Assessment Plan for Bachelor of Arts and Bachelor of Science in Mathematics

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Mission Statement

The mission of the Mathematics Program is to inspire our students to develop the knowledge and skills to understand, communicate, and apply mathematical ideas, through excellence in instruction, in advising, in curriculum, in research and scholarly activities, and through providing valuable resources to the community.

Program Introduction

There is no special accreditation available for mathematics programs in the United States. The Committee on the Undergraduate Program in Mathematics (CUPM) under the umbrella of the Mathematical Association of America develops guidelines for mathematics programs. The current CUPM is the 2015 version.

Assessment Process

This document defines the expected student learning outcomes for the Mathematics Program and outlines a plan for assessing the achievement of the program student learning outcomes. The assessment uses three tools: student program portfolios, an exit survey, and the ETS Major Field Test in Mathematics.

The program began using student program portfolios in Fall 2011. These portfolios collect evidence of student achievement of knowledge of mathematics, ability to use mathematics, ability to communicate mathematics, and their recognition of the importance of continued pursuit of mathematics.

The exit survey began in Fall 2001. The exit survey was intended to determine how graduating mathematics majors perceived the department, its faculty, academic advising, and the quality of the program. The survey was modified in 2012 to account for the portfolios which now collect some of this information.

The program requirement that a mathematics major must take a standardized test of knowledge in order to graduate became effective as of the 2002-2003 catalog. The mathematics faculty decided to require the ETS Major Field Test in Mathematics which is administered by over 300 mathematics programs in the United States.

The mathematics faculty approved the current student learning outcomes in September 2018. They approved the assessment process in September 2012. The annual assessment report is distributed to faculty each summer and any recommendations are discussed and acted upon each fall semester. A committee was instituted in AY2016 to review the portfolios and provide initial feedback on the assessment report.

Mathematics Bachelor of Arts Degree Student Learning Outcomes

Demonstrate knowledge of the techniques of modern mathematical subjects including all of algebra, analysis, discrete mathematics, and probability and statistics.
Demonstrate an ability to solve problems using skills such as deductive logic, data analysis, computation, modeling, connections, and other mathematical techniques.
Demonstrate an ability to create mathematical proofs.
Demonstrate an ability to read, write, and speak about mathematics.
Demonstrate cognizance of their mathematical knowledge, of mathematics around them, and of the benefit of continued study of mathematics.

Mathematics Bachelor of Science Degree Student Learning Outcomes

Demonstrate knowledge of the techniques of modern mathematical subjects including all of algebra, analysis, discrete mathematics, and probability and statistics.
Demonstrate an ability to solve problems using skills such as deductive logic, data analysis, computation, modeling, connections, and other mathematical techniques.
Demonstrate an ability to create mathematical proofs.
Demonstrate an ability to read, write, and speak about mathematics.
Demonstrate cognizance of their mathematical knowledge, of mathematics around them, and of the benefit of continued study of mathematics.
Demonstrate an understanding of the connections between mathematics and another discipline relying significantly on mathematics and recognize mathematical ideas embedded in other contexts.

Assessment Measures

A description of the measures used in the assessment of the program student learning outcomes and their implementation are summarized below. The measures and their relationships to the program student learning outcomes are also listed below.

Measure	Description	Frequency/ Start Date	Collection Method	Administered by
Student Program Portfolios	Portfolios contain statements of goals, reflections on classes, reflections on the outcomes, and materials from classes.	Students begin to construct their portfolio in MATH A264. Portfolios are collected, reviewed, and feedback is provided as part of every math major course, and in the student's penultimate and ultimate semester.	Students submit the portfolios using the eWolf system starting in MATH A264 to the faculty of the course (each semester) or to the program assessment committee (penultimate & ultimate submissions).	All mathematics faculty
Exit Survey	The survey consists of twelve questions and is administered to students in their senior year.	Administered every fall and spring semester.	The surveys are administered using Qualtrics.	Assessment coordinator
ETS Major Field Test in Mathematics	The test is a national standardized test.	Administered every fall and spring semester.	A Mathematics faculty member supervises students taking the test online.	Assessment coordinator or volunteer

Student Learning Outcomes	Student Program Portfolios	Exit Survey	Standardized Test
Demonstrate knowledge of the techniques of modern mathematical subjects including all of algebra, analysis, discrete mathematics, and probability and statistics.	1	0	1
Demonstrate an ability to solve problems using skills such as deductive logic, data analysis, computation, modeling, connections, and other mathematical techniques.	1	0	1
Demonstrate an ability to create mathematical proofs.	1	0	0
Demonstrate an ability to read, write, and speak about mathematics.	1	0	0
Demonstrate cognizance of their mathematical knowledge, of mathematics around them, and of the benefit of continued study of mathematics.	1	1	0
Demonstrate an understanding of the connections between mathematics and another discipline relying significantly on mathematics and recognize mathematical ideas embedded in other contexts.	1	0	0

0 = Measure is not used to measure the associated outcome.

1 = Measure is used to measure the associated outcome.

Assessment Implementation & Analysis for Program Improvement

General Implementation Strategy

Implementation of the assessment plan revolves around the student program portfolios, the ETS Major Field Test in Mathematics, and the exit survey for graduating majors. Math majors construct their initial portfolio in MATH A264 Introduction to the Math Major. They submit it twice that semester to learn the process and receive their initial feedback from faculty. After this class the students submit their portfolio every spring semester and in their penultimate semester in order to received feedback from faculty. They submit a final version of their portfolio the semester they graduate; this version is the one used for assessment. The ETS Major Field Test in Mathematics is administered every fall and spring semester. Students are encouraged to take the test in their penultimate semester. The exit survey is distributed using Qualtrics every term as needed.

All mathematics majors must submit a portfolio and take the ETS Major Field Test in Mathematics to graduate, and all graduating majors receive the exit survey.

Recommendations for Program or Assessment Improvement

The program assessment committee meets at the end of each semester to review portfolios. At the end of the spring semester this committee also reviews the program assessment report and provides suggestions before it is submitted. Early in the fall semester, the faculty in the department are asked to review the assessment report. The program assessment committee or other faculty may recommend modifications of either the assessment tools or the program based on the assessment results.

Recent changes include the following.

- Addition of an outcome to clarify the purpose of the BS emphases
- Modification of the portfolio template to increase clarity (changes suggested and modeled by a student)
- Change to requiring the portfolios to be submitted in every math major course as a means of ensuring regular updates and feedback

Appendix A: Exit Survey

Measure description:

A short survey is administered to graduating mathematics majors to gather information about the quality of the mathematics program, the Department of Mathematics and Statistics, department faculty, academic advising, and why the student selected this major.

Factors that affect the collected data:

The response rate to the survey affect the representative nature of the data.

How to interpret the data:

The data provides information on whether students are satisfied with the educational experience provided by the program and information on changes they suggest.

Exit Survey

Every semester the Department of Mathematics and Statistics requests its graduates from that semester to provide feedback on the department's programs. We use the results to help us evaluate the quality of our undergraduate degrees. Please take a few minutes to fill out this survey. The survey will remain open all summer. No contact information is transmitted, and your responses are confidential.

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1. Which type of degree did you receive? Bachelor of Arts in Mathematics or Bachelor of Science in Mathematics
2. Why did you choose a Bachelor of Arts instead of a Bachelor of Science?
   Why did you choose a Bachelor of Science instead of a Bachelor of Arts?
3. What are the major strengths of the Department of Mathematics and Statistics?
4. In what areas could the department improve?
5. How satisfied are you with the overall quality of your mathematics and statistics courses?
6. Please elaborate on why you are or are not satisfied with the courses.
7. List any mathematics or statistics courses that were not offered at UAA (or were not offered when you could take them) that you would have liked. Explain why.
8. Did you take any mathematics or statistics courses online?
9. What benefit did taking the mathematics or statistics course(s) online provide for you?
10. Did you take any courses other than mathematics and statistics online?
11. What benefit did taking courses other than mathematics and statistics online provide for you?
12. Did you have adequate access to the faculty in the Department Mathematics and Statistics? This includes for classes, advising, and any other interactions.
13. Please explain why you did or did not have adequate access to the faculty.
14. How satisfied were you with the quality of advising in the Department of Mathematics and Statistics? (7 point scale from Very Dissatisfied to Very Satisfied)
15. Please explain why you were or were not satisfied with the advising.

16. If there are any additional comments that you would like to make concerning your undergraduate education, please add them below.

Appendix B: ETS Major Field Test

Tool description:

The ETS Major Field Test in Mathematics is designed to measure the basic knowledge and understanding achieved by senior undergraduates in mathematics. In addition to factual knowledge, the test evaluates students' abilities to analyze and solve problems, understand relationships, and interpret material. The ETS Major Field Test can be used by program faculty to evaluate their curricula and to measure the progress of their students. The tests also provide students with an assessment of their own level of achievement within the discipline of mathematics compared to that of students in participating mathematics programs across the nation. Content areas covered on the test include: Calculus (30%), Linear and Abstract Algebra (30%), Advanced Calculus, Real and Complex Analysis, Discrete Mathematics, Probability and Statistics, Dynamical Systems, Topology, Geometry, Differential Equations, and Numerical Analysis (40%). Changes are made to the ETS Major Field Test in Mathematics periodically to reflect current curriculum trends.

Factors that affect the collected data:

- Student Motivation: Because the requirement is to take the test, not earn a particular score, students may not take it seriously.
- Bad Day: If a student has a bad day, they do not re-take the test. If they chose to take the test in their penultimate semester, they could delay the test. This does occur.
- Difference in Completed Courses: Students do not take the same math courses (e.g., Complex Analysis) or complete all their courses before taking this test. Thus their scores may be raised or lowered by choice of courses and schedule.

How to interpret the data:

A Comparative Data Guide, published each year, contains tables of scale scores and percentiles for individual student scores, departmental mean scores, and any sub scores or group assessment indicators that the tests may support. Overall student scores are reported on a scale of 120-200. The Subject Test has been required as a graduation requirement since the 2002-2003 catalogs.

The test is administered on the last Fridays of October and March, so that the information is available for graduation audits to be completed if students fail to take the exam prior to their final semester.

Appendix C: Generating a Portfolio Rubric

Because the mathematics program portfolios are somewhat free form, the department must be careful to ensure full and consistent assessment. To address the consistency, the department rotates members on the assessment committee to ensure there are always two experienced members and one new one. The schedule of rotation is not yet regular.

Also, the department's assessment committee is developing a rubric. The first step is a checklist contained in this appendix. The checklist contains entries for the three sections of the portfolio that typically contain the most evidence of learning: course list, reflections, and artifacts. Although all evidence from the artifacts should be mentioned by the students in their reflections, we check them independently in case the students did not recognize or forgot to note some evidence. The second section of the checklist contains an entry for each of the core topics. Students are expected to provide evidence for each of these core topics.

The next step is to expand this checklist into a rubric. The assessment committee has discussed developing descriptions of the levels of achievement for each outcome using what we find in student portfolios. In a few years we should be able to produce useful descriptions of level and improve the granularity of our assessment.

Current Portfolio Checklist

	Topics	Problem Solving	Proofs	Communicate	Cognizant
Course List					
Reflections					
Artifacts					
Other					

Linear	
Abstract	
Stat	
Discrete	
Analysis	
Other	