14.381 Statistical Methods
Time and place: TTH 9-10.30
Fall 2008

Instructor (First part). Anna Mikusheva

Instructor (Second Part). Victor Chernozhukov

***Course Description*:** The first part of the course provides an introduction to statistical theory. A brief review of probability will be given mainly as a background material however it is assumed to be known. The second part of the course provides an introduction to regression analysis, focusing on specification (approximation) analysis and estimation and inference in large samples.

Part 1. Statistics

Text. The text, which will be followed closely, is Casella, G. and R. Berger, Statistical Inference, 2nd Edition, Duxbury. This book covers all of the material of the course and in addition provides many problems for practice as well as excellent references.

Outline for Part 1. Numbers after each section refer to sections of the text.

1. Samples and their characteristics: sample vs population, histogram, sample moments, order statistics (5.1-5.4)

2. Types of convergence and limit theorems: LLN, CLT, Slutsky theorem, Chebyshev's inequality (5.5)

3. Summarizing data: sufficient statistics, minimal sufficient statistic, ancillary statistics (6.1-6.4)

4. Point estimates and their comparison: unbiasness, MSE, Rao-Cramer bound, information matrix; asymptotic behavior: consistency, asymptotic normality, asymptotic efficiency (7.3)

5. Method of moments (7.2.1)

6. Maximum likelihood (7.2.2)

7. Testing: size and power, UMP test and Neyman-Pearson lemma, Wald test (8.1-8.3)

8. Confidence sets construction (9.1-9.3)

Grading for Part 1. There will be a midterm on October 23 (worth 35%). Problem sets and solutions will also be handed out (15% grade).

Part 2. Regression Analysis

Text: A recommended (though not required) text for this course is W. Greene's text *Econometric Analysis.* Prentice-Hall, 5th edition, 2003. You can also find most of the material in any standard text on regression. There will also be lecture notes posted on-line.

Outline for Part 2 . The following topics will be covered:

1. Fundamentals of Regression (Conditional Expectation Function, Best Linear Predictor, Best Linear Approximation, Building Functional Forms using Approximation Theory, Splines, Power series, Fourier, and other bases).

2. Regression in Finite Samples (Basic Regression Algebra, Gauss-Markov Optimality, Finite-Sample Inference under Normality and Non-Normality).

3. Regression in Large Samples (Consistency, Asymptotic Normality, Heteroscedasticity, CLTs and LLNs for I.i.d, Mixing, and Martingle Sequences).

Readings for topic 1: Greene, *Econometric Analysis,* Chapters 2 and 3
Judd, K. Chapter "Approximation Methods" in *Numerical Methods in Economics.*

Readings for topic 2: Greene, *Econometric Analysis*, Chapters 4 and 6.

Readings for topic 3: Greene, *Econometric Analysis*, Chapters 5 and 6, 11 and 12

Grading for Part 2. There will be a final (worth 35%) and problem sets (15% grade).