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| **Assurance of Student Learning Report****2020-2021** |
| Ogden College of Science & Engineering | Department of Mathematics |
| 085 Master of Science in Mathematics |
| Richard Schugart |

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| ***Use this page to list learning outcomes, measurements, and summarize results for your program. Detailed information must be completed in the subsequent pages.*** |
| **Student Learning Outcome 1:**  Students should possess knowledge of a broad topic in mathematics commensurate with that of a Masters graduate. |
| **Instrument 1** | All students must take a minimum of 30 credit hours of graduate-level mathematics courses. The courses of the MS program give a broad and deep background in the given concentration. |
| **Based on your results, check whether the program met the goal Student Learning Outcome 1.** | **[ ]  Met** | **X Not Met** |
| **Student Learning Outcome 2:** Students should be able to apply research methods to understand mathematical problems and possess the ability to apply technology and other tools to effectively investigate mathematical problems. |
| **Instrument 1** | Masters thesis. |
| **Instrument 2** | Comprehensive exam. |
| **Based on your results, check whether the program met the goal Student Learning Outcome 2.** | **[ ]  Met** | **X Not Met** |
| **Student Learning Outcome 3:**  Students should be able to speak and write with mathematical maturity commensurate with that of a Masters graduate. |
| **Instrument 1** | Masters thesis. |
| **Instrument 2** | Comprehensive exam. |
| **Instrument 3** | Students should pass MATH 598, a seminar-style class with an emphasis of communication in the discipline. |
| **Based on your results, check whether the program met the goal Student Learning Outcome 3.** | **[ ]  Met** | **X Not Met** |
| **Program Summary (Briefly summarize the action and follow up items from your detailed responses on subsequent pages.)**  |
| For students starting the graduate program in the Fall 2020, all students will be required to complete a 33-credit-hour Masters program. First, the students have three core courses – one each from statistics, applied mathematics, and discrete mathematics. Second, all students must take MATH 598, which is a seminar course emphasizing communication in the discipline. Third, all students will be required to complete a Master’s thesis. We believe these changes to the program will enhance the opportunity for all students in the program to have a set of broad topics in mathematics while simultaneously improving their ability to apply research methods and communicate mathematics in a mature way. |

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| **Student Learning Outcome 1** |
| **Student Learning Outcome**  | Students should possess knowledge of a broad topic in mathematics commensurate with that of a Masters graduate. |
| **Measurement Instrument 1**  | All students must take a minimum of 30 credit hours of graduate-level mathematics courses. The courses of the MS program give a broad and deep background in the given concentration. |
| **Criteria for Student Success** | Completion of the broad-based curriculum in their concentration while maintaining a 3.0 GPA on a 4-point scale. |
| **Program Success Target for this Measurement** | 90% | **Percent of Program Achieving Target** | 86% |
| **Methods**  | For students starting before Fall 2020, the 085 program, which requires a minimum of 30 credit hours for completion, has three concentrations: general math, computational math, and mathematical economics. The concentration in general math requires the student take * Intermediate Analysis I;
* Complex Variables;
* either Algebraic Systems, Partial Differential Equations, or Topology I;
* either Real Analysis, Advanced Applied Mathematics I, Graph Theory, or Complex Analysis;
* a research tool course; and
* 6 other courses from a wide range of graduate mathematics and statistics topics.

The concentration in computational mathematics requires the student take* Numerical Analysis I and II;
* Introduction to Operations Research;
* the computer science course Analysis of Algorithms;
* the statistics course Statistical Methods I;
* two computer science courses from Parallel and Distributed Computing, Data Mining Techniques and Tools, and Advanced Topics in Computer Science;
* a research tool course; and
* three courses from our more applied graduate mathematics and statistics topics.

The concentration in mathematical economics requires the student take * three economics courses Regression and Econometric Analysis, Applied Microeconomic Theory, and Applied Macroeconomic Theory;
* the statistics course Statistical Methods I;
* either Intermediate Analysis I or Probability and Statistics II;
* either Advanced Differential Equations or Statistical Methods II;
* a research tool course; and
* four courses from our more applied graduate mathematics, statistics, or economics topics.

All of these courses are graduate courses and are three credit hours. We had nine students in the program. Four graduated upon completion of their thesis and coursework, while another four are continuing and are on schedule to graduate in the next two years. One student decided to move from the MS program to the MA program since the student felt that the MA program better met his or her needs.For students starting in Fall 2020 (or later), the 085 program, which requires a minimum of 33 credit hours for completion, has three concentrations: general mathematics, computational mathematics, and mathematical economics. Regardless of the concentration, all students must take* the statistics course Statistical Methods I;
* an applied mathematics course, either Advanced Differential Equations or Applied Mathematics-I;
* a discrete math course, either Graph Theory or Topics in Discrete Mathematics;
* a seminar course emphasizing communication I;
* 6 hours of thesis writing.

The general mathematics concentration also requires the students to take* Intermediate Analysis I;
* four courses from graduate mathematics or statistics.

The concentration in computational mathematics also requires the students to take* Numerical Analysis I and II;
* the computer science course Analysis of Algorithms;
* one computer science course from Data Science, Parallel and Distributed Computing, and Data Mining Techniques and Tools in Computer Science;
* one course from graduate applied mathematics or statistics.

The concentration in mathematical economics also requires the students to take* two economics courses Regression and Econometric Analysis and Applied Microeconomic Theory;
* either Intermediate Analysis I or Probability and Statistics II;
* two courses from graduate applied mathematics or statistics.
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| **Based on your results, highlight whether the program met the goal Student Learning Outcome 1.** | **[ ]  Met** | **X Not Met** |
| **Actions** (Describe the decision-making process and actions for program improvement. The actions should include a timeline.) |
| Beginning in Fall 2020, all incoming students will be required to take a core set of courses in statistics, discrete mathematics, and applied mathematics. In addition, the students will be required to take MATH 598, a seminar course that emphasizes communication in the discipline, and complete a Master’s thesis. |
| **Follow-Up** (Provide your timeline for follow-up. If follow-up has occurred, describe how the actions above have resulted in program improvement.) |
| We will continue to monitor how these changes affect our rates of meeting our criteria. |
| **Next Assessment Cycle Plan** (Please describe your assessment plan timetable for this outcome) |
| We believe the best assessment cycle would be every two years since the first set of students under our curricular changes will likely have graduated by then. |

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| **Student Learning Outcome 2** |
| **Student Learning Outcome**  | Students should be able to apply research methods to understand mathematical problems and possess the ability to apply technology and other tools to effectively investigate mathematical problems. |
| **Measurement Instrument 1** | Masters thesis. |
| **Criteria for Student Success** | Committee approval of the completion and defense of the masters thesis. |
| **Program Success Target for this Measurement** | 90% | **Percent of Program Achieving Target** | 86% |
| **Methods**  | All students choosing the thesis option must complete a rigorous Master’s thesis with the supervision of a member of our graduate faculty, and defend that thesis upon its completion to that faculty member and two other faculty that they choose to be on their committee. The committee must agree that the students has completed a rigorous thesis and defended it successfully. 3 students successfully defended their Master’s thesis. 4 more are scheduled to complete a Master’s thesis in the next two years.  |
| **Measurement Instrument 2** | Comprehensive exam. |
| **Criteria for Student Success** | Successful completion of the comprehensive exam, to the satisfaction of the three faculty constructing the exam. |
| **Program Success Target for this Measurement** | 90% | **Percent of Program Achieving Target** | N/A |
| **Methods** | No students took the comprehensive exam. |
| **Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 2.** | **[ ]  Met** | **X Not Met** |
| **Actions** (Describe the decision-making process and actions planned for program improvement. The actions should include a timeline.) |
| We are removing the comprehensive exam option from our program, and requiring each program student to complete and defend a Master’s thesis. All students have now graduated that could have chosen a comprehensive exam. Since this is no longer an option, we will remove this as a measurement instrument and will discuss and develop a new measurement instrument going forward. |
| **Follow-Up** (Provide your timeline for follow-up. If follow-up has occurred, describe how the actions above have resulted in program improvement.) |
| We will continue to monitor how these changes affect our rates of meeting our criteria. |
| **Next Assessment Cycle Plan** (Please describe your assessment plan timetable for this outcome) |
| We believe the best assessment cycle would be every two years since the first set of students under our curricular changes will likely have graduated by then. |

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| **Student Learning Outcome 3** |
| **Student Learning Outcome**  | Students should be able to speak and write with mathematical maturity commensurate with that of a Masters graduate. |
| **Measurement Instrument 1** | Masters thesis. |
| **Criteria for Student Success** | Committee approval of the completion and defense of the Master’s thesis. |
| **Program Success Target for this Measurement** | 90% | **Percent of Program Achieving Target** | 86% |
| **Methods**  | All students choosing the thesis option must complete a rigorous Master’s thesis with the supervision of a member of our graduate faculty, and defend that thesis upon its completion to that faculty member and two other faculty that they choose to be on their committee. The committee must agree that the students has completed a rigorous thesis and defended it successfully. 3 students successfully defended their Master’s thesis. 4 more are scheduled to complete a Master’s thesis in the next two years. |
| **Measurement Instrument 2** | Comprehensive exam. |
| **Criteria for Student Success** | Successful completion of the comprehensive exam. |
| **Program Success Target for this Measurement** | 90% | **Percent of Program Achieving Target** | **N/A** |
| **Methods** | No students took the comprehensive exam. |
| **Measurement Instrument 3** | Students should pass MATH 598, a seminar-style class with an emphasis of communication in the discipline. |
| **Criteria for Student Success** | B or better in MATH 598. |
| **Program Success Target for this Measurement** | 100% | **Percent of Program Achieving Target** | 100% |
| **Methods** | All students must take and complete an intensive course on communication in the discipline. |
| **Based on your results, circle or highlight whether the program met the goal Student Learning Outcome 3.**  | **[ ]  Met** | **X Not Met** |
| **Actions** (Describe the decision-making process and actions for program improvement. The actions should include a timeline.) |
| We are removing the comprehensive exam option from our program, and requiring each program student to complete and defend a Master’s thesis. We are also requiring all students to take a course emphasizing communication in the disciplines. All students have now graduated that could have chosen a comprehensive exam. Since this is no longer an option, we will remove this as a measurement instrument and will discuss and develop a new measurement instrument going forward. |
| **Follow-Up** (Provide your timeline for follow-up. If follow-up has occurred, describe how the actions above have resulted in program improvement.) |
| We will continue to monitor how these changes affect our rates of meeting our criteria. |
| **Next Assessment Cycle Plan** (Please describe your assessment plan timetable for this outcome) |
| We believe the best assessment cycle would be every two years since the first set of students under our curricular changes will likely have graduated by then. |