

# Econ 7818: Mathematical statistics for economists

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Econ 7818 is the first course in the statistics/econometrics sequence for Ph.D. students in Economics. Statistics is the foundation of econometrics.

Most of you are destined to become econometricians of one sort or another: different variations on the theme "applied econometrician."

## 1 What is statistics?

This will be the topic of our first lecture. Put simply: A course in statistics studies . . . . Every function of random variables is a statistic. (What's a random variable?) Econometricians develop statistics, then use these statistics,

## 2 What is statistics? What is econometrics? Some quotes.

Quoting from the front of *Journal of the Royal Statistical Society*, Vol. 2, by M.G. Kendall and A. Stuart. They attributed the exchange to the fictitious K.A.C. Manderville, (1937),

"You haven't told me yet," said Lady Nuttal, "what it is your statistician does for a living."

"He's an statistician ." replied Lamia, with an annoying sense of being on the defensive.



A well-known econometrician recently mentioned to me that he was hired

### 3 Course Description:

Econ 7818 is an introductory course in statistics for Ph.D. students in economics.

Important components include probability theory, distribution theory, statistics, estimators and estimates, properties of estimators, sampling, inference, estimators such maximum likelihood and OLS, and hypothesis testing. Extensive use will be made of the mathematical and statistical software,

#### 3.1 Web page:

My web site is located at <http://www.colorado.edu/economics/morey/index.html>. From it you can link to the web page for Econ 7818, or you can go directly to web page for the course at <http://www.colorado.edu/economics/morey/7818/7818home.html>.

All assignments, review questions, readings, lecture notes, etc. will, hopefully, be available there.

### 3.2 Text and readings:

The text for this course is Alexander Mood, Franklin Graybill, and Duane Boes, , McGraw Hill, 1974. ISBN 0-07-042864-6.

While you want to acquire your own copy of the book and cherish it forever, I have put the chapters of the book on the course web page. The book is no longer in print, but used copies are available from book sellers on the web.

The text for 7828 is Green: , 6th edition. I recommend you get it now rather than waiting.

#### 3.2.1 Another text that I might have chosen for this course is

Takkeshi Amemiya, Introduction to statistics and econometrics, Harvard University Press, 1994, ISBN 0-674-46225-4

#### 3.2.2 For those who are considering additional books, I recommend:

Peter Kennedy, A Guide to Econometrics (4th edition), MIT Press, 1998. ISBN 0-262-61140-6. This is an excellent book that provides, in words, the big picture. I recommend it. It will help with this course, and help even more in 7828.

Russell Davidson and James MacKinnon, , Oxford University Press, 1993. I recommend this book to those who want an advanced text in theoretical econometrics. It is well written. Russell and I went to graduate school together. This book is not for the faint of heart.

#### 3.2.3 Additional reading and notes:

I might assign some additional readings for some topics. If I do, I will put them on the course web page.

### 3.3 Software:

The computer software will be an important tool. You will use it in many assignments. For example, you will use it to investigate distributions such as the Normal, Chi-Squared, Student and F distributions, distributions that play crucial roles in econometrics.

You will use it to draw random samples from these and other distributions.

You will use it to write your own code for different econometric estimators, to do simulations, and to do Monte Carlo studies.

For more details on <http://www.colorado.edu/economics/morey/7818/7818mathematica.html>, including how to download the program to your Mac or PC, see the section of the 7818 web page

### 3.4 Prerequisites:

A sufficient condition for being in this course is that you are a new Ph.D. student in economics here at C.U. But, it is not a necessary condition: graduate students in business often take this course, sometimes other people who simply have too much free time.

You need to get by and do well whether your preparation for 7818 is "not enough", "just right" or "too much."

I won't use matrix algebra in this course, but I am sure it will be used in your upcoming econometrics courses, so you might want to sleep with a matrix-algebra book.

### 3.5 Class format:

Lecture/problem solving/discussion/

I very much believe that one learns statistics by doing statistics—this is true of most things. Listening to me drone on about this or that is not the most efficient way to learn about this or that, particularly given my lack of expertise in the subject. That said, I love to drone on and on, a property I share with most teachers.

Hands on experience will be stressed. Class format will include both indi-



### 3.6 Details of grading:

There will be problem sets, short projects and quizzes. Some of these activities will be done using  $\text{Mathematica}$ . Some of these activities will be done in groups larger than one. Some of these activities will be take-home, some will be done in class.

Your first assignment will be a group assignment, groups of 3. Email it to me as an attachment by 9 a.m. Monday morning. Put simply, show me what you can do with  $\text{Mathematica}$ .

Each assignment will be graded on a 10 point scale. Your best (2) grades on these activities will constitute 50% of your course grade, the midterm 20%, the final 25%, and 5% will be set aside for participation (I will be the "decider" when it comes to how much you positively participated). If you want to get any of this 5% you need to actively and positively participate.

The final will be cumulative and will likely have a take-home part and an inclass part.

Wrt the problem sets, short projects, and quizzes: I do not accept things late. Note that you could, in theory, blow off two assignments and still have a perfect grade on the assignments.

This will be a course where writing down a bunch of math will not suffice. Explaining, in words, what you are doing and what it means is more important. The emphasis will be on understanding, explaining, and applying, not on regurgitating a bunch of math and symbols. So, your ability to write is important. Some of you will have and explaining stuff in words the most difficult part of the course, and some of you will fail the course because you cannot, or won't, explain stuff in words.

### 3.7 Questions:

There are review questions for each section of the course, even some answers. Knowledge of these review questions will be helpful when taking exams. Every year I update these questions, occasionally deleting a bad question, but mostly by adding new questions, some good, some bad.<sup>1</sup> I will update on a section by section basis. Keep in mind that there are few primary questions to ask, but that there are many ways to ask the same primary question.

I strongly encourage you to write out answers to all the review questions and discuss them with your classmates. You will want to form study groups. Bouncing ideas off each other will help you to determine if your thinking is correct, and will make you a better explainer. You can discuss answers with Xavier, your T.A. for the first semester graduate courses.

In class I will ask many questions. I also expect you to ask questions. In addition to these questions, I will sometimes give you the opportunity to earn, or lose, points by verbally answering specific questions. Participation in this latter activity is completely voluntary.

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<sup>1</sup>Often it takes a few iterations to perfect a question.

### 3.8 Advice for quizzes, assignments and exams:

Keep in mind that  $\Delta$  and  $\delta$  are different things. Many of my undergraduate students confuse the former for the latter, so are mad when they fail the exam. You, for example, are likely familiar with toilets but really do not understand how they work, but think you do.

As I said above, your answers to most questions should include a significant

### 3.9 Group Assignments:

Some of the assignments will be done in groups. I will tell you in advance if an assignment is a group endeavor. The first assignment is a group assignment.

The group will work together and turn in only one assignment. Everyone in the group will get the same grade for that assignment. Group activities are one of my ways of giving you an incentive to work and study together.

### 3.10 Office hours, contacting me outside of class, and answering questions outside of class

My office hours are posted on the course web page. If you can't make it to an office hour and want to see me, catch me before or after class to schedule a time.

My office is Econ 122 (right around corner—Beware of Dog). Please feel free to contact me by E-mail at [Edward.Morey@Colorado.edu](mailto:Edward.Morey@Colorado.edu) about setting up an appointment. Sometime an