

Course: Probability and Statistics, Math 113 SMC

Time: MWF 9:10-10:10 a.m. @ GAV 250

Text: **Introduction to Probability and Statistics for Engineers and Scientists, 3ed.**
by Sheldon M. Ross

Instructor: Adam Lucas (office Gal 103D)

Office Hours: MF 11:30-12:30, and 2:15-2:45, or by appointment

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Prerequisite: Calculus 2, Math 28 or equivalent.

Course Description: Statistics is the art of learning from data. Statistics is an indispensable tool in the natural and social sciences for inferring conclusions from numerical data. What makes statistics fun and exciting is its usefulness in applications. For this reason we will always balance mathematical rigor with real world examples.

The course has two parts. The first part of the course will be a crash course in probability theory (chapters 3-5). One could without too much difficulty spend an entire semester introducing concepts such as conditional probability, random variables and expectation. Instead we will spend about nine weeks on this material. In the second part of the course we will also learn about special random variables, such as Bernoulli and Binomial random variables, normal random variables and Poisson random variables, which come up repeatedly in applications. The calculus prerequisite will take effect quite noticeably here when we start talking about continuous random variables in chapter 4.

The second part of the course will be about descriptive and inferential statistics. In descriptive statistics you learn how to describe data sets. Some of you may have taken a statistics course in high school and learned about how to describe data sets using the sample mean or sample median or sample standard deviation. We will quickly review this material. In inferential statistics you wish to learn information about your population from the data. For example you might determine the variance or the mean of a normal population from information you have gathered for a random sample of your population. In chapter 6 we will learn about one of the most remarkable and useful theorems in probability, the Central Limit Theorem and learn some of the technical prerequisites of statistics. If we stop here then you would have an excellent background to take a dedicated statistics course. But hopefully we will have still about 2 weeks to pick and choose topics from chapter 7, and 8. In chapter 7 we learn how to deduce information about a population's mean or

variance from the mean and variance of a sample subpopulation. This is really useful in economic applications. In chapter 8 we will learn about how to design statistical tests to test hypotheses about a population.

All in all, it should be a really rewarding and challenging class. Some of you are already very accomplished math students at SMC with several upper division courses under your belt and even research experience. There is however a spread of backgrounds and we will all work together as a group to keep everyone together through the tough patches. I feel very fortunate and privileged to be able to teach such a motivated group of students.

Homework: As many of you know, math is learned by doing. As a result there will be nightly homework assigned from the textbook. You are expected to spend between two and three hours on homework for each class meeting. Homework is due at the beginning of the next class. Homework will be collected every Wednesday before class. With rare exception, **late homework will not be graded**. It is important for you to do every homework and show me your completed homework even if it is late. I will check you off for completing the assignment.

Academic Honesty: The Saint Mary's policies regarding academic honesty detailed in the student handbook apply to this course. I encourage you to work with other students on the homework, but your write-up should be in your own voice, and consist largely of your own work. Where your argument depends heavily on another's work, say so.

Attendance: Attendance is required and roll will be taken at the *beginning* of each hour. If you are not in your seat when roll is taken, you may be considered absent, so be on time. You are allowed to miss **three** classes without affecting your grade. After your grade is dropped one step (A- to B+, C+ to C, etc.) for each two successive misses. SMC athletes are excused to attend team commitments but are responsible for notifying me ahead of time

Exams/Projects: There will be two 1-hour tests, a project and a 2 hour cumulative final. For your project you will need to summarize and analyze a real data set using Excel.

Missed examinations are given an automatic grade of F. The only exceptions to this, *made at the discretion of the instructor*, are in cases of major emergencies. Contact me ASAP if you think you are going to miss an exam

Exam/Projects Dates: Friday, September 28 (in class) 1 hour exam
Friday, Nov 2 (in class) 1 hour exam
Final exam period. Project due
Finals exam period. 2 hour exam

Grading: Your final grade is computed as follows:
Homework 20%;
Test 1: 15%
Test 2: 15%
Project: 10%
Comprehensive final exam 30%
I-clicker/Webwork score: 10%

Tentative Schedule:

Week 1 (Aug 27-Sept 3) 3 classes Axioms of Prob., sample spaces having equally likely outcomes (sec. 3.1-3.5)
Week 2 (Sept 3-Sept 10) 2 classes, Sample spaces having equally likely outcomes, Conditional probability (sec 3.5)
Week 3 (Sept 10-Sept 17) 3 classes, Conditional probability cont., Bayes formula, independent events (sec 3.6-3.8)
Week 4 (Sept 17-Sept 24) 3 classes, Random Variables, Expectation (sec 4.1-4.2, sec 4.4)
Week 5 (Sept 24-Oct 1), 3 classes, review, **Test 1**, Expectation (sec 4.4)
Week 6 (Oct 1-Oct 8), 3 classes, Expectation continued, Descriptive stats (sec 4.4-4.5, Chap 2)
Week 7 (Oct 8-Oct 15), 2 classes, Descriptive statistics cont, variance, covariance (chapter 2, sec 4.6-4.7)
Week 8 (Oct 15- Oct 22), 3 Chebyshev's inequality, Joint probability mass function, Bernoulli and Binomial random variable (sec 4.9, sec 4.3, sec 5.1)
Week 9 (Oct 22-Oct 29), 3 classes, review, **Test 2**, Poisson Random Variable (sec 5.2)
Week 10 (Oct 29-Nov 5), 3 classes, Normal Random Variables, The Sample Mean (secs 5.5, 6.1-6.2)
Week 11 (Nov 5-Nov 12), 3 classes, Central Limit Theorem, Chi-square distribution, t-distributions (sec 5.8, 6.3)
Week 12 (Nov 12-Nov 19), 3 classes, Parameter estimation, interval estimates (sec 7.1-7.3)
Week 13 (Nov 19- Nov 26), 2 classes, interval estimates cont, hypothesis testing (secs 7.1-7.3, sec 8.1)
Week 14 (Nov 26-Nov 30), 3 classes, hypothesis testing, review (sec 8.1-8.3)