SYLLABUS

Course Description
This course introduces students to advanced mathematical tools that are commonly used in economic analysis. The first half develops these tools, whilst the second half explores their applications. Topics include advanced linear algebra (spectral decomposition and quadratic forms), optimization (convex programming), and dynamic programming. Applications include consumer and producer theory, statistics and econometrics, and dynamic models of growth, search and learning.

Instructor
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Texts

Prerequisites
MATH 215 and either MATH 121 or MATH 216.
A prior course in statistics (e.g. ECON 203/4, MATH 203, MATH 218 or MATH 286) is strongly recommended. This course is intended as part of the Mathematical Economics concentration.

Format
This course will be structured as a seminar. Course notes have been posted on Moodle. Students are expected to have read the requisite sections of the course notes before coming to class. During class, students will work collaboratively to prove various results from the notes, and solve related problems. The in-class problems will be posted on Moodle.

Assessment
Student evaluation will be based on twelve problem sets (50%), class participation (20%) and a final exam (30%).

Problem sets will be posted on Moodle every Thursday, and shall submitted via Moodle the following Thursday. Late problem sets will incur a penalty of 10% if submitted within 3 days of deadline, and 20% if submitted any later. Problem sets should be typeset in Latex. Solutions will be posted on Moodle.
Course Outline

1. Review of Linear Algebra
   a. Subspaces, Basis, Dimension (9/5)
   b. Determinants, Inverses, Linear Systems of Equations (9/7)
   c. Applications (9/12)

2. Eigenvalues and Quadratic Forms
   a. Eigenvalues (9/12)
   b. Diagonalization (9/14)
   c. Singular Value Decomposition (9/19)
   d. Quadratic Forms (9/21)

3. Real Analysis
   a. Limits (9/26)
   b. Continuity (9/28)
   c. Taylor’s Theorem, Implicit Function Theorem (10/3)

4. Convex Programming
   a. Convex Sets, Convex/Concave Functions (10/5)
   b. Quasi-convex/concave Functions (10/10)
   c. Optimisation — Lagrange & Kuhn-Tucker Conditions (10/12, 10/24)
   d. Theorem of the Maximum, Envelope Theorem (10/26)

5. Application to Consumer Theory
   a. Preferences (10/31)
   b. Utility Maximization, Expenditure Minimization (11/2)
   c. Welfare (11/7)
   d. Producer Theory (11/9)

6. Application to Statistics and Econometrics
   a. Distributions and their Properties (11/14)
   b. Linear Regression (11/16, 11/21)
   c. Generalized Method of Moments (11/23)
   d. Principal Component Analysis (11/28)

7. Dynamic Programming
   a. Value Functions, Bellman Equations (12/5, 12/7)
   b. Applications to models of growth, search and learning (12/12, 12/14)