, Assistant Professor of Mathematics and Statistics

11. **Please provide an administrative plan for the proposed new degree:**

No administrative changes are required or anticipated. The new degrees are simply continuations of degree tracks already administered by the department of Mathematics and Statistics

12. **Please provide an advising plan for the proposed new degree:**

Students will be advised by Statistics faculty in the same way current students are advised.
13. **For a proposed graduate program, please provide the admissions standards involved:**

Admissions standards will be the same as for the current MA and PhD in Mathematics. Students admitted to the program will have a bachelor’s degree in Mathematics or Statistics and an excellent academic record.

14. **Please document any implications that the formation of the proposed new degree has on professional accreditation or licensure at the program or school/college level:**

There are no accreditation implications.

15. **Please provide the bulletin copy (exactly as it will appear) for the proposed new degree including program goals/outcomes:**

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**MA in Mathematics**

**Course Requirements**

Eight semester courses (32 credits) approved for graduate study are required. These courses should constitute a coherent program relevant to the objectives of the student. Ordinarily, all courses are in mathematics, or probability and statistics. However, students may petition the departmental graduate committee to use courses from other departments to partially satisfy this requirement.

**Language Requirement**

There is no foreign language requirement for this degree.

**Comprehensive Examination**

This examination, which is offered in April of each year, serves as a master’s degree examination. Students judged to be inadequately prepared for the first examination are allowed to take the examination again. More detailed information is provided upon admission.
MA in Statistics

Course Requirements

Eight semester courses (32 credits) approved for graduate study are required. The following core courses are required:

- CAS MA 575: Linear Models
- CAS MA 576: Generalized Linear Models
- CAS MA 581: Probability
- CAS MA 582: Mathematical Statistics
- CAS MA 583: Introduction to Stochastic Processes

The remaining three courses should constitute a coherent program relevant to the objectives of the student. Ordinarily, all courses are in probability and statistics or mathematics. However, students may petition the departmental graduate committee to use courses from other departments to partially satisfy this requirement.

Language Requirement

There is no foreign language requirement for this degree.

Comprehensive Examination

This examination, which is offered in April of each year, serves as a master’s degree examination. The comprehensive exam is typically taken after completing the required core courses. Students judged to be inadequately prepared for the first examination are allowed to take the examination again. More detailed information is provided upon admission.

PhD in Mathematics

Course Requirements

Sixteen semester courses (64 credits) are required. These shall provide a reasonable breadth of background in mathematics and mastery of the basic tools relevant to the research area selected.

Language Requirement

All students pursuing a PhD in Mathematics are required to demonstrate graduate-level reading proficiency in a foreign language prior to completion of the degree. Language proficiency can be demonstrated through either a language examination, successful completion of a non-credit graduate-level
foreign language reading course offered by Boston University, or the equivalent of two years of undergraduate study of the language at Boston University.

**Comprehensive Examination**

Students in the Mathematics track must pass this examination by the end of their second year.

**Qualifying Examination**

Students in the Mathematics track must pass this examination by the end of their third year.

Students must take this examination within two years of the start of their 700-level study. More detailed information is provided upon admission to the PhD program.

**Dissertation and Final Oral Examination**

Candidates shall demonstrate their abilities for independent study in a dissertation representing original research or creative scholarship. A prospectus for the dissertation must be completed and approved by the readers, the director of graduate studies, and the department chair/program director. Candidates must undergo a final oral examination in which they defend their dissertation as a valuable contribution to knowledge in their field and demonstrate a mastery of their field of specialization in relation to their dissertation. All portions of the dissertation and final oral examination must be completed as outlined in the [GRS General Requirements for the Doctor of Philosophy Degree](#).

*A PhD student leaving the program will obtain an MA, provided they have completed 8 graduate courses (32 credits) and passed the comprehensive exam.*

**PhD in Statistics**

The PhD program in Statistics prepares students for a career pursuing research and/or teaching in either academia or industry. To enter, students need a bachelor’s degree in mathematics, statistics, or a closely related discipline.

**Course Requirements**

Sixteen semester courses (64 credits) are required. These shall provide a reasonable breadth of background in probability and statistics, and mastery of the basic tools relevant to the research area selected.
The following six core courses are required:

- GRS MA 779 Probability Theory I
- GRS MA 780 Probability Theory II
- GRS MA 781 Estimation Theory
- GRS MA 782 Hypothesis Testing
- GRS MA 750 Nonparametric and Semiparametric Data Modeling
- GRS MA 751 Statistical Machine Learning

**Language Requirement**

All students pursuing a PhD in Mathematics are required to demonstrate graduate-level reading proficiency in a foreign language prior to completion of the degree. Language proficiency can be demonstrated through either a language examination, successful completion of a non-credit graduate-level foreign language reading course offered by Boston University, or the equivalent of two years of undergraduate study of the language at Boston University.

**Qualifying Examination**

Students must pass two out of three qualifying examinations in probability, mathematical statistics, and applied statistics by the end of their third year.

Students must take this examination within two years of the start of their 700-level study. More detailed information is provided upon admission to the PhD program.

**Dissertation and Final Oral Examination**

Candidates shall demonstrate their abilities for independent study in a dissertation representing original research or creative scholarship. A prospectus for the dissertation must be completed and approved by the readers, the director of graduate studies, and the department chair/program director. Candidates must undergo a final oral examination in which they defend their dissertation as a valuable contribution to knowledge in their field and demonstrate a mastery of their field of specialization in relation to their dissertation. All portions of the dissertation and final oral examination must be completed as outlined in the GRS General Requirements for the Doctor of Philosophy Degree.

*A PhD student leaving the program will obtain an MA, provided they have completed 8 graduate courses (32 credits) and passed the comprehensive exam.*
16. Please provide sample pathways through the new degree or certificate:

MA in Statistics

<table>
<thead>
<tr>
<th>Year 1: Fall</th>
<th>Year 1: Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS MA 575</td>
<td>CAS MA 576</td>
</tr>
<tr>
<td>CAS MA 581</td>
<td>CAS MA 582</td>
</tr>
<tr>
<td>CAS MA 568</td>
<td>CAS MA 583</td>
</tr>
<tr>
<td>CAS MA 569</td>
<td>CAS MA 585</td>
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</tbody>
</table>

PhD in Statistics

<table>
<thead>
<tr>
<th>Year 1: Fall</th>
<th>Year 1: Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS MA 575</td>
<td>CAS MA 576</td>
</tr>
<tr>
<td>GRS MA 779</td>
<td>GRS MA 780</td>
</tr>
<tr>
<td>GRS MA 781</td>
<td>GRS MA 782</td>
</tr>
<tr>
<td>GRS MA 699</td>
<td>GRS MA 699</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 2: Fall</th>
<th>Year 2: Spring</th>
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</thead>
<tbody>
<tr>
<td>GRS MA 750</td>
<td>GRS MA 751</td>
</tr>
<tr>
<td>GRS MA 703</td>
<td>GRS MA 770</td>
</tr>
<tr>
<td>GRS MA 881</td>
<td>GRS MA 882</td>
</tr>
<tr>
<td>GRS MA 699</td>
<td>GRS MA 699</td>
</tr>
</tbody>
</table>

Additional reading courses or courses in related disciplines are usually taken in later years.

17. If the new program includes a new course or courses, please indicate who will teach the course and how the rest of that faculty member’s course load will be affected (courses(s) redistributed to other faculty, taught less frequently, no longer taught, etc.). Please be specific about affected courses. This information should be reflected in the budget form that accompanies the proposal, e.g. the cost for a new faculty member to teach the new course or a redistributed course:

No changes to the current curriculum are proposed

18. Please list other resources needed including new staff, IT, technology enhanced classrooms, office space, and other facilities. This information should be reflected in the budget:

Since there are no changes being proposed to the existing curriculum, no new resources are required.

19. What charges (tuition, fees, etc.) are to be applied to this program? How will the charges be structured?

Standard GRS tuition and fees will be charged.
20. Please describe the proposed enrollment or the enrollment required to cover the start-up costs of the proposed new degree:

PhD in Statistics: The current admissions target for the PhD in Mathematics is 10. In future this target will be split between the PhD in Mathematics and the PhD in Statistics.

MA in Statistics: We expect 5-10 students to be admitted each year

21. Please submit a complete budget for the new program or credit-bearing certificate, using the appropriate budget template, even if no additional resources are needed.