

### Course Information

Econ 3818 is a first course in probability and statistical methods, with an introduction to econometrics.

This is primarily a lecture course in the theory and tools of statistics. Applications will be taken from topics in economics, and other areas. Both simulated and real data will be used in these examples.

#### Instructor

Donald M. Waldman, Professor



Department of Economics  
E-mail: [waldman@colorado.edu](mailto:waldman@colorado.edu)  
Office: Econ 108. TR 12:30 - 2 pm

#### Teaching Assistants

Hoyn Kim



[Hoyn.Kim@colorado.edu](mailto:Hoyn.Kim@colorado.edu)  
M 1:00 - 2:20 pm, W 9:15 - 10:35 am

Doyoung Park



MW 10:00 -11:00 am,  
F 10:00 am -12:00 pm

#### Instructor Short Biographies

Donald Waldman is a professor in the Economics Department. Both his teaching and research concentrate on statistical methods (econometrics) and applied microeconomics (environmental economics, nonmarket valuation, labor economics, industrial organization). He has taught the classroom version of this course many times.

Hoyn Kim and Doyoung Park are advanced Ph. D. students in the Economics Department. They have taken many of the statistics/econometrics course offerings of the Department, and they have taught this course or been a TA for this course in past semesters.

## 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. This material 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, unless you come to see me about it.

## In the first week of class:

- Please read Caniglia (the course textbook), Chapter 2.
- If you are not already comfortable with it, try out Microsoft Excel. The University has a site license to the MS Office package, so you can get it for free. It is often included in Windows PCs and some Macs, and it is available on all computers in the CU computer labs. If you are using your own computer, install the Analysis ToolPak add-in program. Here are instructions to do so for a Windows machine:

*Click the File tab, and then click Options.*

*Click Add-Ins, and then in the Manage box, select Excel Add-ins. Click Go.*

*In the Add-Ins available box, select the Analysis ToolPak check box, click OK.*

*If Analysis ToolPak is not listed in the Add-Ins available box, click Browse to locate it.*

*If the Analysis ToolPak is not currently installed, click Yes to install it.*

*The Data Analysis command will now be available in the Analysis group on the Data tab.*

*For a Mac, see <http://support.microsoft.com/kb/914208>*

## Course Objectives

- Statistics is the study of data (resulting from either the physical or social world) that is subject to randomness. The major objective of this course is to convey the basic language, mathematical symbols, tools, and techniques of statistics.

- Statistics is the building block of econometrics, which is the application of statistics to economic models and data. A second goal of this course is to provide an introduction to econometrics.
- Since the applied economist uses statistics on data, a third objective of the course is provide the student with the ability to organize and investigate data using Microsoft Excel.

## Lectures and Recitation

There will be two lectures weekly, meeting Tuesday and Thursday from 11:00 a.m. to 12:15 p.m. in Hale, room 270. You should be registered in one of the recitations:

Park, D	101	4:00—4:50	W	MUEN E118
Kim, H	102	5:00—5:50	W	ECON 13
Park, D	103	8:00—8:50	T	HUMN 145
Kim, H	104	9:00—9:50	TH	EDUC 132
Kim, H	105	8:00—8:50	TH	HUMN 145
Kim, H	106	5:00—5:50	T	CHEM 133
Park, D	107	3:00—3:50	M	MUEN E114
Park, D	108	2:00—2:50	M	ECON 2
Park, D	109	5:00—5:50	TH	HLMS 247

In recitation material will be presented relevant to the lectures and problem sets. In addition, Excel issues will be discussed.

In my experience, for a student with average mathematical background, an additional one to two hours *per class* will be required to read the text and work out assignments 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 increases as the semester progresses.

## Course Outline

The course begins with *probability*, continues with *statistics*, and ends with *econometrics*.

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

- 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

Caniglia, Statistics for Economists, An Intuitive Approach, Harper Collins Publisher, 1992. This book is out of print, but available in soft cover at the CU bookstore for \$60. Since there is no disk or key to unlock a publisher web site associated with this book, and since there is only one edition, any used copy is equivalent to a new copy. The text has been used for this course at CU for the last four semesters, so that it is available on all the second hand book sites, at the Colorado Bookstore on College Avenue in Boulder, and other places.

### Assessment

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.

Midterms (2):	in class Thursday, February 12, and Thursday, April 16.
Problem sets:	twice weekly, due Thursday, 11:00 a.m., and Tuesday, 11:00 a.m. (in other words, before the start of the next class).
Quizzes:	twice weekly, to be taken online, before the start of the next class.

### Notes

- The two 10-15 minute quizzes each week, taken online, consisting of a few multiple choice questions. The quiz for material covered Tuesday will be available after the lecture and must be completed by the start of Thursday's lecture, after which solutions will be available. The quiz for material covered Thursday will be available after the lecture and must be completed by the start of the following Tuesday's lecture, and again after that time, solutions will be made available.

- The twice-weekly problem sets have the same timing for availability and completion as that of quizzes. That is, each problem set is geared to a lecture, and in the spirit of keeping up with the material, is due at the start of the next lecture.
- The two midterm exams, in class on Thursdays, February 12 and April 16, will be composed of questions from the quizzes and problem sets, as well as additional questions.

Additional notes on the problem sets:

- Please hand in your problem set before the start of the lecture. Place it on the table in the passageway between the seating tiers as you enter the lecture hall.
- 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 successfully attempted some or all of the extra credit problems.

Course Grade Component Weights:

- *Quizzes* (20%)
- *Weekly Problem sets* (40%)
- *Two midterm exams* (20% each)

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.**

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

### **Students with Disabilities and the Honor Code**

*Notice for students with disabilities:*

If you qualify for accommodations because of a disability, please submit to me a letter from Disability Services in a timely manner so that your needs be addressed. Disability Services determines accommodations based on documented disabilities. Contact: 303-492-8671, Willard 322, and [www.Colorado.EDU/disabilityservices](http://www.Colorado.EDU/disabilityservices)

Disability Services' letters for students with disabilities indicate legally mandated reasonable accommodations. The syllabus statements and answers to Frequently Asked Questions can be found at [www.colorado.edu/disability services](http://www.colorado.edu/disability_services)

### Honor Code Policies

All students of the University of Colorado at Boulder are responsible for knowing and adhering to the academic integrity policy of this institution. Violations of this policy may include: cheating, plagiarism, aid of academic dishonesty, fabrication, lying, bribery, and threatening behavior. All incidents of academic misconduct shall be reported to the Honor Code Council ([honor@colorado.edu](mailto:honor@colorado.edu); 303-735-2273).

Students who are found to be in violation of the academic integrity policy will be subject to both academic sanctions from the faculty member and non-academic sanctions (including but not limited to university probation, suspension, or expulsion). Other information on the Honor Code can be found at <http://www.colorado.edu/policies/honor.html> and at <http://www.colorado.edu/academics/honorcode/>