Department of Economics Fall 2009
UNC-Chapel Hill

Syllabus ECON 770
Introduction to the Mathematical and Statistical Foundations of Econometrics

Meeting time and place:
Tuesday from 11:00am to 12:15pm, Gardner 307
Thursday from 11:00am to 12:15pm, Gardner 307.

Professor:
Eric RENAULT

How to reach me:
My office is located in Gardner Hall 300G. My office phone number is 966-5326.
I will hold office hours on Tuesday and Wednesday from 2:30pm to 4:00 pm.
My email address is renault@email.unc.edu

Goals:
This course is conceived primarily to give to a researcher in econometrics the working knowledge of probability theory needed to understand statistical inference. It covers the measure-theoretical foundations of probability theory, integration and mathematical expectations, stochastic limit theory and applications to the theory of maximum likelihood and moment estimators.

Evaluation:
The grade for the course will be based on three homework sets, each with weight of 10%, a midterm exam (30%) and a final exam (40%).
Homework sets: They require that you derive theoretical results from theorems proven in class.
Midterm exam: The midterm will have the same format as the homework.
Final exam: The final will be cumulative, i.e. cover all the chapters since the beginning of the semester. The format is similar to homework and midterm.
The use of personal handwritten notes and of the Bierens' textbook (required textbook below) will be allowed during the exams. No other book will be allowed.
The grading will be numerical (the maximum grade being 20), which will then be converted to H, P, L or F.

Teaching Assistant:
Guansong Wang
wanggs@email.unc.edu
Recitation on Friday, 11:00 to 11:50am, Gardner 007.
Office hours on Tue. and Wed. from 9:00am to 10:30am in Ga411.

Textbook and Readings:

Required:

Herman J. Bierens (2004): *Introduction to the Mathematical and Statistical Foundations of Econometrics*, Cambridge University Press, Series "Themes in Modern Econometrics".

Other books of interest:

Any course in probability theory. Examples, among many possible, are:

Jean Jacod and Philip Protter (2000), *Probability Essentials*, Springer.

Kai Lai Chung (2001), *A Course in Probability Theory*, Academic Press.

Overview of the course:

1. Probability and Measure:
   - 1.1. Sample Space
   - 1.2. Algebras and Sigma-Algebras of Events
   - 1.3. Probability Measure
   - 1.4. Empirical Distribution and Law of Large Numbers

2. Sampling and Combinatory Analysis:
   - 2.1. Sampling with or without replacement
   - 2.2. Quality control when sampling without replacement
   - 2.3. Quality control when sampling with replacement
   - 2.4. Counting processes

3. Real Random Variables:
   - 3.1. The Uniform probability measure
   - 3.2. The Lebesgue measure
   - 3.3. Random variables and vectors
   - 3.4. Distribution functions
   - 3.5. Density functions

4. Conditional probability, expectations, Bayes' rule and independence:
   - 4.1. Conditional Probability
   - 4.2. Independence
   - 4.3. Mathematical expectations
   - 4.4. Expectation and independence, characteristic function
   - 4.5. Bayes' Rule and Maximum Likelihood

5. Optimal forecasts, conditional expectations and normal distribution:
    5.1. Variance and covariance
    5.2. Computation of optimal forecasts
    5.3. The Univariate Normal Distribution
    5.4. Transformation of variables and the Multivariate Normal Distribution
    5.5. Central Limit Theorem

6. Complements on Modes of Convergence and Maximum Likelihood Theory