

Econ 897 - Part III
Optimization Theory, Probability and Statistics
SUMMER 2009

Instructor: Y. Fatih Karahan
McNeil 417
karahan@econ.upenn.edu
www.econ.upenn.edu/~karahan/teaching.html

Time and Location: 17-28 August Monday through Friday (SH-DH 1206)
Morning Session: 10:00 AM - 12:00 PM
Afternoon Session: 1:30 PM - 3:30 PM

Textbook: For the optimization part, I will use lecture notes from previous years. They are posted on my website. However if you need a book to study from, the following has a nice treatment of the subject with some economic applications: Rangarajan K. Sundaram "A first Course in Optimization Theory". As for the material on probability and statistics, I will follow closely Casella and Berger "Statistical Inference".

Exams and Homeworks: There will be a quiz every Friday covering materials of that week. Many problems will be assigned to get you comfortable with the material. These, however, won't be graded. After the due date, we will discuss some of them in class.

Outline of the Course:

Session 1: Optimization

- Optimization Problems in R^n : setup of optimization problems, motivation (economic applications) and the roadmap
- Existence of Solutions and the Weierstrass Theorem
- Different Notions of Concavity
- Uniqueness of Solutions
- Mathematical Digression
 - Concavity, Quasi-Concavity and Pseudo-Concavity for C^1 and C^2 functions
 - Separating Hyperplane Theorems and Farkas' Lemma
- Characterization of Optimal Solutions
 - Unconstrained Optimization Problems
 - Optimization with Equality Constraints: Theorem of Lagrange
 - Optimization with Inequality Constraints: Theorem of Kuhn and Tucker

Session 2: Probability and Statistics

- Probability Theory (with a slight introduction to σ – *algebras*) (Ch 1 in Casella and Berger)
- Transformations and Expectations, Moments and Moment Generating Functions (Ch 2 in Casella and Berger)
- Common Families of Distributions (Ch 3 in Casella and Berger)
- Multiple Random Variables (Ch 4 in Casella and Berger)
- Convergence Concepts (Ch 5.5 in Casella and Berger)
- Methods of Finding Estimators and Evaluating them (Ch 7.2 and 7.3.1 and 7.3.2 in Casella and Berger)