

# **Academic Program**

## **Plan for Assessment of Student Learning Outcomes**

Department of Mathematics and Statistics

College of Arts and Sciences

The University of New Mexico

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## Part 1

# M.S., Math/Statistics, Plan 1 (Thesis)

## 1A College, Department and Date

1. College: Arts & Sciences
2. Department: Mathematics and Statistics
3. April, 2018

## 1B Academic Program of Study

M.S., Math/Statistics, Plan 1 (Thesis)

## 1C Contact Persons for the Assessment Plan

*Yan Lu, Chair of the graduate Committee, luyan@math.unm.edu*

*Jens Lorenz, Chair of the Department, lorenz@math.unm.edu*

## 1D Broad Program Goals & Measurable Student Learning Outcomes

### 1. Broad Program Learning Goals for this Degree/Certificate Program

- A. A significant knowledge in Math/Stats theory.
- B. Problem solving skills, capacity to conduct and communicate original research.

### 2. List of Student Learning Outcomes (SLOs) for this Degree/Certificate Program

A.1. Demonstrate familiarity with theories, questions and approaches across major areas of Mathematics/Statistics.

UNM Goals (  Knowledge  Skills  Responsibility)

A.2. Achieve understanding of the conceptual framework, major advances and important methodological approaches within Math/Stats.

UNM Goals (  Knowledge  Skills  Responsibility)

B.1. Be able to correctly apply, analyze, and interpret the results from standard mathematical or statistical theories.

—Students in Applied Mathematics and Statistics will be able understand mathematical and statistical modeling, perform numerical experiments, or analyze data using established mathematical and statistical techniques.

—Students in Pure Mathematics will be able to follow complex arguments in analysis, algebra and topology. UNM Goals (  Knowledge  Skills  Responsibility)

B.2. Demonstrate the ability to conduct original research.

UNM Goals (  Knowledge  Skills  Responsibility)

B.3. Exhibit scientific written communication that is clear, logical, and effective.

UNM Goals (  Knowledge  Skills  Responsibility)

B.4. Demonstrate an ability to convincingly explain the importance and impact of his/her research in lay terms to scientists from other disciplines.

UNM Goals (  Knowledge  Skills  Responsibility)

## 1E Assessment of Student Learning Three-Year Plan

All programs are expected to measure selected outcomes and report annually. All programs will measure and report all outcomes at least once over a three-year review cycle.

### 1. Timeline for Assessment

*In the table below, briefly describe the timeframe over which your unit will conduct the assessment of learning outcomes selected for the three-year plan. List when outcomes will be assessed and which semester/year the results will be discussed and used to improve student learning (e.g., discussed with program faculty, interdepartmental faculty, advisory boards, students, etc.)*

Year/Semester	Assessment Activities	SLOs
Years 1–3, Spring	Administer Exit Survey. Implement evaluative questions for defense and written thesis.	A.1., A.2. B.1-B.4
Years 1–3, Fall	Implement evaluative questions for defense and written thesis.	A.1., A.2. B.1.-B.4.

**2. How will learning outcomes be assessed?**

Three instruments will be used in assessment of our SLOs. 1) We carry out an online exit survey of senior graduate students. 2 & 3) We have added questions and associated rubrics to the OGS Report of Examination and Report on Thesis that will be filled out by the thesis/dissertation committee.

A.1. *Obtain familiarity with theories, questions and approaches across major areas of Math/Statistics.*

A.2. Achieve understanding of the conceptual framework, major advances and important methodological approaches within Math/Statistics.

B.1. Be able to correctly apply, analyze, and interpret the results from standard mathematical or statistical theories.

—Students in Applied Mathematics and Statistics will be able to understand mathematical and statistical modeling, perform numerical experiments, or analyze data using established mathematical and statistical techniques.

—Students in Pure Mathematics will be able to follow complex arguments in analysis, algebra and topology.

B.2. Demonstrate the ability to conduct original research.

1. Evaluation of Written Thesis

We expect students to demonstrate their depth of knowledge in their chosen subdiscipline in their written theses. The thesis should demonstrate not only understanding of their subdiscipline, but also their ability to create original research work, to criticize, and compare their work with the body of literature relevant to their subdiscipline. The Math Department's supplement to the OGS Report on Thesis (Appendix 1) will be filled out by each member of the student's thesis committee.

- a. These measures are direct.
- b. Criteria for success are that 80% of students score acceptable (3.0) or above on A.1., A.2., B.1. and B.2.

## 2. Evaluation of Oral Examination (Defense)

We will assess students' knowledge of their chosen discipline within Math/Stats during the oral portion of the examination. The Math Department's supplement to the OGS thesis defense form evaluates depth of knowledge in the specific discipline (Appendix 1).

1. These measures are direct.
2. Criteria for success are that 80% of students score acceptable (3.0) or above on A.1. and A.2.

B.3. Exhibit scientific written communication that is clear, logical, and effective.

B.4. Demonstrate an ability to convincingly explain the importance and impact of his/her research in lay terms to scientists from other disciplines and the colloquium.

## 1. Evaluation of Written Thesis

We will assess students' written communication skills by their written thesis. A rubric aids examiners in grading the student using a 5 point scale: poor, fair, acceptable, good, superior. Written communication skills are not a primary determinant of a pass or fail outcome.

- a. This measure is direct.
- b. Criteria for success are that 80% of students score acceptable (3.0) or above on a general appreciation of the breadth of Math/Stats research and a general communication skills.

2. Evaluation of Oral Examination (Defense)

We assess students appreciation of the breadth of Math/Statistical research during the oral portion of the defense, and assess students' ability in communicating their research. A rubric aids examiners in grading the student using a 5 point scale: poor, fair, acceptable, good, superior. Oral communicating skills are not a primary determinant of a pass or fail outcome.

- a. This measure is direct.
- b. Criteria for success are that 80% of students score acceptable (3.0) or above on a general appreciation of the breadth of Math/Stats research and a general communication skills.

**3. What is the unit's process to analyze/interpret assessment data and use results to improve student learning?**

*Briefly describe:*

1. *who will participate in the assessment process (the gathering of evidence, the analysis/interpretation, recommendations).*

SLOs and assessment plans will be placed on the Math Department web site and incoming students will be alerted to these important documents during orientation, the week before Fall classes. The Graduate Coordinator and Department Data Manager will work with the Graduate Committee (GC) to administer the online annual survey and to disseminate and instruct faculty in the use of the new evaluative questions connected to the thesis defense. All faculty who serve on graduate committees will

participate in applying the new evaluative questions. The data will be summarized using bar charts, other standard graphics, and summary statistics such as means and standard deviations.

2. *the process for consideration of the implications of assessment for change:*
  - a. *to assessment mechanisms themselves,*
  - b. *to curriculum design,*
  - c. *to pedagogy*  
*...in the interest of improving student learning.*

The GC will meet to review and discuss the assessment data after each yearly assessment and will evaluate the effectiveness of our graduate program in light of our agreed upon student learning outcomes. The committee will then draft recommendations for how the department might address areas of concern. Additional faculty input will be requested by email and in the annual spring faculty meeting focused on our graduate programs. If certain areas appear particularly problematic, new faculty committees will be composed to attempt to address these issues.

3. *How, when, and to whom will recommendations be communicated?*

Each semester, data on written theses, oral defense etc, will be collected. Reports will then be sent to the graduate committee who prepare a yearly report which analyzes and interprets this data. At the end of each school year (Spring semester), the graduate committee will distribute a survey to the graduating seniors, then summarize the results in the report.

Once a yearly report has been completed, copies will be distributed to the faculty as a whole. A portion of a faculty meeting will then be dedicated to discussing the report, giving faculty an opportunity to recommend avenues for improvement in the assessment mechanisms, curriculum design, and pedagogy.

## Part 2

# M.S., Math/Statistics, Plan II (Non-Thesis)

## 2A College, Department and Date

1. College: Arts & Sciences
2. Department: Mathematics and Statistics
3. April, 2018

## 2B Academic Program of Study

M.S., Math/Statistics, Plan II (Non-Thesis)

## 2C Contact Persons for the Assessment Plan

*Yan Lu, Chair of the graduate Committee, luyan@math.unm.edu*

*Jens Lorenz, Chair of the Department, lorenz@math.unm.edu*

## 2D Broad Program Goals & Measurable Student Learning Outcomes

1. **Broad Program Learning Goals for this Degree/Certificate Program**
  - A. A significant knowledge in Math/Stats theory.
  - B. Problem solving skills, capacity to conduct and communicate original research.

## 2. List of Student Learning Outcomes (SLOs) for this Degree/Certificate Program

A.1. Demonstrate familiarity with theories, questions and approaches across major areas of Math/Statistics.

UNM Goals (  Knowledge  Skills  Responsibility)

A.2. Achieve understanding of the conceptual framework, major advances and important methodological approaches within Math/Stats.

UNM Goals (  Knowledge  Skills  Responsibility)

B.1. Be able to correctly apply, analyze, and interpret the results from standard mathematical or statistical theories.

—Students in Applied Mathematics and Statistics will be able understand mathematical and statistical modeling, perform numerical experiments, or analyze data using established mathematical and statistical techniques.

—Students in Pure Mathematics will be able to follow complex arguments in analysis, algebra and topology. UNM Goals (  Knowledge  Skills  Responsibility)

B.2. Demonstrate the ability to conduct original research.

UNM Goals (  Knowledge  Skills  Responsibility)

B.3. Exhibit scientific written communication that is clear, logical, and effective.

UNM Goals (  Knowledge  Skills  Responsibility)

B.4. Demonstrate an ability to convincingly explain the importance and impact of his/her research in lay terms to scientists from other disciplines.

UNM Goals (  Knowledge  Skills  Responsibility)

## 2E Assessment of Student Learning Three-Year Plan

All programs are expected to measure selected outcomes and report annually. All programs will measure and report all outcomes at least once over a three-year review cycle.

**1. Timeline for Assessment**

*In the table below, briefly describe the timeframe over which your unit will conduct the assessment of learning outcomes selected for the three-year plan. List when outcomes will be assessed and which semester/year the results will be discussed and used to improve student learning (e.g., discussed with program faculty, interdepartmental faculty, advisory boards, students, etc.)*

Year/Semester	Assessment Activities	SLOs
Years 1–3, Spring	Administer Exit Survey.	A.1., A.2. B.1-B.4
Years 1–3, Fall	Implement evaluative questions for qualifying exams.	A.1., A.2. B.1-B.3

**2. How will learning outcomes be assessed?**

Three instruments will be used in assessment of our SLOs. 1) We carry out an online exit survey (Appendix II) of senior graduate students. 2 & 3) We have added questions and associated rubrics to the qualifying exams (Appendix I) that will be filled out by the graders.

A.1. *Obtain familiarity with theories, questions and approaches across major areas of Math/Statistics.*

A.2. Achieve understanding of the conceptual framework, major advances and important methodological approaches within Math/Statistics.

B.1. Be able to correctly apply, analyze, and interpret the results from standard mathematical or statistical theories. —Students in Applied Mathematics and Statistics will be able understand mathematical and statistical modeling, perform numerical experiments, or analyze data using stablished mathematical and statistical techniques. —Students in Pure Mathematics will be able to follow complex arguments in analysis, algebra, and topology.

B.3. Exhibit scientific oral and written communication that is clear, logical, and effective.

1. Qualifying exams

We expect students to demonstrate depth of knowledge in their qualifying exams. Students should be able to use their knowledge to solve the problems. We will evaluate each student's ability to write a solution to the problem, interpret logically and clearly. The Math Department's supplement to the qualifying exams will be filled out by each grader of the student's qualifying exams.

- a. These measures are direct.
- b. Criteria for success are that 60% of students score acceptable (3.0) or above on each item of the assessment.

**3. What is the unit's process to analyze/interpret assessment data and use results to improve student learning?**

*Briefly describe:*

1. *who will participate in the assessment process (the gathering of evidence, the analysis/interpretation, recommendations).*

SLOs and assessment plans will be placed on the Math Department web site and incoming students will be alerted to these important documents during orientation, the week before Fall classes. The Graduate Coordinator and Department Data Manager will work with the Graduate Committee (GC) to administer the online annual survey and to disseminate and instruct faculty in the use of the new evaluative questions connected to the thesis defense. All faculty who serve on graduate committees will participate in applying the new evaluative questions. The data will be summarized using bar charts, other standard graphics, and summary statistics such as means and standard deviations.

2. *the process for consideration of the implications of assessment for change:*
  - a. *to assessment mechanisms themselves,*
  - b. *to curriculum design,*

*c. to pedagogy*

*...in the interest of improving student learning.*

The GC will meet to review and discuss the assessment data after each yearly assessment and will evaluate the effectiveness of our graduate program in light of our agreed upon student learning outcomes. The committee will then draft recommendations for how the department might address areas of concern. Additional faculty input will be requested by email and in the annual spring faculty meeting focused on our graduate programs. If certain areas appear particularly problematic, new faculty committees will be composed to attempt to address these issues.

3. *How, when, and to whom will recommendations be communicated?*

In Fall semester, data on qualifying exams will be collected. Reports will then be sent to the graduate committee who prepare a yearly report which analyzes and interprets this data. At the end of each school year (Spring semester), the graduate committee will distribute a survey to the graduating students, then summarize the results in the report.

Once a yearly report has been completed, copies will be distributed to the faculty as a whole. A portion of a faculty meeting will then be dedicated to discussing the report, giving faculty an opportunity to recommend avenues for improvement in the assessment mechanisms, curriculum design, and pedagogy.

## Part 3

# Appendix

## 3A Appendix 1: New evaluative questions added to OGS forms

### Addendum to OGS Report of Examination

To be filled out by student committee at the end of the closed-door post-presentation oral exam. The rubric for evaluating performance on these components is as follows:

1 = Poor. Demonstrates limited knowledge or skills that fall below those expected for this graduate degree in Math/Stats.

2 = Fair. Demonstrates areas of knowledge and/or skills, but also exhibits significant gaps relative to what is expected for this graduate degree in Math/Stats.

3 = Acceptable. Demonstrates a typical level of expected skills and/or knowledge appropriate to carry out academic and/or professional activities requiring this graduate degree in Math/Stats.

4 = Good. Demonstrates considerable skills and/or knowledge in this dimension, beyond that required to function professionally as a holder of this graduate degree in Math/Stats.

5 = Excellent. Demonstrates advanced skills and/or knowledge in this dimension that far exceed those of a typical student who has completed this graduate degree in Math/Stats.

**[1.] Please use Table 1 to rate the thesis or dissertation, presentation or qualifying and comprehensive exams on the following:**

Table 1: evaluative questions added to OGS forms

	Excellent	Good	Acceptable	Fair	Poor	NA
A.1. Demonstrate familiarity with theories, questions and approaches across major areas of Mathematics/Statistics						
A.2. Achieve understanding of the conceptual framework, major advances and important methodological approaches within Math/Statistics						
B.1. Be able to correctly apply, analyze, and interpret the results from standard mathematics or statistics theories.						
B.2. Demonstrate the ability to conduct original research						
B.3. Exhibit scientific written communication that is clear, logical, and effective						
B.4. Demonstrate an ability to convincingly explain the importance and impact of his/her research in lay terms to scientists from other disciplines and the colloquium						

**[2.] Optional: summarize briefly your reaction to the thesis, dissertation, qualifying or comprehensive exams.**

## **3B Appendix II: Exit Survey**

1. Your Name:
2. Your program (MS (Plan I thesis, Plan II Non-thesis or Ph.D):
3. Program subject area: (Applied Math, Pure Math or Stats)
4. Major Advisor:
5. Title of Thesis/Dissertation:
6. Presentations and posters you have given in a seminar, conference, defense etc.

7. Publications, submissions or work in progress you have.

8. Self evaluation of student learning outcomes. Please fill in the following table:

Table 2: Evaluative questions added to OGS forms

	Excellent	Good	Acceptable	Fair	Poor	NA
A.1. Demonstrate familiarity with theories, questions and approaches across major areas of Mathematics/Statistics						
A.2. Achieve understanding of the conceptual framework, major advances and important methodological approaches within Math/Statistics						
B.1. Be able to correctly apply, analyze, and interpret the results from standard mathematics or statistics theories.						
B.2. Demonstrate the ability to conduct original research						
B.3. Exhibit scientific written communication that is clear, logical, and effective						
B.4. Demonstrate an ability to convincingly explain the importance and impact of his/her research in lay terms to scientists from other disciplines and the colloquium						

9. Teaching, mentoring, and outreach experience. List courses you have taught, assisted in, or graded for.

10. List any research assistant or internship experience here.

11. List your job here if applicable.

12. What aspects of your education helped you most with your learning, and why were they helpful?

13. What might the department do differently that would help you learn more effectively, and why would these actions help? Please be as specific as possible; this is your opportunity to improve the program.

14. Is there anything else you want to talk about concerning your success in the program?

List awards such as teaching awards, graduate student of the year award etc here.

Thank you for your valuable feedback.