ECON5153 MATHEMATICAL ECONOMICS

University of Oklahoma, Fall 2009

TR, 9 - 10:15am, Hester Hall 213A

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Office Hours:	Tuesday & Thursday, 1:30 - 2:30pm, and by appointment

Course Description

This is the first course in the graduate Mathematical Economics/Econometrics sequence. The objective of this course is to acquaint the students with the fundamental mathematical techniques used in modern economics, including *Matrix Algebra, Dynamics*, and *Optimization*. Upon completion of the course students will be able to set up and analytically solve constrained and unconstrained optimization problems. The students will be able to address first and second order optimality conditions for such problems and use techniques from linear algebra to solve implied systems of equations. The student will also be able to perform comparative statics exercises on equilibrium or first order conditions arising from economic problems.

Textbooks

Required: Carl P. Simon and Lawrence Blume, ***Mathematics for Economists***, W. W. Norton & Company, First edition, 1994.

Other useful books:

Alpha C. Chiang and Kevin Wainwright, ***Fundamental Methods of Mathematical Economics***, Mcgraw-Hill, Fourth Edition, 2005.

Darrell A. Turkington, ***Mathematical Tools for Economics***, Blackwell Publishing, 2007.

Michael D. Intriligator, ***Mathematical Optimization and Economic Theory***, Prentice-Hall, 1971.

Assessment

Grades are based on homework and class participation (10%), two midterms (25% each) and a final exam (40%). You are encouraged to form study groups to discuss homework and lecture materials. All exams will be in closed-book forms.

Exam Dates

Midterm 1 – Tuesday, October 6

Midterm 2 – Thursday, November 12

Final – Thursday, December 17, 8-10am

Problem Sets

Several problem sets will be assigned during the semester. You will typically have one week to complete each assignment. Late homework will not be accepted. You are allowed to work with other students in this class on the problem sets but each student must write his or her own answers. Each student is also required to write the names of the other students he or she worked with on each homework assignment.

Lecture Notes

The lecture notes have borrowed content and notation from various sources and follow, mainly, the material outlined in the text by *Simon and Blume*. You should study these notes in conjunction with the textbook. In preparing them, I have also referred to various other books including *Chiang and Wainwright*; Mathematical Tools for Economics by *Darrell A. Turkington*; Mathematical Optimization and Economic Theory by *Michael D. Intriligator* etc.

Course Outline

The following is a list of topics I wish to cover. We may not be able to cover all the topics. For exams, you will be responsible for material in topics actually covered in lectures.

Chapter 1: Introduction

Mathematical vs. non-mathematical economics, econometrics; Static, comparative static and dynamic analysis; Optimization vs. strategic interaction.

Chapter 2: One-variable calculus is mainly for self-reading.

Monotonicity; Concavity/convexity; Local/global min/max; Differentiability and continuity; Rules of computing derivatives; Taylor expansion; Composite functions; Inverse function theorem; Exponents and Logarithms.

Chapter 3: Matrix algebra

System of linear equations; Matrix operations; Rank of a matrix; Elementary matrices; Determinants; Submatrix, minor, cofactor and adjoint of a matrix;
Algebra of vectors; Planes in Euclidean spaces; Linear independence.

Chapter 4: Functions of several variables

Limits and sets; Level curves; Total differentials; Taylor expansion; Directional derivatives and gradients; Hessian; Matrix calculus.

Chapter 5: Optimization

Quadratic forms; Definiteness of matrices; Unconstrained optimization;
Optimization with equality constraints; Inequality constraints; Kuhn-Tucker conditions; Lagrangian multiplier; Envelope theorems; Homogeneous and homothetic functions; Concave/convex and quasiconcave/quasiconvex functions.

Chapter 6: Dynamics

Linear difference equations; Eigenvalues and eigenvectors; Definiteness of matrices through eigenvalues; Ordinary difference equation; System of linear differential equations; Dynamic optimization.

Chapter 7: Other topics

Integration; Convex sets vs. convex functions; Rish aversion and Jensen inequality; Min-max theorem; Weierstrass's theorem; Intermediate value theorem;
Rolle's theorem; Mean value theorem.