**CCC Materials:**
**Math 4: Introduction to Probability and Statistics**
**Prerecs: Placement exam**
**Normal class size: 35**
**Expected: 1 section in Fall 2012, 2 sections in Spring 2013**
**Appropriate for 1st years**

**2) Coverage of the learning outcomes for Mathematical Understanding**

Math 4 is an introduction to statistics and probability. This course is taken by students in a variety of majors at a variety of points in their Saint Mary's Careers. It is a requirement for sociology majors and an expectation for students in the 2+2 pre-nursing program.
This course covers the basics of probability and statistics with an eye towards applications in a variety of fields. The course performs a dual role, providing specific mathematical tools that can be applied in a student's major field even as it is imbued with the spirit of mathematics as part of the liberal arts tradition. It was specifically designed to meet departmental learning outcomes which are very much consistent with those identified as Mathematical Understanding by the Core Curriculum Committee.

*Apply abstract and logical reasoning to identify patterns and solve mathematical problems*

Students in Math 4 identify the sorts of questions that one asks in statistics—both descriptive and inferential: What are good ways to describe a set of data in a quantitative fashion? What are the established and logically sound ways to make decisions based on sets of data? What are the best ways to design studies to answer particular questions? These are the guiding issues in the statistics part of the course (as summarized in the first three Learning Outcomes listed on the syllabus). Students learn methods and formulas to solve mathematical problems. Also, since every statistical study is different, students must abstract from concrete examples to look for the commonalities that make various statistical methods appropriate.

This course also covers the basic ideas of probability, which is the crucial sister discipline to statistics. Students are challenged to get comfortable quantifying the uncertainty of future events, a process which is inherently more abstract than data analysis. This material connects statistics to more traditional mathematical thinking and gives it important context.

*Communicate mathematical ideas and concepts accurately and clearly using mathematical symbols, language, and formulas.*

The focus on communication is everywhere in Math 4. I tell my students that in high school, they are expected to understand mathematics; but in college, they are expected to understand mathematics and be able to explain their ideas to someone else. Whenever students use a formula or method, they are expected to justify why it is appropriate in the context. Whenever they give a numerical answer, it must be accompanied with comprehensible work leading to it.

Students are taught these communication skills through modeling by the instructor and by written examples from the textbook; through peer-to-peer collaboration and support; and through feedback on their written work on exams, homework, and/or projects. Also, when new concepts and symbols are introduced (such as those in probability), there is explicit discussion of the correct way to interpret and use them in practice.

**3) Assessment artifacts for measuring student learning**

Student learning is assessed primarily through midterm exams and a comprehensive final exam. Exams include questions designed to assess students' ability to solve mathematical problems (i.e., "Calculate the mean of the following data set", "Construct a 95% confidence interval for the following estimation problem") and their ability to relate studies and data described on the exam to methods and examples which we have discussed in class. A student who is successful in

these questions will have demonstrated an achievement of the first Mathematical Understanding learning outcome.
In addition, the exams expect the students to communicate their mathematical ideas as they perform calculations and to justify why the methods they choose are appropriate (as explained in the previous section). Many questions expect the students to take a “real-world” situation and translate it into mathematical language and symbols; or to take the results of their calculation and relate it back to the original data set. It is expected that many questions will be answered in complete interpretive sentences. The communication of mathematical ideas is an expectation that runs throughout the course, and a student who successfully answers these exam questions will have demonstrated an achievement of the second Mathematical Understanding learning outcome.

Other assessment artifacts will often include homework; projects/presentations; and in-class worksheets. Roughly speaking, nightly homework gives students a chance to practice and then demonstrate their mastery of the first learning outcome; while projects give an opportunity to focus more on the second learning outcome. Because of their collaborative nature, in-class worksheets give a nice opportunity to support both learning outcomes.

**4) <u>Department’s disciplinary expertise</u>**

All ranked faculty in the Department of Mathematics and Computer Science possess a doctoral degree in mathematics, and it is the ongoing practice to require such a degree of the candidates in every tenure track search. Almost all lecturers and adjunct faculty possess either a master’s or doctoral degree in mathematics plus prior experience in teaching college-level mathematics. The rare exception would be a lecturer who instead possesses an advanced degree in a field with a strong focus on mathematics, such as physics or engineering, plus a substantial history of success in teaching college-level mathematics.
The department maintains clear guidelines regarding content, goals, and outcomes for each course and actively communicates to each instructor the expectation for adherence to these guidelines.