Program Portfolio
Mathematics
2009-2010

Description of Program

The BA/BS in Mathematics is based on the recommendations of the Committee on the Undergraduate Program in Mathematics (CUPM), a working committee of the Mathematical Association of America. These recommendations acknowledge the need for people trained in disciplined, logical reasoning and who understand the basic methods and models of the mathematical sciences and who are able to convey their mathematical knowledge orally and in writing. The result is a program that provides broad coverage of the main branches of mathematics and yet includes opportunities for elective examination of special topics such as probability and statistics, discrete mathematics, geometry, and areas of applied mathematics.

The program seeks to inculcate in each student a strong background in the foundational content of contemporary mathematical practice and dialogue, including, but not limited to elementary algebra and calculus, statistics, linear and abstract algebra, and analysis.

The core requirements of the major currently include 40 credit hours of mathematics courses plus 4 credits of statistics and 4 credits of computer science. Students must also complete 20 credit hours of upper division electives within the major. For each of the three concentrations, specific electives are selected to guide students to classes that will most help them in their intended future careers. Students in the Mathematical Studies concentration (for future high school teachers) focus on geometry, discrete mathematics, and other topics more closely linked to subjects they are likely to be teaching. Students in the Applied Mathematics concentration take electives in statistics, programming, and mathematical modeling. Majors completing the Theoretical Mathematics concentration take a deeper look at the fundamental areas of abstract algebra and analysis which better prepares them for graduate studies.

Corresponding to the three concentrations, the Mathematics Program also offers three minors – a minor in Mathematics, a minor in Statistical Mathematics, and a minor in Mathematical Studies. The first two minors are available to any Eastern Oregon University student. The third is only available for those students majoring in Multidisciplinary Studies, a major for students intending to enter the field of elementary education.

How Program serves the Mission of the University

The mathematics program supports the mission of the university by providing the necessary mathematical and statistical support courses for students in many disciplines. These disciplines come from both the liberal arts and professional programs and include computer science, the physical and biological sciences, the social sciences, business and economics, multimedia, education, and health. We also offer courses that support students in EOU partner programs such as the OSU agricultural business program and the OHSU nursing degree. The program also plays a major role in the preparation of highly qualified teachers of mathematics for elementary, middle, and secondary schools. Graduates also find employment in the private sector. The program serves the region by promoting outreach activities. These include hosting the annual Regional High School Mathematics Contest and assisting in events such as Girls in Science and the Lego Robotics Competition.

Recent Programmatic Changes

For 2008-2009, the mathematics major initiated several curricular and requirement changes. We reorganized and changed the elective offerings, altered our senior sequence, and extended our capstone from a two-term course to a year-long course.

The reorganization of electives was planned as a result of the recognition that our graduates tended to fall into three different categories – those who plan to teach high school mathematics, those who went on to graduate school, and those who went to work in industry. As part of this reorganization the mathematics program created three different concentrations within the major (described above).

Since the fall of 2008, the Math 407 capstone has been a full year course, earning four credit hours. Students enroll for one credit each of fall and winter terms, and two credits during spring term. Fall term includes an overview of scholarship, as had been presented winter term prior to the change. The new time line requires students to identify their full project by early in winter term, with initial progress reports beginning during the second half of winter term. Spring term continues with each student making regular, but short, presentations. We have found that the requirement of these preliminary discussions provides the primary motivation that serves to help students focus their efforts and energy. The requirement of regular update presentations is proving to be effective in raising the standards for both scholarship and presentation.

Our other recent change is the creation of a new minor in Statistical Mathematics. This is an option for students interesting in minoring in mathematics, who want to study the more applied aspects of the subject. As part of this change we re-organized the first term of statistics into a new Stat 243 class and offer a second term of statistics (Stat 352) once per year.

I. Program Objectives/Outcomes

Graduates from the Mathematics Program will have demonstrated proficiency in the following four areas:

- **Content Knowledge:** Graduates will demonstrate a broad-based knowledge of mathematical content and technique.

- **Problem Solving:** Graduates will demonstrate problem-solving skills in the context of mathematics, and the ability to apply techniques learned in the study of specific topics in new areas.

- **Inquiry and Analysis:** Graduates will be able to employ the skills of independent, careful analysis of mathematical exposition.

- **Communication:** Graduates will be able to use written and oral communication skills appropriate to mathematical exposition.

Connections to the University Learning Outcomes (ULOs)

1. ***Breadth of Knowledge*** – Majors in mathematics demonstrate a breadth of knowledge via the General Education Curriculum and through the range of core courses in the major.
2. ***Inquire, Create and Communicate*** – As part of the mathematics core of courses, majors will take a capstone class that requires students to research a topic of interest to them, write a paper about the topic, and give a presentation of their paper

to an audience.

3. ***Integrated Learning*** – Mathematics majors are required to take calculus and statistics classes which demonstrate how the language of mathematics is used to solve problems in other fields. Many majors also take elective courses in Probability, Operations Research, Mathematical Modeling, and Differential Equations which give them further practice in using mathematics as a tool for solving problems in other disciplines.
4. ***Community Engagement and Personal and Social Responsibility*** – Many students majoring in mathematics work as tutors in the EOU Learning Center. Others have worked as peer leaders in Math Excel courses designed as enrichment classes for pre-calculus level mathematics. Still others volunteer to help with various community events organized by EOU such as the Girls In Science event, the Lego Robotics Competition, and the Regional High School Mathematics Competition. Many students use their capstone research as a project for the annual EOU Spring Symposium, an event where students share their research with the community. Though we are confident that most, if not all, of our mathematics majors engage in community discourse or community service, we do not currently have a mechanism for guaranteeing that all of our majors satisfy this University Learning Outcome. Conversations are currently underway about how we may achieve this.

II. Four-Year Assessment Cycle: Mathematics

Year	Outcome to be Assessed
Spring 2009	#4 (Communication)
Fall 2009-2010	#1 (Content Knowledge)
2010-2011	#2 (Problem Solving)
2011-2012	#3 (Inquiry and Analysis)

III. Curriculum Assessment Plan

Year	Outcome	Course/ Milestone Activity	Assignment/ Task (done by students)	Assessment Tool (to measure outcome)	Standards/Levels of Achievement (i.e., developing, adequate, proficient)
Spring 2009	Communication	Capstone	seminar presentations and written paper	faculty evaluation by rubric	See tables below
Fall 2009	Content Knowledge	Probability	6 questions taken from 3 exams	faculty evaluation by rubric	See tables below
Fall 2010	Problem Solving	Modeling	modeling project written paper	faculty evaluation by rubric	See tables below
Spring 2012	Inquiry and Analysis	Structures	Yet to be determined in detail	Yet to be determined in detail	Yet to be determined in detail

See Key Programmatic Assessments section for rubrics and student samples.

Degree Program Outcomes Assessment

Spring 2009

Degree Program: Mathematics
Outcome Assessed: Communication
Course/Activity: Math 407 (Capstone Seminar) / Final Projects and Presentations

Summary of Assessment Results

Performance Criteria	Assessment Method	Measurement Scale	Target Performance	Targets Met
Student Essay				
Mastery of Content	***Attached Rubric***	***1-3, % at 2 or 3***	***66% at 2 or 3***	√ 75%
Quality of Paper	***Attached Rubric***	***1-3, % at 2 or 3***	***66% at 2 or 3***	XXX 50%
Student Presentation				
Organization	***Attached Rubric***	***1-3, % at 2 or 3***	***66% at 2 or 3***	√ 75%
Verbal Communication	***Attached Rubric***	***1-3, % at 2 or 3***	***66% at 2 or 3***	XXX 50%
Depth of Content	***Attached Rubric***	***1-3, % at 2 or 3***	***66% at 2 or 3***	√ 75%
Accuracy of Content	***Attached Rubric***	***1-3, % at 2 or 3***	***66% at 2 or 3***	√ 100%
Use of Media	***Attached Rubric***	***1-3, % at 2 or 3***	***66% at 2 or 3***	√ 75%

Note: See "Supporting Documentation" tab or for detailed records of the summary. The assessment representative for each department must archive supporting student sa5mples

Explanation of Assignment / Activity / Prompt

Essays and presentations are the tangible product of students in the capstone course. Students began work on their research at the beginning of spring quarter. Each student made several in-class presentations over the quarter, as regular updates on the progress of their studies. Rough drafts of essays were submitted two weeks prior to the end of the quarter.

Analysis of Assessment Results

While all students completed the course with passing grades, the purposes of this assessment require a different standard, insofar as we use the assessment to push for improvements in our curriculum and pedagogy. The assessment made clear the need for improvements, most particularly with increasing the quality of submitted papers, and with verbal communication in presentations.

Closing the Loop: Strengths, Weaknesses, Conclusions, Recommendations

Students do well on content depth, but we clearly have room for improvement in overall quality of their final products. We have made adjustments to the course structure for 2009-2010 based on this assessment. The primary change will be to establish the beginning of research presentations several weeks earlier, by the fourth week of winter term. In addition, we will spend more time discussing the rubric for presentations, and provide more feedback to students from their weekly updates.

Degree Program Outcomes Assessment

Fall 2009

Degree Program: Mathematics

Outcome Assessed: Content Knowledge

Course/Activity: Math 361 (Probability and Statistics) / Exam Questions

Summary of Assessment Results

Performance Criteria	Assessment Method	Measurement Scale	Target Performance	Targets Met
Computational Problem (Law of Inclusion/Exclusion)	*Exam #1 Problem – rubric*	*1-4, % at 3 or 4 % above 1*	*66% at 3 or 4 100% above 1*	√ *XXX (only 89%)*
Computational Problem (Beyes's Theorem)	*Exam #1 Problem – rubric*	*1-4, % at 3 or 4 % above 1*	*66% at 3 or 4 100% above 1*	*XXX (only33%)* √
Conceptual Problem (Definition and Proof of the Law of Total Probability)	*Exam #1 Problem – rubric*	*1-4, % at 3 or 4 % above 1*	*66% at 3 or 4 100% above 1*	√ √
Computational Problem (Probability Densities)	*Exam #2 Problem – rubric*	*1-4, % at 3 or 4 % above 1*	*66% at 3 or 4 100% above 1*	√ √
Computational Problem (Beyes's Theorem)	*Final Exam Problem – rubric*	*1-4, % at 3 or 4 % above 1*	*66% at 3 or 4 100% above 1*	√ *XXX (only 89%)*
Conceptual Problem (Events and Set Algebra)	*Final Exam Problem – rubric*	*1-4, % at 3 or 4 % above 1*	*66% at 3 or 4 100% above 1*	√ √

Note: See "Supporting Documentation" tab or for detailed records of the summary. The assessment representative for each department must archive supporting student samples

Explanation of Assignment / Activity / Prompt

QUESTION (for Law of Inclusion and Exclusion): An auto insurance company has 10,000 policy holders. Each of them is classified as either “male” or “female”, “low risk” or “high risk”, and “married” or “single”. Of all the policyholders, 4800 are male, 2200 are high risk, and 6200 are married. Further 1200 are high-risk males, 3000 are married males, and 1500 are married and high-risk. Finally, 600 are high-risk, married, males. How many of the policyholders are low-risk, single women?

Analysis of Assessment Results

EXEMPLARY	PROFICIENT	MARGINAL	UNSATISFACTORY
3	3	2	1

Though one target goal was not met on this problem, it was through a misunderstanding of a single student, which was easily rectified. Students generally performed well on this question.

Explanation of Assignment / Activity / Prompt

QUESTION (Beyes’s Theorem): A fair die is rolled. If it comes up 1, 2, or 3, a fair coin is flipped. If it comes up a 4 or 5, two fair coins are flipped. If it comes up a 6, three fair coins are flipped. First determine the probability that, of whatever coin(s) are flipped, exactly one will show tails. Then use Beyes’ Theorem to determine the probability that the die roll was a “1” given that exactly one flipped coin showed tails.

Analysis of Assessment Results

EXEMPLARY	PROFICIENT	MARGINAL	UNSATISFACTORY
2	1	6	0

Student performance on this question was not up to an appropriate level. More time was spent on Beyes’ Theorem with the intent to re-evaluate at the end of the term (see QUESTION #5 below).

Explanation of Assignment / Activity / Prompt

QUESTION (Definition and Proof of the Law of Total Probability): First give the definition of P(A|B) and explain what assumption must be made about B for this definition to make sense? Then prove our first version of the "Law of Total Probability" which said

$$P(F) = P(F|E)*P(E) + P(F|E^c)*P(E^c).$$

Analysis of Assessment Results

EXEMPLARY	PROFICIENT	MARGINAL	UNSATISFACTORY
1	5	3	0

Though only one student showed exemplary performance, the class as a whole met both targets. Additional time spend on proper mathematical exposition while writing proofs could further boost results.

Explanation of Assignment / Activity / Prompt

QUESTION (Probability Densities): Suppose a random variable has the following density:

$f_X(z) = kx(x – 4)$ if $0 < x < 4$

0 otherwise

Determine the value of k.

How likely is it that this random variable produces a value less than 1?

Analysis of Assessment Results

EXEMPLARY	PROFICIENT	MARGINAL	UNSATISFACTORY
6	1	2	0

Students performed well above targets interpreting and computing probabilities using densities.

Explanation of Assignment / Activity / Prompt

QUESTION (Beyes's Theorem): A box contains five light bulbs. All look alike, but four are standard light bulbs (with a lifetime that follows an exponential random variable with an average of 2 years) while one is an Edison Super-Delux Mega-Bulb (with a lifetime that follows an exponential random variable with an average of 4 years).

Suppose one of the bulbs is selected at random from the box. Given that it is still working eight years later, how likely is it that the selected bulb is the Edison Super-Delux Mega-Bulb?

Analysis of Assessment Results

EXEMPLARY	PROFICIENT	MARGINAL	UNSATISFACTORY
3	4	1	1

This question was asked as a re-assessment of understanding of Beyes's Theorem after performances fell well short on the first exam. Generally students performed much better on this question than on the earlier question. One target was still not met, but this was due to a single student with an unsatisfactory performance.

Explanation of Assignment / Activity / Prompt

QUESTION (Events and Set Algebra): A die is rolled repeatedly. Let A_n, B_n, C_n, D_n, E_n, and F_n be the events that the n^{th} roll is a "1", "2", "3", "4", "5", or "6" respectively. In terms of the given events, what is the event that the first die rolled is even and the second die rolled is larger than four?

Analysis of Assessment Results

EXEMPLARY	PROFICIENT	MARGINAL	UNSATISFACTORY
6	1	2	0

Students exceeded target performances on this question.

Closing the Loop: Strengths, Weaknesses, Conclusions, Recommendations

With a few exceptions students performed at or above target goals. Students seemed to have a solid grasp of concepts as all goals were met for the two “conceptual problems” that were assessed. Three target goals failed to be met among the “computational problems”. However two of these targets were missed due to a single student with an unsatisfactory performance. The third showed a deficiency in understanding how to apply Beyes’ Theorem. An end-of-term assessment showed that further work on such applications seems to have been effective.

Degree Program Outcomes Assessment

Fall 2010

Degree Program: Mathematics
Outcome Assessed: Problem Solving
Course/Activity: Math 323 (Mathematical Modeling) / Written Project

Summary of Assessment Results

Performance Criteria	Assessment Method	Measurement Scale	Target Performance	Targets Met
Student Modeling Project				
Organization	***Attached Rubric***	***1-3, % at 2 or 3***	***66% at 2 or 3***	
Quality of Paper	***Attached Rubric***	***1-3, % at 2 or 3***	***66% at 2 or 3***	
Depth of Content	***Attached Rubric***	***1-3, % at 2 or 3***	***66% at 2 or 3***	
Accuracy of Content	***Attached Rubric***	***1-3, % at 2 or 3***	***66% at 2 or 3***	

Note: See "Supporting Documentation" tab or for detailed records of the summary. The assessment representative for each department must archive supporting student sa5mples

Explanation of Assignment / Activity / Prompt

As a UWR (University Writing Requirement) course, a significant portion of the content of this course is the creating and revising of written reports detailing mathematical models designed to solve specific problems. One of those reports will be assessed for organization, quality, and depth and accuracy of content.

Degree Program Outcomes Assessment

Spring 2012

Degree Program: Mathematics
Outcome Assessed: Inquiry and Analysis
Course/Activity: Math 382 (Structures of Abstract Mathematics)

Explanation of Assignment / Activity / Prompt

Yet to be determined in detail. The Math 382 course will be taught in Spring 2010 after which time an appropriate assessment tool will be finalized.

Key Programmatic Assessments

Communication Rubrics
Assessment in Math 407, the senior capstone seminar

Rubric for Senior Capstone Presentation

CRITERIA	EXCELLENT	SATISFACTORY	UNSATISFACTORY
Organization	Presentation was well organized with a smooth flow. The listeners could easily follow the ideas and logic.	Presentation showed an acceptable degree of organization, but with some awkwardness to the flow. Main ideas could be followed, but only with effort.	Organization was minimal or absent. Major ideas were lost on the listeners due to the poor flow of the presentation.
Effectiveness of Verbal Communication	Speech was very articulate, and grammatically correct. Speaker kept the listeners' attention. Mathematical terms were used accurately and appropriately.	Speech flowed reasonably well with some minor breaks or grammatical errors. Mathematical terms were, with a few exceptions, used accurately and appropriately.	Speech was awkward and distracted the listeners from the main ideas of the talk. Mathematical terms were consistently misused.
Depth of Content	Content went well beyond a rudimentary understanding while remaining accessible to upper division math majors.	Content showed appropriate depth, though too much time or focus was spent on simple rudimentary ideas.	Content lacked depth. The presentation was not a level that should challenge upper division math majors.
Accuracy of Understanding	Presenter demonstrated a solid understanding of all major ideas of the talk. Presenter seemed well prepared to answer listener questions.	Presenter demonstrated a satisfactory degree of understanding, though was occasionally shaky on the details and unsure of the answers to listeners questions.	Presenter showed a lack of understanding of major ideas within the talk.
Effective use of Media	Use of classroom media-chalkboard, transparencies, computer projection, etc.- was well coordinated and effectively used to provide a smooth pacing of the talk.	Noticeable awkwardness in the use of media (such as poor blackboard technique, small fonts on transparencies, or awkward transitions among media) that took away from the overall effect of the talk without losing major aspects of the content.	Substantial awkwardness in the use of media that significantly detracted from the audience's understanding of major ideas within the talk.

Rubric for senior capstone paper

CRITERIA	EXEMPLARY	SATISFACTORY	UNSATISFACTORY
Mastery of the subject	The content of the paper went well beyond a rudimentary understanding of the topic. Integrates and applies basic mathematical concepts and theorems	Content showed appropriate depth, though too much of the paper was spent on simple, rudimentary ideas	Content lacked depth. The paper was written at a level of a beginning undergraduate student. Lacks understanding of basic mathematical concepts and theorems
Quality of the written paper	Paper was well organized, succinct, and grammatically correct. Mathematical terms were used accurately and appropriately	Paper showed an acceptable degree of organization, overlooks some information, or has some grammatical errors. Mathematical terms were, with a few exceptions, used accurately and appropriately	There was minimal or no organization to the paper. Mathematical terms were consistently misused

Content Knowledge General Rubrics
(Question specific rubrics are built from these general forms and are provided below along with student samples).

General Rubric for Computational Problem

EXEMPLARY	PROFICIENT	MARGINAL	UNSATISFACTORY
Solves the problem correctly with all steps clearly indicated. Clear explanation of the validity of non-obvious steps is given.	Solves the problem correctly, or fails due to no more than one very minor error. Little or no explanation for steps is provided.	Demonstrates a reasonable approach to the problem, which fails due to a major computational error, multiple minor errors, and/or missing steps.	Fails to demonstrate a reasonable approach to the problem.

General Rubric for Conceptual Problem

EXEMPLARY	PROFICIENT	MARGINAL	UNSATISFACTORY
Provides a well-written, detailed, and accurate description of the concept using appropriate notation and terminology.	Provides an essentially accurate description of the concept, perhaps lacking detail, with no more than a few minor errors in notation and/or terminology.	Provides a confusing or incomplete description of the concept, which nevertheless contains some of the key ideas.	Fails to address any of the main ideas of the concept accurately.

Problem Solving Rubric
Assessment for Math 323 Mathematical Modeling Paper

CRITERIA	EXCELLENT	SATISFACTORY	UNSATISFACTORY
Organization	Report was well organized with a smooth flow. Readers could easily follow the concepts and conclusions.	Report showed an acceptable degree of organization, but with some awkwardness to the flow. Main ideas and conclusion could be followed, but only with effort.	Organization was minimal or absent. Major ideas and conclusions were lost on the readers due to the poor flow of the presentation.
Quality of the written paper	Report was grammatically correct. References were clearly and appropriately documented, and all sections were present and clearly labeled.	Report was grammatically correct with a few exceptions. References and all appropriate sections were present.	Report had persistent grammatical errors. References or sections were lacking.
Depth of Problem	Selected problem was sufficiently complex and intricate to make an in-depth study a course-appropriate challenge.	Selected problem was non-trivial, but lacked complex details making it solvable with only superficial analysis.	Selected problem was insufficiently complex. Effort required to solve it was not course-appropriate.
Accuracy of Content	Report demonstrated a solid understanding of all major ideas of the talk. Mathematical and technical terms were used accurately and appropriately.	Report demonstrated a satisfactory degree of understanding, though was occasionally shaky on the details. Mathematical and technical terms were, with possibly a few exceptions, used accurately and appropriately.	Report showed a lack of understanding of major ideas within the talk. Mathematical and technical terms were consistently misused.

Content Knowledge – Specific Rubrics for Math 361 questions for Fall 2009 assessment.

Specific Rubric for Question #1 (Law of Inclusion/Exclusion)

EXEMPLARY	PROFICIENT	MARGINAL	UNSATISFACTORY
Obtains the correct answer of 1,900 using a clearly described series of steps.	Identifies a correct way to solve the problem (such as using the Law of Inclusion/Exclusion), but arrives at a wrong answer though incorrect computations.	Attempts to solve the problem using a valid method (such as using the Law of Inclusion/Exclusion), but fails to correctly write or apply the Law.	Does not attempt to solve the problem using a valid method.

Exemplary Example:
Let E be the set of "male" policy holders, F be the set of "high risk" policy holders, and G be the set of "married" policy holders.
Then, by the Law of Inclusion and Exclusion,
$|E \cup F \cup G| = |E| + |F| + |G| - |E \cap F| - |E \cap G| - |F \cap G| + |E \cap F \cap G|$
$= 4800 + 2200 + 6200 – 1200 – 3000 – 1500 + 600 = 8100$.
Since 8,100 policy holders have at least one of the characteristics of "male", "high risk", or "married", the remaining 1,900 must be low-risk, single women.

Proficient Example:
$|E \cup F \cup G| = |E| + |F| + |G| - |E \cap F| - |E \cap G| - |F \cap G| + |E \cap F \cap G|$
$= 48\% + 22\% + 62\% - 12\% - 30\% - 15\% + 6\% = 81\%$.
So 19% are.

Marginal Example:
$E + F + G – (EF + EG + FG) – EFG$
$= 4800 + 2200 + 6200 – (1200 + 3000 + 1500) – 600 = 6900$
So the 3,100 that are left are low-risk, single, and female.

Unsatisfactory Example:
$|E| = 4800$, $|F| = 2200$, $|G| = 6200$,
$|E \cap F| =1200$, $|E \cap G| = 3000$, $|F \cap G| = 1500$, $|E \cap F \cap G| = 600$
$P(E \cup F \cup G) = |E \cup F \cup G| / |S| = 13200/10000 = 1.32$

Specific Rubric for Question #2 (Beyes' Theorem)

EXEMPLARY	PROFICIENT	MARGINAL	UNSATISFACTORY
Obtains the correct answer of 4/23 using a clearly described series of steps.	Demonstrates an understanding of the connection between the two questions asked and correctly utilizes Beyes' Theorem, but obtains the wrong answer due to a miscomputation not related to Beyes' Theorem	Correctly utilizes Beyes' Theorem, but in a way that demonstrates a lack of understanding of the relationship to the first question. Fails to obtain the correct answer due to this lack of understanding.	Does not use or misuses Beyes' Theorem.

Exemplary Example:
Let F be the event that exactly one coin is "tails".
Let E_j be the event that the die rolled the number "j".
From the Law of Total Probability,
$P(F) = P(F|E_1)*P(E_1) + \ldots + P(F|E_6)*P(E_6)$
$= (1/2)*(1/6) + (1/2)*(1/6) + (1/2)*(1/6) + (2/4)*(1/6) + (2/4)*(1/6) + (3/8)*(1/6)$
$= 23/48$.
So using Beyes' Theorem,
$P(E_1|F) = P(F|E_1)*P(E_1) / P(F)$
$= (1/2)*(1/6) / (23/48) = 4/23 \approx 0.174$.
If exactly one coin came up "tails" there is about a 17.4% chance that the die rolled "1".

Proficient Example:
Let F be the event that exactly one coin is "tails".
Let E_1 be the event that the die rolled 1, 2, or 3.
Let E_2 be the event that the die rolled 4 or 5.
Let E_3 be the event that the die rolled 6.
$P(F) = P(F|E_1)*P(E_1) + P(F|E_2)*P(E_2) + P(F|E_3)*P(E_3)$
$= (1/2)*(3/6) + (1/4)*(2/6) + (1/8)*(1/6)$
$= 17/48$.
So,
$P(E_1|F) = P(F|E_1)*P(E_1) / P(F)$
$= (1/2)*(1/6) / (17/48) = 4/17$.

Marginal Example:
P(1, 2, or 3) = 3/6 = 1/2.
P(4 or 5) = 2/6 = 1/3.
P(6) = 1/6.
For Beyes' Theorem,
$P(E_1|F) = P(F|E_1)*P(E_1) / P(F)$
and $P(F) = (1/2)*(1/6)+(1/3)*(1/6)+(1/6)(1/6) = 1/6$,
so $P(E_1|F) = (1/2)*(1/6) / (1/6) = ½$.

Unsatisfactory Example: (There were none)

Specific Rubric for Question #3 (Definition and Law of Total Probability)

EXEMPLARY	PROFICIENT	MARGINAL	UNSATISFACTORY
Correctly states the definition and then uses it to provide a logically consistent proof of the Law of Total Probability.	Correctly states the definition and then attempts a proof of the Law of Total Probability which, while containing important steps of an accurate proof, fails to be logically rigorous in at least one way.	Correctly states the definition, and then attempts a proof of the Law of Total Probability which is incomplete or fundamentally flawed.	Incorrectly states the definition, or states it correctly but is unable to use it to attempt a proof of the Law of Total Probability.

Exemplary Example:
$P(A|B)$ is defined to be $P(A\cap B)/P(B)$. This definition requires that $P(B)>0$.

To prove the theorem we may divide F into two disjoint pieces, $(F\cap E)$ and $(F\cap E^c)$. Using the probability axiom for disjoint events we have
$P(F) = P((F\cap E) \cup (F\cap E^c)) = P(F\cap E) + P(F\cap E^c)$.

Provided that E and E^c both have positive probability,
$P(F) = P(F\cap E)*(P(E)/P(E)) + P(F\cap E^c)*(P(E^c)/P(E^c))$
$= P(F|E)*P(E) + P(F|E^c)* P(E^c)$.

Proficient Example:
$P(A|B) = P(A\cap B)/P(B)$ if $P(B)>0$.

$P(F) = P(F|E)*P(E) + P(F|E^c)* P(E^c)$
$P(F) = P(F\cap E)*(P(E)/P(E)) + P(F\cap E^c)*(P(E^c)/P(E^c))$
$P(F) = P(F\cap E) + P(F\cap E^c)$
Which is true since the events are disjoint and their union is all of F.

Marginal Example:
$P(A|B) = P(A\cap B)/P(B)$ if $B\neq\varnothing$.

$P(F) = P(F|E)*P(E) + P(F|E^c)* P(E^c)$
$P(F|E) = P(E\cap F)/P(E)$

Unsatisfactory Example: (There were none)

Specific Rubric for Question #4 (Probability Densities)

EXEMPLARY	PROFICIENT	MARGINAL	UNSATISFACTORY
Obtains the correct answers of k = – 3/32 and correctly determines that the associated probability is 5/32 using a clearly described series of steps.	Correctly obtains the value k = – 3/32, but is unable to use that result to determine the correct probability of 5/32.	Attempts the problem using a valid method which makes it clear the student understands the meaning of the concept of "density", but is unable to obtain the correct value for k due to computational errors.	Makes no attempt to solve the problem or attempts to solve it with a method which makes it clear the student fails to understand the meaning of the concept of "density".

Exemplary Example:

$$1 = \int_0^4 kz(z-4)\,dz = k\left[(1/3)z^3 - 2z^2 \right]\Big|_{z=0}^{z=4} = -32/3$$

Therefore, k = –3/32.
So,

$$P(X < 1) = \int_0^1 kz(z-4)\,dz = (-32/3)\left[(1/3)z^3 - 2z^2 \right]\Big|_{z=0}^{z=1} = (-32/3)[(1/3) - 2] = 5/32.$$

Proficient Example:

$$1 = \int_0^4 kz(z-4)\,dz = k\left[(1/3)z^3 - 2z^2 \right]\Big|_{z=0}^{z=4} = -32/3$$

So, k = –3/32 and

$$E[X] = \int_0^4 z{*}kz(z-4)\,dz = 2.$$

Marginal Example:

$$1 = \int_0^4 z{*}kz(z-4)\,dz = k\left[(1/4)z^4 - (4/3)z^3 \right]\Big|_{z=0}^{z=4} = -64/3$$

So, k = –3/64 and therefore

$$P(X < 1) = \int_0^1 z{*}kz(z-4)\,dz = (-3/64)\left[(1/4)z^4 - (4/3)z^3 \right]\Big|_{z=0}^{z=1} = 13/256.$$

Unsatisfactory Example: (There were none)

Specific Rubric for Question #5 (Beyes' Theorem)

EXEMPLARY	PROFICIENT	MARGINAL	UNSATISFACTORY
Obtains the correct answer of 0.65 using a clearly described series of steps.	Correctly identifies the need to use Beyes' Theorem and correctly utilizes Beyes' Theorem, but obtains the wrong answer due to a miscomputation not related to Beyes' Theorem	Correctly identifies the need to use Beyes' Theorem, but fails to obtain the correct answer due to an incorrect interpretation of the terms in Beyes' Theorem	Does not use or misuses Beyes' Theorem.

Exemplary Example:
Let E be the event that the Edison bulb was selected.
Let F be the event that a selected bulb works for over 8 years.
From the Law of Total Probability
$P(F) = P(F|E)*P(E) + P(F| E^c) *P(E^c)$
$= e^{-2} (1/5) + e^{-4} (4/5)$
From Beyes' Theorem,
$P(E|F) = P(F|E)*P(E) / P(F) = [e^{-2} (1/5)] / [e^{-2} (1/5) + e^{-4} (4/5)] \approx 0.65$.
There is about a 65% chance the bulb is the longer-lasting one.

Proficient Example:
Let E be that we picked the Edison bulb and F the probability it lasts over 8 years.
$P(F) = P(F|E)*P(E) + P(F| E^c) *P(E^c)$
$= e^{-8} (1/5) + e^{-16} (4/5)$
So, from Beyes' Theorem,
$P(E|F) = P(F|E)*P(E) / P(F) = [e^{-8} (1/5)] / [e^{-8} (1/5) + e^{-16} (4/5)] \approx 1$.
Essentially no

Marginal Example:
Beyes' Theorem says $P(E|F) = P(F|E)*P(E) / P(F)$
$P(E) = P(Exp(4) = 8) = 99\%$

Unsatisfactory Example:
$X \sim Exp(2)$
$P(X>8) = e^{-8} + e^{-16}$

Specific Rubric for Question #6 (Events and Set Algebra)

EXEMPLARY	PROFICIENT	MARGINAL	UNSATISFACTORY
Correctly determines the correct event: $(B_1 \cup D_1 \cup F_1) \cap (E_2 \cup F_2)$	Produces an answer that demonstrates an understanding of the correct meaning and interrelation of the given events, but which is not precisely correct.	Misinterprets the meaning or interrelation of the given events, but attempts to provide an answer using appropriate use of unions, intersections, and complements.	Fails to use set algebra to describe the event.

Exemplary Example:
$(B_1 \cup D_1 \cup F_1)$ is the event that the first roll is either a "2", a "4", or a "6".
$(E_2 \cup F_2)$ is the event that the second roll is either a "5" or a "6".
So, $(B_1 \cup D_1 \cup F_1) \cap (E_2 \cup F_2)$ describes the event that the first roll is even AND the second roll is larger than a four.

Proficient Example:
$(B_1 \cup D_1 \cup F_1) \cap (D_2 \cup E_2 \cup F_2)$ is the event that the first roll is even and the second roll is at least as large as four.

Marginal Example:
$(A_2 \cup A_4 \cup A_6) \cap (B_5 \cup B_6)$

Unsatisfactory Example: (There were none)

Student Accomplishments

Several of our students have been successful competing in national and international competitions in both theoretical and applied mathematics. Hieu Do was among the top finishers in the Virginia Tech Regional Mathematics Competition in 2008 and placed among the top 500 students nationally in the William Lowell Putnam Competition that same year. We have also had students achieve high results in the COMAP Mathematical Modeling Contest. In 2005 a team which included math major Voja Petrovic and math minors Jason Vielma and Zach Goode received a "Meritorious" award for their modeling paper. In 2006 a team of three math majors – Ihsane Bikri, Christopher Cox, and Ivan Simeonov also received a "Meritorious" award for their efforts.

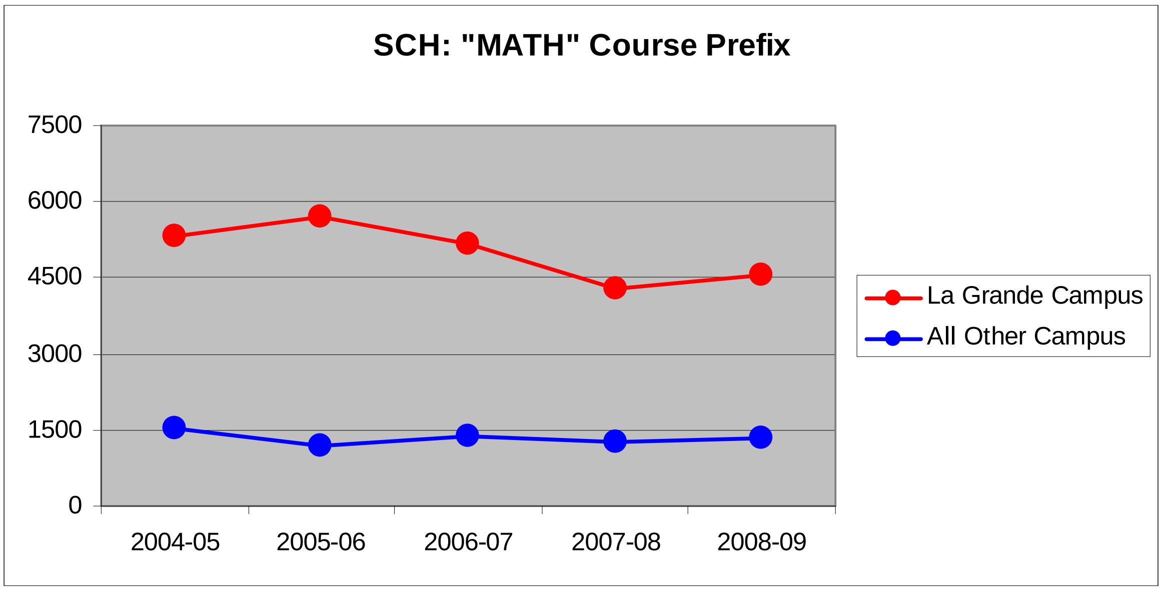
We have had several recent students see success in graduate programs. Marianna Jagodina and Ihsane Bikri both earned Master's Degrees (Marianna at Cal State Long Beach and Ihsane at Oregon State University). Ihsane now teaches math at a community college in Nebraska. Mariana has also taught at a community college (in California) and has passed two of the actuarial exams needed to become a candidate for the Society of Actuaries. Recent graduates currently in post-baccalaureate programs include Hieu Do (at Oregon State University), Matt Lewis (at Western Washington University), Justin Hilyard (at Notre Dame), Voja Petrovic (at Utah State), and Ivan Simeonov (in the Statistics Ph.D. program at Penn State).

Many of our graduates major in mathematics with the intent to teach high school. Most of these students take advantage of EOU's MAT program in the College of Education. A short list of those who have gone on to a successful teaching career include Adil Abounadi (at Central High School in Independence, OR), Mike Lindsay (at Hockinson High School near Vancouver, WA), Nick Zolotoff (at Newburg High School in Newburg, OR), Michelle Taisican (teaching in Micronesia), Amanda Potter (at the International School in Beaverton, OR), and Tyler Davis (in Stanfield, OR). With regard to the Program's responsibility and goal of effectively preparing teachers, we refer to the data provided by the College of Education on student success in the Praxis examinations. Our last survey of those records showed that from 2001-2007 all EOU mathematics graduates entering the EOU MTE program had successfully passed the required Praxis exams.

Enrollment and Program Performance

Eastern Oregon University

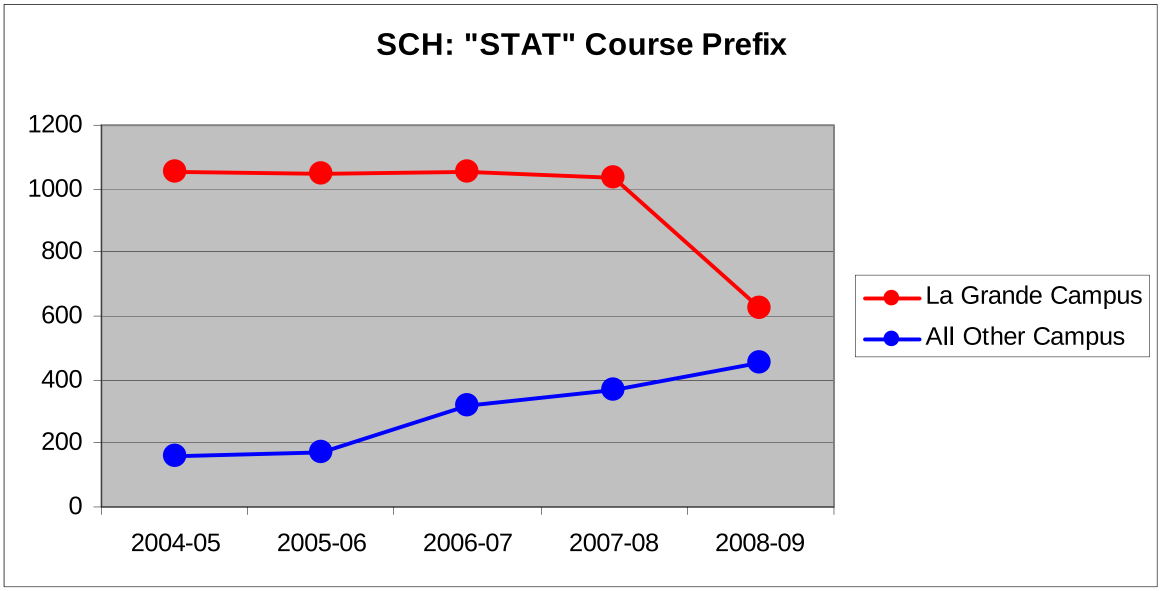
5 Year Student Credit Hours Generated by 'MATH' Course Prefix



	2004-05	2005-06	2006-07	2007-08	2008-09
La Grande Campus	5316	5706	5170	4278	4564
All Other Campus	1520	1196	1373	1254	1346
Total	6836	6902	6543	5532	5910

Data include all terms, effective end-of-term

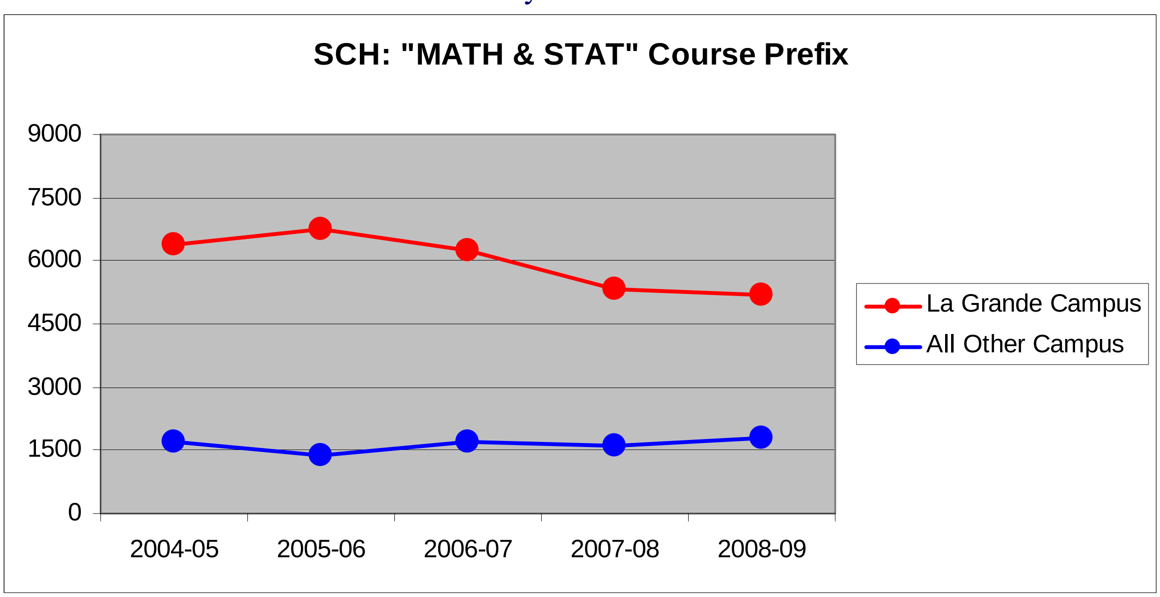
5 Year Student Credit Hours Generated by 'STAT' Course Prefix



	2004-05	2005-06	2006-07	2007-08	2008-09
La Grande Campus	1051	1049	1052	1036	624
All Other Campus	160	172	321	369	451
Total	1211	1221	1373	1405	1075

Data include all terms, effective end-of-term

5 Year Student Credit Hours Generated by 'MATH' & 'STAT' Course Prefix

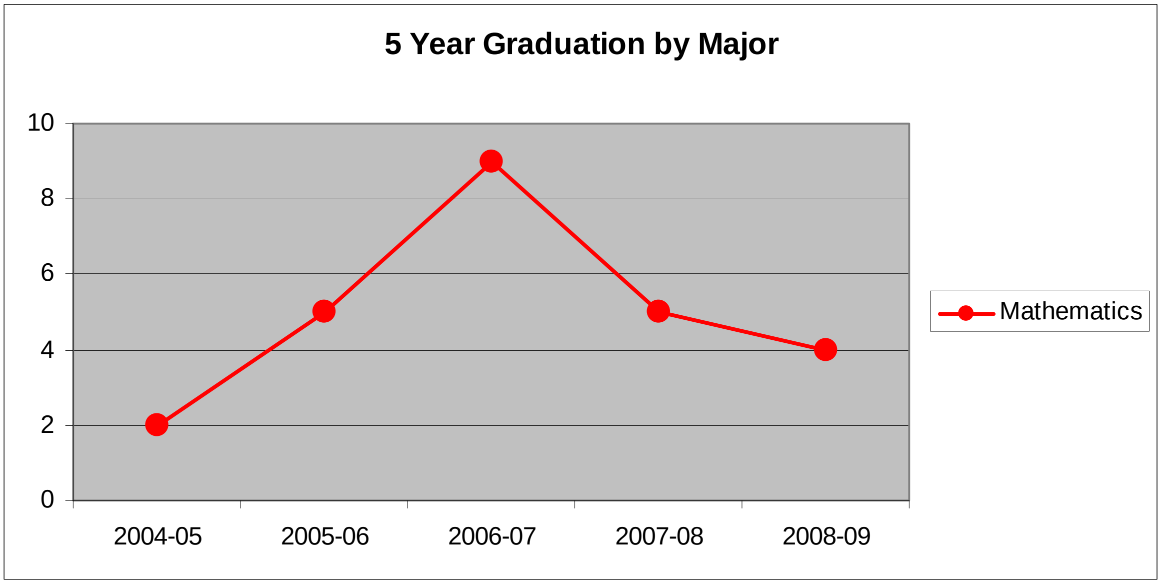


	2004-05	2005-06	2006-07	2007-08	2008-09
La Grande Campus	6367	6755	6222	5314	5188
All Other Campus	1680	1368	1694	1623	1797
Total	8047	8123	7916	6937	6985

Data include all terms, effective end-of-term

Commentary on Enrollment and Graduate Trends

5 Year Graduation by Major



	2004-05	2005-06	2006-07	2007-08	2008-09
Mathematics	2	5	9	5	4

Program and Course Scheduling Requirements

This is the proposed schedule of classes with estimated enrollments of our minimal model. This will be our two-year schedule after the current EPCC changes are passed.

FALL – Year One

COURSE (sections)		LOAD (per section)	EST. ENROLLMENT (per section)
SERVICE (only)			
Math 040 (3)		9 (3 per section)	45 (15 per section)
Math 070 (4)		16 (4 per section)	72 (18 per section)
Math 095 (3)		12 (4 per section)	80 (25 – 30 per section)
Math 102 [095Excel]		1	5
Math 111 (3)		12 (4 per section)	120 (35 – 45 per section)
Math 122 [111Excel]		1	5

GEN ED		
Math 105	4	25
Math 211	4	25
Math 212	4	25
MAJOR/MINOR		
Stat 243 (2) * ^	8 (4 per section)	65 (30 – 35 per section)
Math 251 (2) * ^	8 (4 per section)	50 (20 – 25 per section)
Math 321	4	10
Math 323	4	8
Math 341 ^	4	15
Math 344	4	6
Math 407	1	6
TOTAL (in-load)	88 load hours	562 students (estimated)
(estimate)	25.0 SCH/load hour	2155 SCH (estimated)

**** indicates that this is also a GenEd class.***
^ indicates that this is also a service class.

WINTER – Year One

COURSE (sections)	LOAD (per section)	EST. ENROLLMENT (per section)
SERVICE (only)		
Math 040	3	15
Math 070 (2)	8 (4 per section)	30 (15 per section)
Math 095 (2)	8 (4 per section)	60 (30 – 35 per section)
Math 102 [095Excel]	1	5
Math 111 (3)	12 (4 per section)	120 (35 – 45 per section)
Math 122 [111Excel]	1	5
Math 112	4	35
GEN ED		
Math 105	4	25 (25 – 30 per section)
Math 211	4	25
Math 213	4	25
Math 241 ^	4	25
MAJOR/MINOR		
Stat 243 * ^	4	35
Stat 352 ^	4	20
Math 252 * ^	4	45
Math 254	4	10
Math 338	4	10
Math 445	4	6

Math 407		1	6
TOTAL (in-load)		78 load hours	502 students (estimated)
(estimate)		24.9 SCH/load hour	1945 SCH (estimated)

**** indicates that this is also a GenEd class.***
^ indicates that this is also a service class.

SPRING – Year One

COURSE (sections)		LOAD (per section)	EST. ENROLLMENT (per section)
SERVICE (only)			
Math 040		3	10
Math 070		4	15
Math 095		4	30
Math 102 [095Excel]		1	5
Math 111 (2)		8 (4 per section)	70 (35 – 45 per section)
Math 122 [111Excel]		1	5
Math 112		4	35
Math 231		4	20
GEN ED			
Math 212		4	25
Math 213		4	25
Math 241 ^		4	25
MAJOR/MINOR			
Stat 243 (2) * ^		8 (4 per section)	70 (35 – 40 per section)
Math 251 * ^		4	15
Math 253 * ^		4	25
Math 311		4	6
Math 382		4	10
Math 407		2	6
Math 452		4	8
TOTAL (in-load)		79 load hours	440 students (estimated)
(estimate)		21.4 SCH/load hour	1693 SCH (estimated)

**** indicates that this is also a GenEd class.***
^ indicates that this is also a service class.

FALL – Year Two

COURSE (sections)		LOAD (per section)	EST. ENROLLMENT (per section)
SERVICE (only)			
Math 040		3	15

Math 070 (3)		12 (4 per section)	45 (15 per section)
Math 095 (4)		16 (4 per section)	130 (30 – 35 per section)
Math 102 [095Excel]		1	5
Math 111 (3)		12 (4 per section)	120 (35 – 45 per section)
Math 122 [111Excel]		1	5
GEN ED			
Math 105		4	25
Math 211		4	25
Math 212		4	25
MAJOR/MINOR			
Stat 243 (2) * ^		8 (4 per section)	70 (35 – 40 per section)
Math 251 (2) * ^		8 (4 per section)	50 (20 – 25 per section)
Math 311		4	6
Math 321		4	10
Math 341 ^		4	15
Math 361 ^		4	8
Math 407		1	6
TOTAL (in-load)		82 load hours	525 students (estimated)
(estimate)		24.8 SCH/load hour	2037 SCH (estimated)

**** indicates that this is also a GenEd class.***
^ indicates that this is also a service class.

WINTER – Year Two

COURSE (sections)		LOAD (per section)	EST. ENROLLMENT (per section)
SERVICE (only)			
Math 040		3	15
Math 070 (2)		8 (4 per section)	30 (15 per section)
Math 095 (2)		8 (4 per section)	60 (30 – 35 per section)
Math 102 [095Excel]		1	5
Math 111 (3)		12 (4 per section)	120 (35 – 45 per section)
Math 122 [111Excel]		1	5
Math 112		4	35
GEN ED			
Math 105		4	25 (25 – 30 per section)
Math 211		4	25
Math 213		4	25
Math 241 ^		4	25
MAJOR/MINOR			

Stat 243 * ^		4	35
Stat 352 ^		4	20
Math 252 * ^		4	45
Math 355		4	10
Math 412		4	6
Math 407		1	6
Math 483		4	10
TOTAL (in-load)		78 load hours	502 students (estimated)
(estimate)		24.9 SCH/load hour	1945 SCH (estimated)

**** indicates that this is also a GenEd class.***
^ indicates that this is also a service class.

SPRING – Year Two

COURSE (sections)		LOAD (per section)	EST. ENROLLMENT (per section)
SERVICE (only)			
Math 040		3	10
Math 070		4	15
Math 095		4	30
Math 102 [095Excel]		1	5
Math 111 (2)		8 (4 per section)	70 (35 – 45 per section)
Math 122 [111Excel]		1	5
Math 112		4	35
Math 231		4	20
GEN ED			
Math 212		4	25
Math 213		4	25
Math 241 ^		4	25
MAJOR/MINOR			
Stat 243 (2) * ^		8 (4 per section)	70 (35 – 40 per section)
Math 251 * ^		4	15
Math 253 * ^		4	25
Math 344		4	6
Math 382		4	10
Math 407		2	6
Math 462 ^		4	8
TOTAL (in-load)		79 load hours	440 students (estimated)
(estimate)		21.4 SCH/load hour	1693 SCH (estimated)

**** indicates that this is also a GenEd class.***

^ indicates that this is also a service class.

Typical DDE yearly schedule and enrollment

Fall DDE		Credits	Approximate Enrollment
Math 070		4	10
Math 105		4	20
Math 111		4	15
Math 211		4	25
Math 212		4	15
Math 213		4	5
Math 239		2	5
Math 240		2	5
Stat 311 (1 – DDE)		2	20
Stat 312 (1 – DDE)		2	15

Winter DDE			
Math 095		4	20
Math 111		4	15
Math 211		4	15
Math 212		4	25
Math 213		4	15
Math 239		2	5
Math 240		2	5
Stat 311		2	20
Stat 312		2	15

Spring DDE			
Math 105		4	20
Math 111		4	15
Math 211		4	15
Math 212		4	25
Math 213		4	15
Math 239		2	5
Math 240		2	5
Stat 311		2	20
Stat 312		2	15

Total SCH Required per academic year (General Education and service courses and major courses)

Total: 197 SCH

Staffing
OnCampus
Bryan Fisher
Stephen Tanner
John Thurber
Amy Yielding

Current assessment of Faculty

Based on the current faculty in Math, the following FTE are available:

Total = 5.0 fte; 3 fixed term, 3 tenure

Cost Ratios

<u>Load/Faculty On Campus</u>

The Provosts Office will help make these calculations for each major/minor. We will provide the raw data and computations for these areas. Prepares should make notes or – provide clarifications if the data are inadequate to communicate the entire truth.

Based on the 2008-2009 SCH, the ratio of SCH to faculty in MATH prefix courses is ---- Student load hours/---- FTE = ------ load hours per faculty member.

Total SCH: 5,910

ON Campus SCH: 4,564

ONLINE SCH: 1,346

ON SITE SCH :0

<u>SCH/Faculty ratios:</u>

On campus (--------SCH/-------- FTE) ------- SCH per faculty member

Based on the 2008-2009 SCH, the ratio of SCH to faculty in STAT prefix courses is ---- Student load hours/---- FTE = ------ load hours per faculty member.

Total SCH is: 1,075

ON Campus SCH: 624

ONLINE SCH: 451

ON SITE SCH:0

SCH/Faculty ratios:

On campus (--------SCH/-------- FTE) ------- SCH per faculty member

Administrative Review (Dean Marilyn Levine)

Administrative Assessment of program portfolios will consist of three areas of commentary: assessments conducted relating to student learning outcomes; comments on enrollment indicators; program goals and observations. If appropriate other observations will be offered.

1 . Assessment of Program Outcomes:
The selection and breadth of the assessments was a strength. In the Communication (Math 407) analysis, there needs to be more depth as to possible program implications that outline what kind of improvements are needed, other than earlier attention. Mathematics faculty might explore more frequent direct training in oral presentation, or perhaps assign materials on displaying visual data as some possible additions to their plans. The rubric for the capstone presentation was excellent.

2. Enrollment Indicators:
Although the mathematics sch and graduation rate has declined, the Mathematics faculty have been stretched delivering program, general education courses and developmental mathematics courses. The faculty has been agile in working with all units to rationally plan course offerings, in particular these past two years when needs have shifted between delivery areas.

3. Program Goals and Observations:
Although the portfolio does not have a summary section, I would highlight two areas that need focus. First, strengthening and recruiting for the recent program changes that the Mathematics faculty have developed and put into the curriculum. Secondly, a longitudinal understanding of course needs and offerings.
Another area that should be addressed in planning is the development of collaborative initiatives with the College of Education to recruit more students in STEM.

Other Observations:
The mathematics faculty have been challenged with two faculty resigning amidst a major university re-organization. The focus on serving the program and broader institutional needs is the challenge they face.
Finally, in terms of the development of the portfolio, the mathematics faculty need a summary and recommendation section. I also would recommend an expansion on the mathematics faculty with short biographies and accomplishments mentioned.