Resource Economics 701  
Fall 2015  
Quantitative Methods

Description
This course will focus on probability theory and statistical inference, the foundations of econometric analysis. The department now uses this course (ResEcon 701) as the first course in our econometrics series. This course is followed by two econometrics courses (ResEcon 702 and 703).

Probability theory is the building block that will allow you to understand estimation and statistical inference. In this course, we’ll first focus on univariate distributions and then move on to multivariate ones, with care taken to differentiate discrete and continuous random variables. We will then move on to estimation and inference. We will not be able to cover all the material related to inference, but we will be able to have a good idea of different estimation methods and the basics of estimators’ properties.

Objectives
The goal is to present probability theory and statistical inference concepts at an intuitive and practical level. For this, I will make efforts to provide you with practical experience working with datasets and statistical software (Matlab and Stata). A goal at the end of the class is that you will be able to code, from scratch, (simple versions of) estimation routines such as OLS and maximum likelihood. We will meet in Morrill III 212 for the remainder of the semester (with, possibly, the exception of the midterm which we will likely hold in Stockbridge 303).

Texts
The main text that I plan to use is Mathematical Statistics with Applications, by Wackerly, Mendenhall and Scheaffer (WMS). I will also refer to Learning and Practicing Econometrics, by Griffiths, Hill and Judge (GHJ) (you may want to get this book as it will be used later in other econometrics courses; i.e., 702), as this text will allow to bridge a gap between the purely statistical treatment of WMS and that of an econometrics. An optional textbook is Probability Theory and Statistical Inference by Aris Spanos; this text offers and intuitive (in for some topics advanced) treatment (it also offers some alternative views of the discipline that are a bit controversial). The topics in this class will largely be those of a first course in statistics, but we plan to look at material, as much as possible, from an economist’s angle. If you have a previous econometrics text, you’ll find most topics covered in the first few chapters or perhaps an appendix. Reading multiple references, reading different presentations/explanations for this material can be helpful.

Prerequisites
You must be familiar with basic statistical concepts, linear algebra and calculus. You should also be familiar with the basics of matrix algebra.

Examinations
There will be a mid-semester exam and a final exam; the final is by nature comprehensive but will focus on topics following the mid-semester exam. The mid-semester exam is scheduled for November 9. The two exams will comprise 50% of your final grade, with each exam carrying equal weight.

Problem Sets
There will be several problem sets (~8) and in-class assignments that will each comprise 25% of your grade. Form a team with one of your colleagues and submit problem sets with your partner. Problem sets will comprise theoretical and/or applied material. I don’t want you to word process your problems sets, but your handwriting must be immaculate. For the in-class assignments, there will be instances when I will ask you to individually work on something (likely a small quiz) and other times when you will be asked to work in groups (of 2) on a dataset/code; in either case, I will ask you to submit your work by the end of class.
Grading
I anticipate the following boundaries for assigning final grades based on my prior experience: greater than 90 is A; 85 to 90 is A-; 80 to 85 is B+; 75 to 80 is B; 70 to 75 is B-; 65 to 70 is C+ and 60 to 65 is C.

Computer Software
Knowledge of Windows and Excel are expected. We will be using Matlab (and very likely Stata). We have both softwares available in the (Resec) Graduate lab and throughout campus.

The outline on the following pages is my planned list of topics. But, this can change at any time. Stay tuned.

I. Introduction –
   - Empirical Modeling: WMS: Chapter 1
   - Economics, Economic Data, and Inference: GHJ (Ch. 1, and 2.1 – 2.3);

II. Probability Theory
    Basic concepts of probability, calculating probabilities, laws of probability, events and random variables
    - WMS: Chapter 2

III. Discrete Random Variables and Probability Distributions
    Basic concept, probability distribution for a discrete random variable, expected values, examples of discrete probability distributions.
    - GHJ: 2.5, 2.6
    - WMS: Chapter 3

IV. Continuous Variables and Probability Distributions
    Basic concept, probability distributions, expected values, examples of continuous probability distributions.
    - GHJ: 2.4 – 2.6
    - WMS: Chapter 4

V. Additional Topics: Multivariate Probability Distributions and Functions of Random Variables.
    Some selected topics from bivariate and multivariate probability distributions, marginal and conditional distributions, covariance, variance, multinomial distributions.
    - WMS: Chapters 5 and 6.

VI. Sampling Distributions and the Central Limit Theorem.
    Basic concept, sampling distributions and the normal distribution, central limit theorem.
    - GHJ: Chapter 3
    - WMS: Chapter 7

VII. Estimation.
    Introduction/basic concept, classes of estimators, evaluating estimators and confidence intervals.
    - GHJ: Chapter 3
    - WMS: Chapters 8 and 9

VIII. Hypothesis Testing.
    Basic concept, elements of a test, common tests, errors, power of a test, relationship to confidence intervals, p-values.
    - GHJ: Chapter 4
    - WMS: Chapter 10