Math 392-1 Accelerated Probability and Statistics

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Office Hours: 1:00-2:00 Tuesday & 3:00-4:00 Thursday in 328 Anderson
Class Meeting Times: 1:30-2:50 Monday, Wednesday, and Friday
Class Location: Annenberg G22

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Course Description

Math 392-1 is designed to prepare students to learn applied econometrics (the focus of the next course in the sequence, Math 392-2). This course provides a calculus-based introduction to probability theory and statistics. The main topics covered include: independence, conditional probability, Bayes's Rule, random variables, discrete and continuous distributions, the central limit theorem, sampling distributions, confidence intervals, and basic hypothesis testing. More than half the class will focus on those topics relating to probability theory while the last part of the course will focus on those relating to basic statistics.

This course is cumulative in nature since many materials in the beginning serve as fundamentals upon which later topics build. Therefore, students are strongly encouraged to make use of office hours, review sessions, etc. if they feel they are falling behind at any time, especially in the beginning.

Friday meetings will differ significantly from those on Monday and Wednesday in that most if not all of the class time will be spent as a section used to go over trouble areas on homework and with the course material in general. On occasion, Ambarish will discuss new material, but the vast majority of the time will be spent discussing problems the students have been assigned or wish to discuss.

Required Text

Probability and Statistics, Third Edition, by Morris H. DeGroot and Mark J. Schervish, Addison Wesley, 2002. The book is available at Norris Center bookstore.

Homework

Homeworks will be assigned on Mondays and Fridays. Students are permitted and even encouraged to work in groups for homework sets, but each must turn in his or her own solutions on the due date. Regarding late homeworks, the number of possible points for each homework decreases by 1/3 per day after the due date (i.e., no points are available 3 days after the due date).

A quick point on homeworks…Two assignments per week seems like a large workload, but using this system as opposed to weekly problem sets is really only a repackaging of the same homework quantity. In other words, the workload isn't increased, just redistributed. Thus, Friday's assignment will typically be short, and by breaking up the problem sets, it aligns incentives away from putting off a large amount of work until the last minute and risking falling behind.

Exams and Grading

Final grades will be established in the following way:

Problem Sets	15%
First Midterm (Friday 10/10)	20%
Second Midterm (Friday 11/7)	20%
Final (Friday, 12/12…9:00-11:00)	45%

All exams are open book and open notes; however, no electronic devices may be used. A curve will be implemented if necessary, but the overall criteria will never be stricter than: 92-100 is an A; 90-91 is an A-; 88-89 is a B+; 82-87 is a B; etc. I have faith that this won't be an issue, but to be thorough, anyone caught cheating on a midterm or final will be excused from the exam and given a failing grade for the course.

Blackboard

I plan to make extensive use of the blackboard website for this course. One can gain access to blackboard by following either http://courses.northwestern.edu or http://hereandnow.nwu.edu. Gaining access requires use of your Northwestern NetID and password. Most if not all class documents will be distributed via blackboard, and I will send out emails whenever new documents are posted. This email will be send to official Northwestern accounts (i.e., those ending in @northwestern.edu). Any students who use alternate accounts are responsible for ensuring that emails sent to their Northwestern account are forwarded appropriately.

Final Comment

I know this class has a reputation for requiring a great deal of work; I don't mean to say otherwise here, but I do want to reemphasize the value of keeping up with the material early because of the cumulative nature of the course. Following this strategy will certainly make the course load more manageable and learning the material a much more pleasant experience.

Course Outline

1. Introduction to Probability
    a. Set Theory 1.4
    b. Axioms of Probability 1.5
    c. Finite Sample Spaces 1.6
    d. Counting Methods 1.7
    e. Basic Combinatorics 1.8
    f. Multinomial Coefficents 1.9
    g. Probability of a Union (inclusion-exclusion) 1.10
2. Conditional Probability
    a. Basic Definition 2.1
    b. Independent Events 2.2
    c. Bayes's Theorem 2.3
    d. Markov Chains 2.4
3. Random Variables and Distributions
    a. Basic Definitions and Discrete Distributions 3.1
    b. Continuous Distributions 3.2
    c. Distribution Functions 3.3
    d. Bivariate Distributions 3.4
    e. Marginal Distributions 3.5
    f. Conditional Distributions 3.6
    g. Multivariate Distributions 3.7
4. Expectation
    a. Basic Definitions 4.1
    b. Properties of Expectations 4.2
    c. Variance 4.3
    d. Moments and Moment Generating Functions 4.4
    e. Mean and Median 4.5
    f. Covariance and Correlation 4.6
    g. Conditional Expectation 4.7
    h. Sample Means and Two Useful Inequalities 4.8
5. Special Distributions
    a. Bernoulli and Binomial 5.2
    b. Normal 5.6
    c. Central Limit Theorem 5.7
6. Estimation
    a. Basis of Inference 6.1

    b. Maximum Likelihood Estimators (MLE) 6.5
    c. Properties of MLE 6.6
7. Sampling Distributions
    a. Definition 7.1
    b. The Chi-squared Distribution 7.2
    c. The t Distribution 7.4
    d. Confidence Intervals 7.5
    e. Unbiased Estimators 7.7
8. Testing Hypotheses
    a. The Problem 8.1
    b. Type I and Type II Errors 8.2
    c. The t Test 8.5
    d. The F Distribution 8.7

Suggested Reading:

Week 1 (ending 9/26):

1.1-1.5

Week 2 (ending 10/3):

1.6-1.10

Week 3 (ending 10/10)

2.1-2.3

Week 4 (ending 10/17)

2.4, 3.1-3.3

Week 5 (ending 10/24)

3.4-3.7

Week 6 (ending 10/31)

4.1-4.4

Week 7 (ending 11/7)

4.5-4.7

Week 8 (ending 11/14)

4.8, 5.2, 5.6, 6.1

Week 9 (ending 11/21)

6.5, 6.6, 7.1, 7.2, 7.4, 7.5

Week 10 (ending 11/26)

7.7, 8.1, 8.2, 8.5, 8.7