Econ 7818: Mathematical statistics for economists

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Econ 7818 is the first course for Ph.D. students in Economics in the statistics/econometrics sequence. Statistics is the foundation of econometrics. Most of you are destined to become econometricans of one sort or another: different variants on the theme applied econometrican

What is statistics?

This will be the topic of our first lecture. Put simply: A course in statistics studies statistics. Every function of random variables is a statistic. Econometricans develop statistics, then use these statistics, along with data, to estimate things about the world of interest to economists.

> To understand God's thoughts we must study statistics, for these
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> are the measure of His purpose. Florence Nightingale)
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> Statistics are like a bikini. What they reveal is suggestive, but what they conceal is vital. (Aaron Levenstein)
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> The first lesson that you must learn is, when I call for statistics about
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> the rate of infant mortality, what I want is proof that fewer babies died when I was Prime Minister than when anyone else was Prime Minister. That is a political statistic. (Winston Churchill)
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> There are three kinds of lies: lies, damned lies, and statistics.
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> (Benjamin Disraeli, but sometimes Mark Twain)

What is econometics?

Quoting from *A Guide to Econometrics* by Peter Kennedy (The exchange originally appeared, with *statistican* rather than *econometrican* in the front of *The Advanced Theory of Statistics*, Vol. 2, by M.G. Kendall and A. Stuart. They attributed it to the

economic relationships and the lack of controlled experimentation, these assumptions are seldom met.

Econometricians are often accused of using sledgehammers to crack open peanuts while turning a blind eye to data deficiencies and the many questionable assumptions required for the successful application of these many techniques.

Econometric theory is like an exquisitely balanced French recipe, spelling out precisely with how many turns to mix the sauce, how many carats of spice to add, and for how many milliseconds to bake the mixture at exactly 474 degrees of temperature. But when the statistical cook turns to raw materials, he finds that hearts of cactus fruit are unavailable, so he substitutes chunks of cantaloupe; where the recipe calls for vermicelli he used shredded wheat; and he substitutes green garment die for curry, ping-pong balls for turtle's eggs, and for Chalifougnac vintage 1883, a can of turpentine. (Valavanis)

It is the preparation skill of the econometric chef that catches the professional eye, not the quality of the raw materials in the meal, or the effort that went into procuring them (Griliches)

The art of the econometrician consists in finding the set of assumptions which are both sufficiently specific and sufficiently realistic to allow him to take the best possible advantage of the data available to him (Malinvaud)

The applied econometrician: The applied econometrician, unlike the theoretical econometrician, needs to worry as much about her data as about the theory. The

forecasts and predictions generated by the econometric model are only as good as the data that produced them.

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, and particular estimators such maximum likelihood and OLS. Extensive use will be made of mathematical and statistical software.

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, additional readings, lecture notes, etc. will be made available at this site on an as-need basis.

Text and readings:

The text for this course is Alexander Mood, Franklin Graybill, and Duane Boes, Introduction to the Theory of Statistics, 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 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 *A Course in Econometrics*, by Arthur S. Goldberger. Harvard University Press, 1991. I recommend you get it now rather than waiting.

Other texts that I might have chosen for this course include:

Takkeshi Amemiya, Introduction to statistics and econometrics, Harvard University

Press, 1994, ISSBN 0-674-46225-4

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 highly. It will help with this course, and help even more in 7818

Russell Davidson and James MacKinnon, *Estimation and Inference in Econometrics*, 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.

Additional reading and notes:

I will assign some additional readings for some topics. I will try to put these on the course web page.

Software:

For many of you the computer software *Mathematica* will be an important tool. You will use it to investigate distributions such as the Normal, Chi-Square, Student t and F distribution: 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 estimates, to do simulations, and to do Monte Carlo studies.

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

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.

Class format:

Lecture/problem solving/discussion/computer/estimation

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 necesarily the most efficient way to learn about this or that.

Hands on experience will be stressed. Class format will include both individual and group problem solving. We will extensively use random sampling to investigate the properties of a statistic, and then relate what we find to statistical theory. After completing the course, you will be better able to critically evaluate and apply econometric theory.

You will spend a considerable amount of class time interactively formulating and solving problems and building models. Small groups will often be utilized.

I am hoping that you will spend more time talking than I will spend talking.

Details of grading:

There will be problem sets, short projects and quizzes. Some of these activities will be done using *Mathematica* or some other mathematical software. 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.

Each will be graded on a 10 point scale. Your best $(N - 2)$ 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 participated). The final will be cumulative and might have two parts: a take home part and an inclass part (it had two parts last year).

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

This will be a course where writing down a bunch of math will **not** be 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.

Questions:

I hope to provide you with review questions for each section of the course, maybe

even some answers. Knowledge of these review questions will be will be helpful when taking exams. I strongly encourage you to write out answers to all the review questions and discuss them with you 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.

In class I will ask many questions. I also expect you to ask questions. In addition to these question, I will sometimes give you theperoportunithystoatterna,civilosis, pointsetolsetTportant.u711 voluntary.

Review questions:

Advice for quizzes, assignments and exams:

Your answers to most questions should include a significant proportion of explanatory words, not just math. Some of you are likely more comfortable keepJ-0JTJT*0.0015Tc[yo correct.

There is always the issue of what the grader should assume you know when you don't state it. ForcJ-0.8(ou)-me to make these ch is generh bad idea. If I chn assume

Keep in mind that if you have a question, you can E-mail your question to everyone in the class, including me. I encourage this. I suspect that some of your fellow students will have better answers than mine. People can comment on and add to the answers of others.