REQUEST FOR PRE-AUTHORIZATION OF A
MASTER’S OF SCIENCE IN APPLIED STATISTICS AT UW-LA CROSSE

ABSTRACT

The University of Wisconsin-La Crosse seeks to establish a Master's of Science in Applied Statistics. UWL currently offers a B.S. in Statistics housed in the Department of Mathematics and has seen the number of students majoring in statistics almost double over the past three years. Given this increase in demand for the undergraduate program and the positive outlook for employment of statisticians, there is a present need for an Applied Statistics graduate degree both in the regional area and within UW-System.

PROGRAM IDENTIFICATION

Institution Name
University of Wisconsin-La Crosse

Title of Proposed Programs
Master of Science in Applied Statistics

Degree/Major Designations
Master of Science in Applied Statistics

Mode of Delivery
Single institution; Classroom instruction.

Projected Enrollment by Year Five
It is projected that there will be 30 students enrolled in the M.S. in Applied Statistics program within five years.

Tuition Structure
For students enrolled in the M.S. in Applied Statistics program, the standard tuition and fees for UW-La Crosse graduate students will apply. For the current academic year, the residential tuition and fees total $9,235 per year for a full-time student. Non-residents pay $18,822. Students admitted to the dual degree program (3+2 model) will be able to take a maximum of three graduate level courses as undergraduates, with undergraduate tuition applied. Students will then be required to enroll as a Graduate Special student, with standard graduate level tuition applying to all other graduate level courses.

Department or Functional Equivalent
Department of Mathematics

College, School, or Functional Equivalent
College of Science and Health

Proposed Date of Implementation
Fall, 2017
INTRODUCTION

1. Why is the program being proposed? What is its relation to the institution’s mission?

The Mathematics Department has seen an increase in the number of students majoring in and graduating from its Statistics degree program in recent years. From Spring 2012 to Spring 2015, the number of Statistics majors almost doubled, growing from 25 to 44 students. The number of graduates from the program has increased accordingly, with 4 graduates during the 2011 – 2012 academic year and 13 graduates during the 2014 – 2015 academic year. As the major and number of graduates grow, more students are showing an interest in graduate school for statistics. Further, career opportunities and opportunities for promotion in the field of statistics are greater for those with advanced degrees.

The current Statistics B.S. has a proven record of producing critical thinkers and skilled practitioners as evidenced by the success of those who have graduated from the program. Revisions to the program have resulted in a deeper and broader incorporation of statistics, emphasizing its multidisciplinary nature. The proposed degree will involve a research experience that allows students to work first hand with regional business partners or other programs on campus. Therefore, the proposed degree will continue to build on the current success of the B.S. in Statistics by fostering “life-long learning through collaboration, innovation, and discovery,” and will “prepare students to take their place in a constantly changing world community” as indicated in UWL’s Mission (http://www.uwlax.edu/Academic-Affairs/Mission/).

2. What evidence is there for demand for this program?

As mentioned above, the number of statistics majors at UWL has almost doubled over the past three years. With this increase we have seen more students interested in graduate school, especially at the Master’s level. With the M.S. degree in Statistics at UW-Madison being more theoretical in nature than our undergraduate statistics students are typically prepared for, the students we see going to graduate school always leave the state. Therefore, there is a demand for a more applied statistics graduate degree in the area.

Demand for statisticians, in general, is currently high and growing. According the Bureau of Labor Statistics (2015), employment of statisticians is projected to grow 27 percent from 2012 to 2022, which is much faster than the average for all occupations. Growth is expected to result from more widespread use of statistical analysis to make informed business, healthcare, and policy decisions. For example, a large amount of data is generated from internet searching and the use of social media, smartphones, and other mobile devices. Demand for statisticians to organize and analyze the data for commercial reasons will grow. Demand for statisticians is also expected to increase in the pharmaceutical industry, as an aging U.S. population will encourage companies to develop new treatments and medical technologies.
3. How does the program represent emerging knowledge, or new directions in professions and disciplines?

The use of statistics is widespread and growing. Statistical models aid in decision making in both private industry and government. There will always be a demand for the skills statisticians provide. Technological advances are expected to spur demand for statisticians. Ever-faster computer processing allows statisticians to analyze greater amounts of data much more quickly and to gather and sort through large amounts of data that would not have been analyzed in the past. As data collection and data processing continue to become more efficient and less expensive, an increasing number of employers will want to employ statisticians to take advantage of the new information available. Individuals with a M.S. degree in statistics have opportunities in a variety of fields. For example, many jobs involve the analysis and interpretation of data from economics, biological science, psychology, computer software engineering, education, and other disciplines.

DESCRIPTION OF PROGRAM

1. Describe the general structure of the program, including:

   a. The ways in which the program fits into the institutional program array and academic plan, including positive and negative impacts of the program on existing programs

The Bachelor’s degree in Statistics is already well-established at UWL and although it has only existed in name since 2013, the program has existed since 1977 as a Bachelor’s of Mathematics with an emphasis in Statistics. Our statistics students already have a positive impact on various other programs at UWL through their involvement with the Statistical Consulting Center (SCC), which is required under the Statistics B.S. degree as MTH 440: Statistical Consulting. The SCC was established within the Mathematics department in 2004. MTH 440 is a 1-credit course, repeatable up to 3 credits, in which students gain field experience as statistical consultants as they offer statistical guidance to the UWL community, including students, faculty, and staff, under the supervision of the SCC director. Several departments and programs are served by the SCC each semester. Some of the programs served by the SCC in recent years include, but are not limited to, Biology, Education Studies, English, Exercise and Sports Science, Library, Management, Psychology, Student Affairs Administration, and Therapeutic Recreation. By offering M.S. in Applied Statistics, it is anticipated that the overall statistics program at UWL will grow. This will allow for more collaboration between the statistics program and other programs utilizing statistics. By leveraging the established network of research and industry clients that are served by the existing SCC, we have a readily accessible pool of thesis projects available to potential candidates in the Applied Statistics M.S. program.
b. The extent to which the program is duplicative of existing programs in the University of Wisconsin System

UW-Madison offers a M.S. and Ph.D. in Statistics, while UW-Milwaukee offers a M.S. in Mathematics with a statistics option. The programs at UW-Madison and UW-Milwaukee are more theoretical in nature than the applied degree that is being proposed at UWL. A collaborative online Master’s Degree in Data Science with various partner schools within the UW System started in the Fall 2015 semester. The degree in Data Science does not have the same focus on statistics as the proposed Master’s in Applied Statistics and targets working adults rather than the traditional college student.

c. The collaborative nature of the program, if appropriate, including community partners and specific institutional responsibilities

For the thesis component of the M.S. degree, students will be expected to work on real-world projects that require extensive statistical analyses. While some of these projects may come from other departments at UWL, we anticipate some of them to come from external business or community partners. The Statistical Consulting Center was expanded in 2014 to include off-campus clients. Through our consulting, we have formed relationships with local non-profit organizations, businesses, and researchers. The mathematics and statistics faculty have also recently begun speaking with Fastenal and Gundersen Health about opportunities for our students to be involved in offering statistical support and analyzing data for their business and we anticipate some thesis projects being generated through these relationships.

2. Brief overview of program outcomes and curriculum

Students who complete a M.S. in Applied Statistics will be able to:

1. choose appropriate statistical procedures and models to effectively address research questions
2. conduct and interpret the computational aspects for a variety of statistical procedures using statistical software
3. effectively communicate statistical analysis orally and in writing
4. explain distribution theory and how it relates to the construction of statistical inference procedures like confidence intervals and hypothesis tests.

Eligibility requirements for students entering the M.S. in Applied Statistics program will fall into two categories: (1) students with a B.S. or B.A. degree from accredited institutions who have taken at least three semesters of calculus and at least one semester of probability/statistics; or (2) an early admission option for current undergraduate students majoring in statistics who meet the required criteria for admission (a 3 + 2 model).

Under option (1), students will be required to take 36 credits, of which 12 credits would be for a thesis component. Required courses include MTH 541: Mathematical Statistics I, MTH 542: Mathematical Statistics II, MTH 545: Correlation and Regression Analysis, and MTH 546: Analysis of Variance and
Design of Experiments. The remaining 12 credits would come from a list of possible electives, with at least 2 of these elective courses needing to be at the 700-level. Typical time to completion is two years.

**Course Plan for a M.S. in Applied Statistics**

<table>
<thead>
<tr>
<th>Year</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MTH 541*, MTH 545, Elective</td>
<td>MTH 542*, MTH 546, Elective</td>
</tr>
<tr>
<td>2</td>
<td>Elective 6 thesis credits</td>
<td>Elective 6 thesis credits</td>
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*These courses would be added as slash courses to our currently existing MTH 441 and 442

**MTH 500+ Electives**
- MTH 543 Categorical Data Analysis (already exists)
- MTH 547 Nonparametric Statistics (already exists)
- MTH 549 Multivariate Statistics (already exists)
- MTH 741 Bayesian Statistics (new course)
- MTH 742 Statistical Computing (new course)
- MTH 743 Biostatistics (new course)

Under option (2), students may be accepted into the dual degree program any time before they have completed seventy-five undergraduate credits hours. Applicants for undergraduate admission to UWL may request admission into the dual degree program. In order to remain in the program students must maintain a 3.00 GPA. Award of the B.S. degree will occur upon completion of 120 credits, the Statistics major requirements, the SAH college requirements, and the general university requirements. Students must have graduate student status prior to registering for their fourth graduate course (normally in the second semester of their 4th year.) Award of the M.S. degree will occur after the completion of the B.S. and M.S. requirements.

The dual degree program enables a UWL student to earn both a Bachelor of Science degree with a statistics major and a Master of Science in Applied Statistics in five years. Students in this dual degree program should complete the following by the end of their junior year:

<table>
<thead>
<tr>
<th>Course Number</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTH 207</td>
<td>Calculus I</td>
<td>5</td>
</tr>
<tr>
<td>MTH 208</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>MTH 245</td>
<td>Probability and Statistics</td>
<td>4</td>
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</tbody>
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### MTH 309
- Linear Algebra with Differential Equations
- 4 credits

### MTH 310
- Calculus III: Multivariate Calculus
- 4 credits

### MTH 405
- Statistical Methods
- 3 credits

### MTH 440
- Statistical Consulting
- 1 credit

### MTH 441
- Mathematical Statistics I
- 3 credits

### MTH 442
- Mathematical Statistics II
- 3 credits

### MTH 445
- Correlation and Regression Analysis
- 3 credits

### MTH 446
- Analysis of Variance and Design of Experiments
- 3 credits

### MTH elective
- 3 credits

During the senior year students should complete two MTH 500+ courses each semester. In the fifth year, students should complete the two remaining MTH 500+ courses (one per semester) along with taking 6 thesis credits a semester. A sample plan for these courses is given below.

**Sample Course Plan for a Dual Degree B.S./M.S. in Applied Statistics**

<table>
<thead>
<tr>
<th>Year</th>
<th>Fall</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MTH 207</td>
<td>MTH 208, MTH 245</td>
</tr>
<tr>
<td>2</td>
<td>MTH 405, MTH 445</td>
<td>MTH 446, MTH 310, MTH 440</td>
</tr>
<tr>
<td>3</td>
<td>MTH 441, MTH 309</td>
<td>MTH 442, MTH elective</td>
</tr>
<tr>
<td>4</td>
<td>Two MTH 500+ courses*</td>
<td>Two MTH 500+ courses*</td>
</tr>
<tr>
<td>5</td>
<td>One MTH 500+ course*</td>
<td>One MTH 500+ course*</td>
</tr>
<tr>
<td></td>
<td>6 thesis credits</td>
<td>6 thesis credits</td>
</tr>
</tbody>
</table>

*From the list MTH 543, 547, 549, 741, 742, 743*
3. Discussion of any need for external accreditation for program viability
None

4. Resource needs for the program
The proposed M.S. in Applied Statistics will require the creation of three additional 3-credit courses beyond what are currently offered by the Mathematics Department. The department currently has 6 PhD-level statisticians that teach all upper-level statistics courses. It is anticipated that one more PhD-level statistician would need to be hired by the third year of the program’s inception to cover the load created by the additional classes. Ideally this would be an additional position in the department, but could possibly be handled through a reassignment of a position within the department pending a retirement. For the first two years, we will staff lower-level statistics courses through part-time instructional academic staff, freeing faculty to teach the three new graduate courses.

5. A letter of support from the Dean of the College in which the program is housed