MATH 203 Recertification proposal (2011-2012) example

Course description

(ACE 3) MATH 203. Contemporary Mathematics (3 cr) Prereq: Sophomore standing and removal of all entrance deficiencies in mathematics. Not open to students with credit or concurrent enrollment in MATH 104, 105, 106, or STAT 218. Applications of quantitative reasoning and methods to problems and decision making in the areas of management, statistics, and social choice. Includes networks, critical paths, linear programming, sampling, central tendency, inference, voting methods, power index, game theory, and fair division problems.

Original Certification Proposal

Outcome(s)

SLO3: Use mathematical, computational, statistical, or formal reasoning (including reasoning based on principles of logic) to solve problems, draw inferences, and determine reasonableness.

1. Describe opportunities students should have to learn the outcome.
   How is the learning objective embedded in the course?

   The primary goal of this course is to broaden the student’s understanding of what mathematics is, going beyond algebra to patterns, paths, simple statistics, social decision (such as voting and fair division) methods, and learning some of the limitations of these methods and algorithms. In order to achieve this, students are shown how to tackle a number of problems which most of them would not have considered to be mathematical. They are then required to apply these techniques on similar problems. Although the precise content may vary from year-to-year, topics covered include finding Euler and Hamiltonian circuits and their applications to finding efficient routes that might be used in police patrols, mail delivery, and garbage collection; scheduling problems including finding the shortest times and paths for completion of a complex set of order-dependent tasks; understanding the computation of variability and its meaning in elementary statistics; and discussion of various voting methods for social decision making in a democracy. Other topics that might be covered include tilings and symmetries, check digit schemes for number verification and UPC codes, equitable division (including physical division of assets and apportionment problems), and exponential growth and decay. Lectures and the text present some formal definitions and descriptions of the types of problems related to the definitions, algorithms for tackling the problems, and facts or theorems related to the results obtained. These algorithms and theorems usually arrive naturally from an instructor motivated discussion of what is a reasonable approach to a given quantitative problem. The methods devised from the theorems, when properly used, allow the students to check the reasonableness of their solutions, and the students are expected to do this. The primary focus of the statistics section is how to gain information from a data set and how to check to see if various conclusions are reasonable or supported. Students are assigned homework problems using these ideas. Their
understanding is assessed with a series of quizzes and/or tests. The tests or quizzes are returned to the students with comments designed to help with their understanding. Most of the questions the students tackle on these homework assignments, tests and quizzes require careful reasoning and drawing conclusions from what they have learned.

2. Describe student work that will be used to assess student achievement of the outcome and explain how the students demonstrate the knowledge and skills specified by the outcome.

The instructors are given some flexibility in the choice of topics, with approximately 75% of the material prescribed for all sections by the course convener. Grading scheme details are determined by the individual instructor, but they all assign homework in each topic and they all give quizzes and/or exams over the homework and class presentations. The quiz and exams comprise at least 1/3 of the course grade. All sections also have the students do at least one mathematical project or a set of mini-projects, requiring the students to tackle one or more problems in far greater depth than can be put on an in-class test. These projects are graded on mathematical content, coherence, and proper use of English, and are returned with comments. In all sections, the graded mathematical content is at least 60% of the total grade, often 70% or more. So the larger part of the student’s grade is determined by how well they demonstrate attainment of ACE Outcome 3.

3. As part of the ACE certification process, the department/unit agrees to collect and assess a reasonable sample of students' work and provide reflections on students' achievement of the Learning Outcomes for its respective ACE-certified courses. Please comment on your plans to develop a process to collect and evaluate student work over time for the purpose of assessing student success for this ACE outcome.

Each year the Math 203 convener will select 2-3 representative sections (after reflecting on the diversity of approaches to the course). The instructors of these sections will be required to submit random samples of student projects and of quizzes or tests over a common topic. These samples will be distributed as follows: 2 from the good range (B+ to A+), 2 from the acceptable range (C to B) and 2 from the unacceptable range (F to C-), if any exists. The instructor will also give the percent of students in each of these grade ranges. This information will be given to the Department Undergraduate Advisory Committee. That committee will provide reflections on student achievement, archive the sample material and these reflections, and share this information with the Department.

**Reinforcements**

What Outcome(s) or skill(s) will be reinforced in this course? Writing

All sections require either one or two major projects or a series of mini-projects to be written up, involving substantial writing of non-fiction prose. These projects are graded on the mathematics, coherence, and proper use of English and returned with comments.

Civics
This course reinforces civics in at least two ways. First, all sections discuss voting methods and the associated problems resulting from Arrow’s Theorem and the frequent absence of a Condorcet winner. This means that often any choice that can be made would be considered inferior to another choice by a majority (but that other choice would be considered inferior to a third choice by a different majority, etc.) Understanding that there is often, when dealing with complex issues like taxing and spending, no perfect solution, and that we must be willing to live with flawed solutions if we believe in democracy, is vital to the tolerance that is needed to make democracy work. It also supports civics in a more indirect way through the discussion of basic statistics. Much news is circulated about polls and the opinions of others these days. Understanding both the strengths and weaknesses of such polling data helps people to understand the true content of such stories, and make decisions better informed on the attitudes of others in our democratic society.

Critical Thinking
Students are required to use the mathematics to critically analyze routing problems, scheduling problems, various voting techniques, and the validity of conclusions drawn from data sets.

Recertification

1. Please indicate the semesters the course has been taught as an ACE certified course.

   Fall 2009 (1098), Spring 2010 (1101), Summer 2010 (1105), Fall 2010 (1108), Spring 2011 (1111), Summer 2011 (1115), Fall 2011 (1118)

2. What have assessment data revealed about how the course helps students achieve the designated Student Learning Outcome(s)? (You might be able to complete this textbox by copying information found in the Summary & Conclusion sections from your Department/Program ACE Assessment Report.)

   The exams and project papers show that students who earn a C or better are demonstrating significant achievement of the standards for Outcome 3. The material taught in these courses is far less sophisticated than what we teach in our courses taken by majors. Nevertheless, the work for the course does involve a significant amount of mathematical thinking and problem solving. The course is viewed favorably by the majority of students who take it, and evidence from teaching evaluations indicates that students who take the course emerge from it with a more positive view of mathematics and an improved appreciation of how mathematics applies to situations in everyday life, such as planning a garbage collection route or dividing an estate among heirs.

3. How have those assessment data been used to help the course meet the certified Student Learning Outcome(s)? (You might be able to complete this textbox by copying information found in the Summary & Conclusion sections from your Department/Program ACE Assessment Report.)
Instructors in the course have expressed the view that they would be even more successful if they had more control over the course content. As a result of this request, and the very positive evidence from student work, the Undergraduate Advisory Committee is recommending that the course structure change so that the required topic list would represent two credits worth of material, with the instructor allowed to choose the rest of the material from the other topics in the text. Because many students come to this course with a sense that mathematics is neither useful nor enjoyable, it would be beneficial to allow instructors the latitude they need to include topics about which they are particularly excited and omit ones that they find less compelling.

4. If your assessment plan does not include collection of student work from all sections each time the course is taught, indicate how your department ensures that all sections are taught in accordance with the ACE plan.

One faculty member serves as the coordinator for Math 203, taking responsibility for choosing the textbook and writing a standard course syllabus. All new Math 203 instructors meet with the coordinator at the beginning of the semester, where they are given information about the course expectations and suggestions for how to teach the course.

5. If the response in the original proposal for ACE certification indicated that the assessment process was still being developed, the UCC/ACE subcommittee expects an explanation of the process. (May be referenced in the Methods section of the Department ACE Assessment Report.)

N/A