Syllabus for Econ 897  
Summer 2012

Instructors:
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Schedule:  
July 16 - August 31, 2012: Monday, Tuesday, Wednesday, Thursday and Friday  
Time: 10:00 AM-12:00 noon and 1:30 PM-3:30 PM each day  
Final (Waiver) Exam: Friday, August 31, 2012 at 9 AM  
Location: TBA

Course Website:  
http://economics.sas.upenn.edu/graduate-program/current-students/course-information/summer-math-camp

Textbook:  
There is no required textbook for the course. We will post lecture notes on our website covering most of the material that we go over in class. You might find some of the following books useful to supplement different parts of the lectures. Some of them are shelved at the Upenn bookstore. For the real analysis part as well as for differentiation we suggest one of the following excellent textbooks: 

For linear algebra part, we will basically follow Linear Algebra and Its Applications by Gilbert Strang. Linear Algebra by Serge Lang is another excellent textbook. It is at a slightly higher level and more theoretical.

Most of the materials covered in the optimization part can be found in the nice treatment by Rangarajan K. Sundaram A First Course in Optimization Theory. A short summary is also contained in the appendix of Mas-Colell, Whinston, Green: Microeconomic Theory. The book of Sunderam covers a lot of material and has some nice economic applications in it. For the review of statistics the recommended text is Statistical Inference by Casella and Berger, but any basic introduction into probability and statistics on a advanced undergraduate level will suffice if you already own such a book.

Exams and Homeworks:  
There will be graded tests every Friday to cover the materials covered in the corresponding week. These two tests will be graded. Additionally, each instructor might give quizzes and will post problem sets. These might influence your grade as well. We strongly recommend you to try to solve the questions before you see solutions.

1Do not be confused if some of them are shown are required at the bookstore; there is no required textbook for the course. Consider them as heavily suggested in case you feel the need to have a textbook.
The waiver exam is the final for all three parts of Econ 897. Your grade will be determined as the average of your grades for all three parts. For the exact determination of the grade for the parts we refer to the individual syllabi.
Outline of the Course:

1. Fundamentals (Selman, Week 1 - Week 2):
   Proofs, Sets, Relations, Functions, Real Numbers

2. Basic Topology & Metric Spaces (Selman, Week 1 - Week 2)

3. Sequences, Convergence and Limits (Selman, Week 1 - Week 2)

4. Continuous Functions (Selman, Week 1 - Week 2)

5. Differentiation in \( \mathbb{R} \): (Ju, Week 3 - Week 4)
   a) Definition and basic properties
   b) Mean value theorem and its applications
   c) Inverse function theorem
   d) Intermediate value theorem for derivative
   e) L’Hospital Rule
   f) Higher order derivatives and Taylor’s theorem

6. Linear Algebra: (Ju, Week 3 - Week 4)
   a) Matrix algebra, inversion and transpose
   b) Vector spaces
   c) Linear mappings
   d) Inner product and orthogonality
   e) Determinants
   f) Eigenvalues and eigenvectors
   g) Definite matrix

7. Analysis in \( \mathbb{R}^N \): (Ju, Week 3 - Week 4)
   a) Limits, continuity and basic properties
   b) Directional derivatives and partial derivatives
   c) Differentiation and its basic properties
   d) Inverse function theorem
   e) Implicit function theorem and examples

8. Optimization Theory in \( \mathbb{R}^n \): (Mattis, Week 5 - Week 6)
   - Definitions and the Basic Setup
   - Existence of Solutions and the Weierstrass Theorem
• Convex Sets and Concave Functions
  – Convex Sets
  – Concavity, Quasi-Concavity and Pseudo-Concavity
  – Separating Hyperplane Theorems and Farkas’ Lemma

• Uniqueness

• Characterization of Optimal Solutions
  – Unconstrained Optimization Problems
  – Optimization with Inequality Constraints: Theorem of Kuhn-Tucker
  – Optimization with Equality Constraints: Theorem of Lagrange
  – Optimization with Mixed Constraints

• Sensitivity
  – Continuity of Correspondences
  – Theorem of the Maximum (Berge’s Theorem)
  – Sensitivity and the IFT
  – Envelope Theorems

9. Brief Review of Basic Probability Theory (Mattis, Week 5 - Week 6)
• Definitions
• Random Variables
• Moments
• Bayes’ Rule
• Joint Distribution, Marginal Distribution, Conditional Distribution
• Change of Variable