Economics 3818 Professor Donald Waldman
Office: Room 108 waldman@colorado.edu
Tues/Thurs 4:00 - 5:30, and by appointment

## Course Information

Welcome to Econ 3818. This is a first course in probability and statistics, with an introduction to econometrics. Applications will be taken from topics in economics, and

(environmental economics, nonmarket valuation, labor economics, industrial organization). He has taught this course many times.

Eric Penner and Tyler Shenkel are advanced graduate students in the Economics Department. They have completed the Ph. D. level course requirements in statistics and econometrics in the Economics Department.

**Prerequisites**

The most important background to bring into this course is ability to think abstractly. In addition, students will find it easier if they have a good understanding of algebra at the level of high school Algebra II; differential and integral calculus play a smaller role in this course, but they will be used. Calculus will be reviewed during the course.

The course prerequisites are *one* of the following:

ECON 1078 and 1088;
MATH 1300;
MATH 1310;
MATH 1081;
MATH 1080, 1090, and 1100;
APPM 1350.

If you have not taken one of these classes, you cannot take Econ 3818 without a waiver.

**In the first week of class:**

- Please read Caniglia (the course textbook), Chapter 2.
- If you are not already comfortable with Microsoft Excel, try

**Lectures, Recitation, Work Load**

There will be two lectures weekly, meeting Tuesday and Thursday from 11:00 to 12:15 p.m. in GOLD A2B70 .


Attendance is mandatory!!!  It is possible to learn statistics

| | | | |
|---|---|---|---|
| 117 | TH | 3:30—4:20 | DUAN G1B25 |
| 118 | TH | 5:00—5:50 | HLMS 263 |

In recitation material will be presented relevant to the lectures and problem sets. In addition, Excel programming and issues will be discussed. Recitation is an integral part of the course. There are more than 150 students enrolled, so recitation is the best chance to learn one-on-one. Since you will receive four credits if you pass the course compared to the usual three credit course, recitation attendance is also mandatory:

**To pass this course, you must attend at least 10 recitations**.

In my experience, for a student with average mathematical background, an additional one to two hours *per lecture* will be required to read the text and work out assignments in order to fully understand the course material. This course starts with fairly basic concepts, but don't let this mislead you--both the conceptual and mathematical rigor increase as the semester progresses.

**Course Outline**

The course begins with *probability*, continues with *statistics*, and ends with *econometrics*, all terms to be defined.

The following is a list of sections, one covered roughly every three weeks. This list may be useful to you to see where we are in the text or if you have had a statistics course previously (but I expect it will have little meaning to most of you at this point).

*Section 1*

- Research in “Hard” and “Soft sciences
- Summation notation
- Introduction to probability. Axioms; Venn diagrams
- Addition and complement rules of probability
- Conditional probability
- Tree diagrams
- Independence and mutual exclusivity
- Bayes' law
- Urn problems
- Bayes' Law for partitions

*Section 2*

- Random variables and probability distributions
- Discrete random variables; the probability mass function
- Bernoulli, binomial, and Poisson random variables
- Mathematical expectation
- Expectation of a function of random variables; variance
- Continuous random variables; the probability density function

- The power, exponential, and standard normal distribution
- Bivariate, marginal, and conditional distributions
- Conditional expectation and variance
- Covariance and correlation

*Section 3*

- The general normal distribution
- From probability to statistics - population and sample
- Sampling theory - the distribution of the sample mean
- The Central Limit Theorem
- The chi-squared distribution
- Point estimation
- Unbiasedness as a property of an estimator
- Relative efficiency and best (minimum variance estimation)
- Examples from portfolio theory
- Comparing biased and unbiased estimators--mean-squared error
- Maximum likelihood estimation
- Confidence intervals

*Section 4* - hypothesis testing

- Introduction - the State of Nature and the outcome of a test
- Type I and Type II errors. The power of the test
- Testing hypotheses about the population mean - classical method
- p-value and the p-value method of testing hypotheses
- Using confidence intervals
- Testing hypotheses about the population proportion
- Some caveats in testing hypotheses

*Section 5* - the classical, normal, linear regression model

- Model specification and assumptions
- Estimation and hypothesis testing
- Prediction and goodness-of-fit
- Multiple regression
- Review

**Text**

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**Grading Criteria**

- *Quizzes* (15%)
- *Weekly Problem sets* (20%)
- *Three midterm exams* (15% each)
- *Final exam* (20%)

Course grades will be assigned based upon overall percentage course score:

| | |
|---|---|
| 93 - 100 | A |
| 90 - 92 | A- |
| 87 - 89 | B + |
| 84 - 86 | B |
| 80 - 83 | B - |
| 75 - 79 | C + |
| 70 - 74 | C |
| 65 - 69 | C - |
| 60 - 64 | D |
| < 60 | F |

Grades may be curved at the end of the term.

Notes

- The weekly 10 minute quiz is available online after Thursday's lecture. It will consist of four to eight multiple choice questions covering the material presented in that week's lectures. For maximum benefit in learning the mostly sequential material of this course, the quiz must be completed by **the start of the next Tuesday's class,** so by 12:30 pm.
- The weekly problem sets will be available on Thursday as well, and are due the following Thursday by 6 pm. They may be handed in in lecture, in recitation, or in the envelope posted outside your TA's office door.
- The three in-class midterm exams are scheduled for Thursday, September 22, Thursday, October 20, and Tuesday, November 15. They will be composed of questions from the quizzes and problem sets, as well as additional questions.
- The final exam is cumulative, to be given on Tuesday, December 13, 4:30 to 7:00 p.m.

Additional notes on the problem sets:

- You must answer all exercises, but not all will be graded.
- On some problem sets, there will be an Extra Credit problem or problems. These are truly extra credit: they can only raise your grade. To be clear, at the end of the term I will calculate grades for every student without regard to the extra credit problems. Then I will return to my assessment spreadsheet and raise the grades of students who have tried and at least sometimes successfully attempted some or all of the extra credit problems.

Like many courses but unlike, perhaps, a "topics-in something" course, this course is sequential in nature. That is, Thursday's material will likely be unintelligible unless Tuesday's material has been mastered. Therefore, to make understanding material easier, answers to quizzes and problem sets will be made available shortly after their due date and time. This means strict deadlines for completion of quizzes and problem sets.

The lowest problem set score and the lowest quiz score will be dropped. Given this policy, the fact that solutions will be posted immediately after the assignment is due, and the importance of keeping up on the material in this course, **no late problem sets or quizzes will be accepted**.

*Classroom behavior*: Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, color, culture, religion, creed, politics, veteran's status, sexual or