

Program:	Mathematics, MS (Online Option)			
Cycle:	2016-2017			
Mission Statement:	<p>The Department of Mathematics offers a Masters Program that prepares students to pursue successful careers as professional mathematicians in sectors such as education, government, industry, and research. Our current MS tracks are: 1. Traditional track option 2. Teaching track option 3. Applied professional tracks: a. Industrial option b. Computational Math option c. Mathematical Biology option. Application areas: c.1. Genetics and Bioinformatics c.2. Ecological modeling c.3. Mathematical Physiology and Biomedical Engineering c.4. Mathematical Epidemiology and Infectious Disease Modeling. Students in the Traditional Track are typically trained to join a Ph.D. program; those in the Teaching track acquire the necessary pedagogical skills to teach at a High School and 2 year College level, and students in the Applied Professional Track options are prepared for careers in industry, business and education. Furthermore, in order to address the needs of a professional student population seeking career advancement or having geographical, economical or personal constraints we also offer an online Distance Masters program which has a Teaching option and a Computational Math option. The distance masters program is similar in scope and structure to the in-residence program, except that the instruction is provided with the aid of distance education technology. Courses in this program are entirely asynchronous, so that students can access course content at their convenience. Material is provided either in the form of short (typically ten to fifteen minute) video lectures or in the form of printed documents (many instructors combine these two forms). Students gain a breadth of training and depth of knowledge in an area of specialization by completing program requirements in a spectrum of mathematics classes, complemented by required courses taken outside the Department and targeted to the professional track chosen. Additionally, students are exposed to various internship opportunities and teaching experiences. Some students may also choose to participate in the Masters Degree with Thesis option, for which they must write a Masters Thesis representing an original contribution to an area of knowledge. Such contribution may consist of new results in the area and/or a new perspective and exposition of important results in the field.</p> <p>Additional Information: The computational and teaching tracks for our Master's Program are offered both on campus and online. (The remaining tracks are only offered on campus, with standard face-to-face instruction). The courses and degree requirements for the campus and online tracks match closely with a few exceptions: For the campus computational track, students are expected to obtain a "coordinated minor" in an application area outside of mathematics, and since there are limited options for such a coordinated minor for students in the distance program, students in the distance program are given more flexibility in selecting this group of classes. In particular, they often take only math and statistics classes, because the math and statistics departments both have on-line Master's programs. For the teaching track, the four core classes are only offered on-line, so students in the distance program take exactly the same classes (for these four) as the students in the campus program. However, students in the campus program are allowed to take up to two undergraduate courses to fill in deficiencies, and since such courses are not offered with a distance option, students in the distance program must take graduate math or statistics classes instead. Our Master's program includes a combination of synchronous and asynchronous instruction. In particular, all campus-based courses are primarily synchronous and all online courses are primarily asynchronous.</p>			
Outcome/Objective	Measure	Target	Finding	Action Plan
Outcome 1: Students will demonstrate rigorous breadth of knowledge and mastery in the foundations of Mathematics by demonstrating the ability to analyze and solve mathematical and/or application problems by using appropriate tools and techniques developed throughout the program. Students will successfully complete intensive coursework in foundational areas and fulfill the Masters Program core requirements. The main objective here is to ensure that the students will have a solid understanding the theory, concepts and core principles in mathematics, culminating with a comprehensive view of the subject through the foundational coursework and related experiences.	Measure 1: During their final oral exam, each student in the Master's program is evaluated on a scale of 1-5 in the following category: The student demonstrated suitable knowledge of one or more foundational areas of mathematics such as algebra, analysis, and topology. The rankings are: 1. Inadequate; 2. Below expectations; 3. Satisfactory; 4. Above expectations; 5. Excellent.	90% of students will receive an average score of 3 or better in this category. We introduced a new oral exam assessment rubric in Fall 2015 for the campus Master's program, and so this is the second cycle during which we're reporting on it. The assessment tool was not introduced in our distance Master's program until Spring 2017, so for that program this is the first cycle during which we're reporting on it. Now that we have baseline results, this target will likely change for the next cycle.	Target: Met Of 18 MS students (campus + distance) who took the oral exam in Summer 2016, Fall 2016, or Spring 2017, 100% received an average score of 3 or better in the category of foundational knowledge. This finding reflects our commitment to ensuring that all students in our Master's program gain a strong background in core areas of mathematics. This count of 18 MS students includes 15 campus MS students and 3 distance MS students. The oral exam assessment rubric has just been implemented for distance MS students, and 6 students in this program who took an oral exam were not assessed by the rubric (because it wasn't implemented until Spring 2017).	<i>No affiliated Action Plan</i>
Outcome 2: Students will demonstrate depth of knowledge and mastery in an area of specialization associated with the professional track chosen, along with a proven ability to think critically on the subject, by demonstrating the ability to analyze and solve mathematical and/or application problems by using appropriate tools and techniques for their field of specialization.	Measure 2: During their final oral exam, each student in the Master's program is evaluated on a scale of 1-5 in the following category: The student demonstrated a high level of knowledge in his/her area of specialization. The rankings are: 1. Inadequate; 2. Below expectations; 3. Satisfactory; 4. Above expectations; 5. Excellent.	90% of students will receive an average score of 3 or better in this category. We introduced a new oral exam assessment rubric in Fall 2015 for the campus Master's program, and so this is the second cycle during which we're reporting on it. The assessment tool was not introduced in our distance Master's program until Spring 2017, so for that program this is the first cycle during which we're reporting on it. Now that we have baseline results, this target will likely change for the next cycle.	Target: Met Of 18 MS students (campus + distance) who took the oral exam in Summer 2016, Fall 2016, or Spring 2017, 94% (17 out of 18) received an average score of 3 or better in the category of specialized knowledge. This finding reflects our commitment to ensuring that each student in our Master's program develops expertise in a specific area of mathematics. This count of 18 MS students includes 15 campus MS students and 3 distance MS students. The oral exam assessment rubric has just been implemented for distance MS students, and 6 students in this program who took an oral exam were not assessed by the rubric (because it wasn't implemented until Spring 2017).	<i>No affiliated Action Plan</i>

<p>Outcome 3: Students will effectively communicate and present mathematics in writing and orally by completing written exams and assignments, giving oral presentations during coursework, and writing a Masters Thesis (Thesis option only).</p>	<p>Measure 3: During their final oral exam, each student in the Master's program is evaluated on a scale of 1-5 in the following category: The student was able to effectively communicate his/her mathematical knowledge to the committee. The rankings are: 1. Inadequate; 2. Below expectations; 3. Satisfactory; 4. Above expectations; 5. Excellent.</p>	<p>90% of students will receive an average score of 3 or better in this category. We introduced a new oral exam assessment rubric in Fall 2015 for the campus Master's program, and so this is the second cycle during which we're reporting on it. The assessment tool was not introduced in our distance Master's program until Spring 2017, so for that program this is the first cycle during which we're reporting on it. Now that we have baseline results, this target will likely change for the next cycle.</p>	<p>Target: Met Of 18 students (campus + distance) who took the oral exam in Summer 2016, Fall 2016, or Spring 2017, 100% received an average score of 3 or better in the category of oral communication. This finding reflects our commitment to ensuring that each student in our Master's program becomes proficient with communicating mathematics. This count of 18 MS students includes 15 campus MS students and 3 distance MS students. The oral exam assessment rubric has just been implemented for distance MS students, and 6 students in this program who took an oral exam were not assessed by the rubric (because it wasn't implemented until Spring 2017).</p>	<p><i>No affiliated Action Plan</i></p>
<p>Outcome 4: Whether pursuing a career in academia, government, or industry (or beyond), and whether their interest is primarily in teaching or primarily in research, students will succeed on the job market.</p>	<p>Measure 4: We will administer an exit survey [the Department of Mathematics Graduate Program Exit Survey] to all graduating students to obtain their views on the curriculum, advising, instruction, job placement, and future plans. Our goal is for every student who pursues a job in the profession to obtain a good one, and for every student who wants to continue into a PhD program to be admitted into a strong one. Nonetheless, we understand that a target of 100% is unrealistic, both because a small number of graduates do not pursue either a job in the profession or additional graduate study, and because a small number of graduates never report on employment status. We have set our target at the high level of 90% in an indication of how important we view employment success when assessing our program.</p>	<p>90% of students will either have obtained a desirable job in the profession at the time of graduation, or will be pursuing a PhD in math or a math-related area.</p>	<p>Target: Not Met For the period August 2016 - May 2017, 18 students graduated from our campus Master's program. Employment for these students was as follows: Continuing into a PhD program in math or a math-related area: 11; Assistant professor at a junior college: 1; Government employment: 1; No information: 5. In summary, 13 out of 18 students in our campus Master's program (72%) reported having obtained a job. This is a slight increase from last year's 68%. For the period August 2016 - May 2017, 9 students graduated from our distance Master's program. Employment for these students was as follows: High school math teacher: 3; Middle school math teacher: 1; Industry: 1; Unreported: 4. In summary, 5 out of 9 students in our distance Master's program (56%) reported having obtained a job. (Most of the students in this program are working while in the program, and continue to have the same job following graduation. Unfortunately, these students often don't fill out our exit survey.)</p>	<p>In our Measure 4 ("Exit Survey"), we state the following goal: "90% of students will either have obtained a desirable job in the profession at the time of graduation, or will be pursuing a PhD in math or a math-related field." During the current assessment cycle, we found that 72% of the students in our campus Master's program and 56% of students in our distance Master's program reported having a desirable job at the time of graduation. (For the distance Master's program, we think this number of considerably skewed downward by the fact that students often don't report.) By discussing employment prospects with representatives from government and industry, we have found that for students in the mathematical sciences, and especially for those pursuing jobs in government and industry, the development of strong computational skills is becoming absolutely essential. In light of this, starting in Fall 2017 we will encourage students to develop such skills in the following ways: (1) during our department's bi-weekly First Year Graduate Student Seminar we will inform all Master's students in our program about the advantages of developing such skills while in graduate school; (2) we will require students in our teaching MS track and in all of our MS applied tracks (computational, industrial, biology) to take at least one course with an emphasis on computation; and (3) through our new Industrial and Applied Math Seminar, we will give students a chance to see for themselves the role computation plays in industrial applications.</p>
	<p>Measure 5: We administer an annual survey [the Department of Mathematics Graduate Program Alumni Survey] to all students who graduated from the program at least five years earlier. In this survey, students are asked to rate job satisfaction on a scale 1-10. Some graduates will be on track to obtain a permanent position with a postdoctoral degree (i.e., the student may be in a PhD program or have a post-doctoral position), and these students rate their satisfaction with the PhD program they are in, or the post-doctoral position they have. Most of our students have a particular type of career in mind while pursuing their Master's degree (academic, industrial, government, etc.), and it is critical that we help them succeed in their goal.</p>	<p>Our target is for 90% of students to rate their job at least 6 or better (i.e., in the upper half of the scale). We view this as an extremely important measure, as indicated by the high target value of 90%.</p>	<p>Target: Partially Met During the nine-year period Dec. 2004 - August 2012 (the current scope of the alumni survey), 127 students graduated with an MS from our campus program. Of these students, 25 responded to our annual alumni survey. Students were asked to rate their job satisfaction on a scale 1-10, and 22 out of 25 rated their job a 6 or better. This corresponds with 88% job satisfaction, which almost meets our target (and is a slight improvement from the previous year). During the four-year period Dec. 2008 - August 2012 (the current scope of the alumni survey), 55 students graduated with an MS from our online program. Of these students, 18 responded to our annual alumni survey. Students were asked to rate their job satisfaction on a scale 1-10, and 18 out of 18 rated their job a 6 or better. This corresponds with 100% job satisfaction, which meets our target.</p>	

<p>(Analysis Question #1) Consider the Findings and the Action Plan(s) established this cycle. How did the program/unit identify these next steps for action? Why does the program/unit believe this Action Plan(s) should improve future assessment results?</p>	<p>For the Master's program, we are introducing one new action plan this cycle, "Enhanced development of computational skills." This action plan is in response to our assessment during this cycle of our Outcome/Objection 4 on "Career Success," which asserts that "Whether pursuing a career in academia, government, or industry (or beyond), and whether their interest is primarily in teaching or primarily in research, students will succeed on the job market."</p> <p>One measure for this Outcome/Objection is Measure 4 ("Exit Survey"), for which the stated goal is that "90% of students will either have obtained a desirable job in the profession at the time of graduation, or will be pursuing a PhD in math or a math-related field." During the current assessment cycle, we found that 72% of the students in our campus Master's program and 56% of students in our distance Master's program reported having a desirable job at the time of graduation. (For the distance Master's program, we think this number of considerably skewed downward by the fact that students often don't report.)</p> <p>Students with demonstrated computational skills have an advantage in the current job market in the mathematical sciences, and so we have introduced this new action plan in order to ensure that all of our students are aware of the importance of computational skills, and that students interested in jobs in government and industry will be required to develop such skills while in the program. This action plan will enhance students' computational skills in the following ways: (1) during our department's bi-weekly First Year Graduate Student Seminar we will inform all Master's students in our program about the advantages of developing such skills while in graduate school; (2) we will require students in our teaching MS track and in all of our MS applied tracks (computational, industrial, biology) to take at least one course with an emphasis on computation; and (3) through our new Industrial and Applied Math Seminar, we will give students a chance to see for themselves the role computation plays in industrial applications.</p> <p>Following the implementation of this action plan, we expect that more of our students will be able to find employment in government and industry. We will monitor this with our exit and alumni surveys.</p>
<p>(Analysis Question #2) Provide an update for completed or ongoing action plans from the previous year(s). Discuss any successes, challenges, and/or obstacles the program/unit has experienced while implementing the Action Plan(s). Address whether or not the program/unit has seen any improvement in assessment results for the targeted Outcome(s) the Action Plan(s) were designed to address and why the action plan may/may not have resulted in improvements.</p>	<p>We discuss our two action plans that have been moved from "In Progress" to "Finished" this cycle, and our two action plans that have been moved from "Planned" to "In Progress."</p> <p>I. The following action plans have been moved from "In Progress" to "Finished:"</p> <p>1. "Development of refined evaluation criteria for Master's final oral exams"</p> <p>Background: Our Outcome/Objectives 1, 2, and 3 all address fundamental competencies, respectively Foundational Knowledge, Specialized Knowledge, and Communication Skills. The single most important measure associated with these outcomes/objectives is the final oral exam (used for Measure & Finding 1, 2, and 3), and during the 2015-2016 assessment cycle it was found that we were not obtaining a sufficient amount of information from these exams to thoroughly assess all competencies. In light of this, we have introduced a new uniform system of criteria for our Master's oral exams, and along with this a new mandatory evaluation form for committee members to fill out. This has now been implemented in assessment cycles 2015-2016 and 2016-2017, and we are moving this action plan to the "Finished" category. Result: This new assessment tool provides us with a much better overview of what students are learning in our MS program, and we expect that this will make our assessments more effective in the years ahead.</p> <p>2. "Introduction of a new on-line course in real analysis"</p> <p>Background: Our Outcome/Objective 1 states that "Students will demonstrate rigorous breadth of knowledge and mastery in the foundations of mathematics." During the assessment cycle 2014 - 2015, one of the Measures for this Outcome/Objective addressed program coursework requirements (the Measure has now been eliminated). In that cycle, it was found that students in our distance MS program do not have access to a sufficient number of foundational courses, and (starting Fall 2015) we introduced a new distance course in real analysis. Result: Course enrollment in Fall 2015 was 8 students, and for Fall 2017 it is up to 14. This course has now been added as a core course in our distance Master's curriculum. We expect that the introduction of this course will lead to improved results on foundational knowledge, as measured by our Measure 1, "Oral exam foundations assessment." However, this measure was not implemented for our distance Master's program until Spring 2017, and so we do not yet have enough data to assess the results.</p> <p>II. The following action plans have been moved from "Planned" to "In Progress"</p> <p>1. "Introduction of a new Industrial and Applied math Seminar"</p> <p>Background: Our Outcome/Objective 4 on Career Success states: "Whether pursuing a career in academia, government, or industry (or beyond), and whether their interest is primarily in teaching, or primarily in research, students will succeed on the job market." One measure of this Outcome/Objective is Measure 4, Exit Survey. The target for this measure is for 90% of students to either have obtained a desirable job in the profession at the time of graduation, or to be pursuing a PhD in math or a math-related field. For the 2015-2016 assessment cycle, it was found that 13 out of 19 students in our campus Master's program (68%) reported having achieved one of these criteria. This number was significantly below our target, and we introduced an action plan in which a new seminar on Industrial and Applied Mathematics was introduced. The goal of this seminar is to inform students about the role of mathematics in government and industry, and to better prepare students for the job markets in these sectors. Results. This seminar is one part of a slate of activities we've been introducing to help our students succeed on the job market. For the 2016-2017 assessment cycle, 13 out of 18 students in the campus Master's program reported achieving success on the job market, and this corresponds with 72%, which is a slight improvement over the previous cycle.</p> <p>2. "Enhanced education and experience with the mathematical and computational challenges of science, engineering, and industry"</p> <p>Background: Our analysis described in Item II.1 above also led to a second action plan that involved the proposal for NSF funds to support our students in their preparation for the job market. This proposal was not funded, but we are continuing with the goal of better preparing Master's students for the current job market. Result: For the 2016-2017 assessment cycle, 13 out of 18 students in the campus Master's program reported achieving one of our success criterion. This corresponds with 72%, which is a slight improvement over the previous cycle.</p>

<p>(Distance Education Question #1) How is the program ensuring the comparability of the distance education program with comparable campus-based (i.e., face-to-face) programs?</p>	<p>The distance Master's program in mathematics has two tracks, computational and teaching, and these mirror two tracks with the same titles that are offered in the campus program. The courses and degree requirements for these tracks match closely with a few exceptions: For the campus computational track, students are expected to obtain a "coordinated minor" in an application area outside of mathematics, and since there are limited options for such a coordinated minor for students in the distance program, students in the distance program are given more flexibility in selecting this group of classes. In particular, they often take only math and statistics classes, because the math and statistics departments both have on-line Master's programs. For the teaching track, the four core classes are only offered on-line, so students in the distance program take exactly the same classes (for these four) as the students in the campus program. However, students in the campus program are allowed to take up to two undergraduate courses to fill in deficiencies, and since such courses are not offered with a distance option, students in the distance program must take graduate math or statistics classes instead.</p>
<p>(Distance Education Question #2) What data/evidence are used to regularly assess the effectiveness of the distance education program (in comparison to comparable campus-based programs)? (1) What data are routinely used to assess effectiveness and comparability? (2) What evidence does the program have to support the comparability of the distance education program with similar campus-based program(s)?</p>	<p>Students in the distance Master's program remotely take an oral exam that is in the same format as the oral exam required by the campus Master's program, and is evaluated with the same rubric used to evaluate campus Master's oral exams. This uniformity in the evaluation of oral exams just began in Fall 2016, and so the associated data is only preliminary. Nonetheless, we can compare results for students in the distance program with results of students in the campus Master's program. The rubric for this oral exams consists of three categories, and committee members rank students in each category with the following scale: 1. Inadequate; 2. Below expectations; 3. Satisfactory; 4. Above expectations; 5. Excellent. The first category is: 1. "The student demonstrated suitable knowledge of one or more foundational areas of mathematics such as algebra, analysis, and topology." For this category, the average rating for students in the distance Master's program was 4.0/5.0, while the average rating for students in the campus Master's program was 4.2/5.0. The second category is 2. "The student demonstrated a high level of knowledge in his/her area of specialization." For this category, the average rating for students in the distance Master's program was 4.3/5.0, while the average rating for students in the campus Master's program was 4.1/5.0. The third category is: 3. "The student was able to effectively communicate his/her mathematical knowledge to the committee." For this category, the average rating for students in the distance Master's program was 4.8/5.0, while the average rating for students in the campus Master's program was 4.1/5.0. In light of these numbers, our preliminary assessment is that students in the distance Master's program and students in the campus Master's program are developing comparable skills while in the programs.</p>
<p>(Distance Education Question #3) What steps have been taken, if any, for improvement of the distance education program to ensure comparability? (i.e., provide the basic components of an Action Plan)</p>	<p>Starting in Fall 2016, our department began giving and assessing final oral exams in a uniform way for the distance and campus Master's programs. Specifically, the formats for the exams are the same for both programs, and the exams are assessed with the same rubric. In addition, the program requirements for students in the distance Master's program were updated in Fall 2016 to bring them more in line with requirements for the associated campus Master's programs.</p>