Assessment Report – May, 2010

Bachelor's Degree (BS/BA) Program in Mathematics

Goals and Associated Outcomes

Goal 1: Graduates will have acquired a firm foundation of knowledge of fundamental mathematical concepts, methods, language, and modes of reasoning sufficient to support further academic work or careers in fields that require mathematical understanding.

Outcomes: The student exhibits the ability to:

(a) Use important definitions and results correctly.
(b) Apply mathematical results and procedures to concrete problems.
(c) Generate straightforward extensions of mathematical procedures and results.
(d) Analyze quantitative data using appropriate mathematical tools.
(e) Use mathematical software to investigate and solve problems.
(f) Identify logical errors in mathematical arguments.
(g) Prove immediate consequences of basic theorems.

Goal 2: Graduates will be able to communicate mathematical ideas and results clearly and with appropriate precision, both orally and in writing.

Outcomes: The student exhibits the ability to:

(a) Use mathematical notation and terminology correctly.
(b) Organize computations and proofs clearly and logically.
(c) Explain the reasoning that supports solutions to mathematical problems.

Goal 3: Graduates will have acquired sufficient mathematical background and experience to use the professional literature to progress further on their own.

Outcomes: The student exhibits the ability to:

(a) Use the professional literature (journal articles, articles available on the web, higher-level textbooks, etc.) to write a paper on a mathematical topic not covered in formal study.

Overview

Our principal assessment tool is our capstone course, MTH 496 (Senior Project), in which students are required to write a paper on a mathematical topic not covered in previous formal study. We also collect work from one 200-level course and one 300-level course, MTH 288 (Linear Algebra) and MTH 301 (Introduction to Applied Mathematics). Thus, we will have samples of most majors' work at three stages of their undergraduate careers. Each spring these samples are evaluated against the specified outcomes by the department's Undergraduate Assessment Committee. The Chair is actively involved, the Associate Chair

chaired the Undergraduate Assessment Committee this year, and a report is made to the Undergraduate Program Committee (UPC).

Goals and Outcomes

Early attempts at departmental self-assessment of the undergraduate program lacked measurable outcomes and were excessively complex. The present collection above was developed in Fall 2002 using input from the UPC and open meetings and agreed to by the entire department. They have served us well and have not been changed since then.

Research Methods

For MTH 288, we collect all of the final exams from the Fall Semester each year and evaluate each with a 5 point rubric on Goal 1, Outcomes a and b, and Goal 2, Outcomes a, b, and c. This instrument has not been modified. The checksheet and scoring rubric are attached.

For MTH 301, we collect the major projects from the Fall Semester each year and evaluate each with a 5 point rubric on Goal 1, Outcomes a, b, d, and e, and Goal 2, Outcomes a, b, and c. This instrument is unchanged from last year. The checksheet and scoring rubric are attached. Oral presentations are assessed by the course instructor. A copy of the checklist is attached; this is unchanged from last year.

For MTH 496, we collect the course papers from the Fall Semester each year and evaluate each with a 9 point checksheet that covers all of Goals 1, 2, and 3 above with each of their Outcomes. This instrument is unchanged from last year; a copy of this checksheet is attached. Oral presentations are assessed by the course instructor. A copy of the checklist is attached; the instructor this year used a slightly different checklist than last year.

One indirect method used in the past was exit interviews for graduating math majors. These were conducted in spring 08, after a long period in which they were not conducted. In spring 09, it was unfortunately not possible to conduct these. This year, spring 10, the chair has been able to conduct these interviews again. A summary report on these is attached.

Findings

For MTH 288, the average score for the 16 students was 16.8, and the maximum possible score is 20. This is significantly higher than the 14.7 average last year. This year, the final exam was given entirely in class. Last year, the final exam had two parts, one given in class and one taken at home. The committee had found much better student performance this year than last year.

For MTH 301, there were 25 students in the class. The faculty member could not find time to do oral presentations. No data was collected for MTH 301 for assessment this year.

For MTH 496, the average score for the 9 students was 8.1, and the maximum possible score is 9. This is slightly higher than the 7.9 average of MTH 495 of the previous year. The oral presentation is not required for MTH 496.

Review

For MTH 288 the data were analyzed in the Spring Semester, 2010, by a four-person committee with input from the Chair, Each committee member evaluated each final exam.

For MTH 496, the written projects were analyzed in the Spring Semester, 2010 by a four-person committee with input from the Chair. Each committee member evaluated each course paper.

Results of each of these two components were reviewed by the Chair, Associate Chair, and UPC Chair as well as members of the UPC.

Actions

When we began with assessment in the late 1990's, we used just the capstone course, MTH 495, which had been in place for several years. But experience then showed that it would be desirable to have samples of majors' work from earlier in their academic careers; hence the current version.

A major change in MTH 167, MTH 168, MTH 181, and 182 took place beginning the fall semester of 2009. A coordinator for calculus courses and a coordinator for precalculus courses were assigned. All homework assignments, tests, and grading are more uniform both from one section to another and from one term to another. Discussions about the new changes were organized by the coordinators. We are pleased to find that the changes worked well and students progressed satisfactorily. We anticipate adding an assessment method to one or more of these courses at some future time.

For MTH 288, generally speaking, the process is working well and the students are performing well. There are no significant changes for this course.

For MTH 496, improvement appears evident. Since the replacement of MTH 495 by MTH 396 and MTH 496, students are better prepared doing the exit projects MTH 496. Junior seminar, MTH 396, enable students to properly write a mathematical paper and understand what is expected of them. The instructors of MTH 496 this year continued the practice of requiring that all projects be submitted electronically and used the University's plagiarism checking software.

It is intended that this report, together with the review of this report generated by the Office of Assessment's review, be presented briefly and discussed at a fall Department meeting.

Cleveland State University
Department of Mathematics
Exit Interviews 2010 Summary Report

No. of 2009-2010 graduating majors (each one invited to participate): 15

No. of exit interviews conducted: 4

Comments: One more interview was actually scheduled, but resulted in a no-show. Interviews were conducted third week in May (week after final exams). Some of the 2009-2010 graduating majors graduated in fall 2009.

The interviews followed a script, which was developed by the chair and is attached. This script is essentially the same as that used in 2007, which was the last time these exit interviews were held.

The following is a subjective (by the chair) aggregation of information gleaned from the interviews, following the headings of the interview script.

1. **Career goals/plans:**

Of the 4 graduates we have information for:

- 1 is pursuing grad school: enrolled in our MS mathematics program at CSU, with a GA-ship from TASC, where he will be tutoring;
- 1 intends to pursue an MS in biostatistics, probably at Ohio State: this student would do our MS with the applied stats specialization, but was not able to secure a GA-ship;
- 1 has obtained a job as a high school math teacher (Laurel School; starts fall 10) and a second is licensed and is pursuing a job as a high school math teacher.

Students seemed generally satisfied with careers information and guidance provided to them. On the other hand, each of these students had fairly certain ideas about their future. We have made some efforts to provide careers information through the "Careers Seminar Series" through our Math Club and through Professor Shao's Math of Finance course. These are popular events that students seem to appreciate. Because of Professor Shao's efforts here, these events have been focused on financial or actuarial careers. It would be worthwhile trying to broaden the scope of such events, by adding events on careers other than those in the financial area: for example, "careers in statistics."

On student commented that having courses flavoured towards a certain career path, as opposed to a straight-ahead math course (e.g. "math for teachers") would be a "turn-off;" this student felt it important that the courses offered were honest math courses, first and foremost, and that it was the mathematics that was the attraction, not the purposes to which it could be put.

2. Courses: 3. Do you feel that you have acquired a basic knowledge of math?

Students seemed generally satisfied. MTH358 and MTH424 were mentioned as being "tough" courses. Students nonetheless appreciated these courses. MTH333 and MTH301/493 were mentioned, along with MTH358, as being key courses for developing students' abilities with proofs.

Students were asked specifically about their experience with MTH396 (junior seminar) and MTH496 (senior project). This is a recently introduced pair of courses that have replaced our old senior seminar. The students' experience with MTH496 seemed rather positive. This consists of individual work with a faculty member. One effect of the switch to the new structure is that students are able to work with a wider range of faculty than before. This seems to be a good idea, as it allows the student great flexibility in both topic and advisor, thereby increasing the likelihood they will end up dong something that meshes well with their interests or purposes.

MTH396 seemed fairly well-received. This course includes presentations by faculty on topics of interest to them, and which suggest to the students possible topics for senior project. Presentations of Professors Bubenik, Gold, and Oprea were mentioned as being especially good. One comment made by several students concerned the great variability of these presentations, particularly as regards technical level or difficulty. It might be worth trying to "coach" faculty presenters on the purposes of MTH396, and try to avoid situations in which a faculty presentation relies on too great a mathematical background on the students' part, or suggests a possible project topic that would be unrealistic for a student to attempt.

4. Use of technology?

Students seem generally satisfied. The flexibility and availability of our computer lab was appreciated. Stats software used is a little weak, professionally: perhaps offer SAS? One comment on Maple: much time was spent dealing with syntax issues; the experience was of questionable value, and didn't really help with the types of problems one might tackle.

5. Advising/mentoring:

Students seemed very happy at the openness and availability of faculty (and staff) generally.
One student remarked that having a mapped-out completion plan, as regards courses to be taken, would be helpful. This student's experience was more of a semester-by-semester plan.

6. Independent study courses:

Students enjoy project work. One student encountered a lack of responsiveness from their supervisor, although the project was eventually completed satisfactorily. Another student found the project did not get as far as she had hoped (perhaps unrealistically), because her topic was one for which she had no previous coursework. The project was completed successfully, and the student greatly appreciated the supervisor (Wu). But the point about balancing students' hopes for how far they will get on a particular topic, with a realistic assessment of how much background would be needed for the particular topic is a good one. This factor could be included in the considerations used as a basis for choice of topic.

7. Peer relations:

Students seem to be familiar with, and friendly with, their peers. Small classes and group work encourages contact. One student—a student athlete—said that a "buddy system" had been very important for his being able to keep up with the work in periods when he had heavy commitments of his time outside of class. Another students said that she wil definitely keep in touch with some of her peers after graduation.
Generally, space in the Department could be greatly improved to enhance student interaction.

8. General comments: Anything to suggest or say?

Overall experience of these students seemed a very positive one. Some concrete suggestions:

- Offer further professional preparation, such as SAS base-level programming or other professional certifications; intern possibilities; expanded "careers" events in areas other than finance/actuary.

Comments from the students: "I got what I wanted from the program;" "I'm happy with my experience here;" "adequate [preparation] for going to grad school."

Future Actions:

1. Share this with Department at a fall Department meeting; solicit response.
2. Review script, and consider holding exit interviews at different point(s) during the year so as to increase participation.
3. Develop a separate survey instrument which may be mailed to all graduating majors.

Student Name_____

MTH 288 Assessment

Goal	Outcome		4 Excellent	3 Good	2 Satisfactory	1 Almost Satisfactory	0 Unsatisfactory
1	a	The student exhibits the ability to use important definitions and results correctly.					
1	b	The student exhibits the ability to apply mathematical results and procedures to concrete problems.					
2	a	The student exhibits the ability to use mathematical notation and terminology correctly.					
2	b	The student exhibits the ability to organize computations and proofs clearly and logically.					
2	c	The student exhibits the ability to explain the reasoning that supports solutions to mathematical problems.					

Total: _____

Rater:_____

Assessment Rubric MTH 288

Item 1.
Excellent: Gives a complete, clear, coherent, and unambiguous response.
Good: Gives a fairly complete response that is reasonably clear.
Satisfactory: Conveys the basic idea but the wording is imprecise or muddled, and parts of the statement may be omitted.
Almost satisfactory: Conveys the basic idea but makes minor errors or major omissions; wording is difficult to understand.
Unsatisfactory: Shows no understanding of the statement, or shows no comprehension of the need for precision.

Item 2.
Excellent: Applies the correct result or procedure correctly, with a full and precise explanation of why this applies.
Good: Applies the correct result or procedure correctly or with minor errors, with some explanation as to why this applies.
Satisfactory: Applies the correct result or procedure correctly or with minor errors, but leaves parts of the solution out; inadequate explanation as to why this applies.
Almost satisfactory: Begins to apply the correct result or procedure, but with major errors or with significant parts of the problem unsolved; little or no useful explanation as to why this applies.
Unsatisfactory: Applies the correct result or procedure with several major errors, or attempts to apply results or procedures that are not applicable.

Item 3.
Excellent: Writes in a manner suitable for a textbook or written report.
Good: Writes in an understandable manner but with minor technical flaws or omissions.
Satisfactory: Writes in a muddled but understandable way, may include unnecessary symbols or other confusing material.
Almost satisfactory: Has some knowledge of the notation and terminology, but could not be understood by someone who did not already know the solution.
Unsatisfactory: Misuses terminology and notation, shows little or no knowledge of syntax

Item 4.
Excellent: Gives a complete, clear, coherent, and unambiguous response. Shows all necessary steps in the correct order.
Good: Gives a fairly complete response that is reasonably clear. Some necessary steps may be omitted and unnecessary steps may be included.
Satisfactory: Gives an understandable response that is generally correct. Parts of the response may be muddled or irrelevant.
Almost satisfactory: Gives a response that could not be understood by someone who did not already know the solution. Parts of the response may be muddled, incorrect, or irrelevant.

Unsatisfactory: Has major errors in computation and/or logic, or has no understanding of the problem.

Item 5.
Excellent: Gives a complete, clear, logical, coherent, correct, and unambiguous response.
Good: Gives a fairly complete response that is reasonably clear . Any omissions are minor.
Satisfactory: Gives a fairly complete response that is reasonably clear, but parts may be muddled. Any omissions are minor.
Almost satisfactory: Gives a fairly complete response that is generally muddled, and could not be understood by someone who did not already know the solution. Shows incomplete knowledge of the solution, and there may be a major omission.
Unsatisfactory: The reasoning contains a major logical error, or is irrelevant to the problem, or just incorrect.

Student Name_____

Senior Project Checklist

Mark each question from 1-9 (9 being best) or with NA when it does not apply to the project at hand. At the end, take the average of the non-NA scores. This is the overall evaluation for the project.

1.	Organizes project well with main results clearly stated	_____
2.	Includes crucial definitions and background information	_____
3.	Uses important definitions and/or results correctly	_____
4.	Analyzes information well	_____
5.	Uses mathematical language and symbols appropriately	_____
6.	Uses mathematical techniques well	_____
7.	Uses mathematics appropriate for the problem	_____
8.	Uses software appropriate for the problem	_____
9.	Formulates appropriate and convincing conclusions	_____
10.	Explains the problem and work clearly	_____
11.	Displays a knowledge of literature on the subject	_____
12.	Displays an in-depth analysis of the problem or area	_____

Overall Score _____

A score of 7-9 rates the project as **High**; 4-6 as **Medium**; and 1-3 as **Low**.

High represents a project displaying a complete response to the problem set forth. The general analysis and write-up should be correct, clear and coherent, communicating the problem and the relevant mathematics effectively to the intended audience. The project should display an understanding of the ideas and processes involved and, where appropriate, should contain examples and/or counterexamples.

Medium represents a complete solution to the problem set forth, but the explanation may be unclear in places, there may be minor mathematical mistakes or understanding of the underlying concepts or techniques may not be displayed in a convincing manner. In general, however, the analysis and conclusions are correct.

Low represents either a lack of solution of the problem set forth or an explanation which lacks coherence and/or clarity. There may be gross mathematical errors or errors in analysis and conclusions which do not (or apparently do not) follow from the analysis.

Rater: _____