ECO 6371.
Introduction to Quantitative Economics.
Fall, 2015.

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Office Hours: Mondays & Wednesdays, 10 - 11.30 AM & by appointment.
Lectures: Tuesdays & Thursdays, 9.30-10.50 AM, Room 303, Umphrey Lee.

Teaching Assistant: Mr. Xiang Han, E-mail: xiangh@smu.edu (Office hours: Tuesday and Thursday, 3.30 - 4.30 PM, in the department library).

This is a course on basic mathematics for a doctoral program in economics.

It is important to understand that there is high variation in the extent and kind of mathematics used in various sub-fields and approaches in economic research (including econometrics). It is impossible for a course of this kind to cover he mathematical results used in all fields of economics - or even most of them. A course of this sort has to be selective and limited.

This course will focus on some basic results in linear algebra, real analysis and static optimization theory. The selection of topics is, to a large extent, motivated by constraints on the time available for the course, the typical background of the incoming Ph.D. students and the need to have a course that is self-contained. Therefore, the course will not be able to cover important topics such as probability and measure theory, stochastic dynamic optimization techniques etc. Hopefully, other courses will cover such material.

Instead of presenting a haphazard glossary of large number of results, the course will aim to provide students with an understanding of the important results, the mathematical arguments behind them and their implications.

Learning Objectives:

Acquaint students with a set of fundamental mathematical results and techniques that are useful for other core and field courses in the Ph.D. program in economics.

Equip them with the ability to construct and analyze mathematical economic models.

Enable them to handle constrained and unconstrained optimization problems using classical and modern approaches.

Create understanding of some basic concepts in linear algebra that are useful in econometric analysis.

Enable them to read scientific papers in their areas of interest.

Reading:

There is no required textbook for this course.

Instead this course will be based on a highly acclaimed set of lecture notes by Prof. T. Mitra of Cornell University for a similar course. These notes will be circulated in class.

Recommended supplementary reading (optional):

Mathematics for Economists by Carl Simon and Lawrence Blume, W. W. Norton & Co., 1994. ISBN 0-393-95733-0.

A First Course in Optimization Theory by Rangarajan Sundaram, Cambridge University Press, 1996. ISBN 0-521-49770-1.

Home Assignments:

Home assignments will be given out from time to time. It is extremely important that students work on these assignments on their own. Solutions will be circulated or discussed in class.

Examinations:

One midterm and one final exam.

Evaluation:

Final grade will be assigned on the following basis:

Midterm Exam (50%)

Final exam (50%).

Tentative List of Topics

I. Linear Algebra:

Vectors: Vector Spaces, Linear Dependence, Rank and Basis, Inner Product and Norm.

Matrices: Matrix Algebra, Rank, Inverse, Invertible and Non-Singular Matrix.

Simultaneous Linear Equations: Existence, Uniqueness and Calculation of solutions, Determinants, Matrix Inversion, Cramer's Rule.

Characteristic Values and Vectors: Trace and Determinant, Symmetric Matrices, Spectral Decomposition, Quadratic Forms & Characterization.

II. Real Analysis:

Basic concepts: Norm, Distance, Open & Closed Sets, Convergence of Sequences, Compact Sets, Continuous functions, Existence of solutions to constrained optimization problems.

Differential calculus: Partial derivatives, chain rule, Homogenous functions and Euler's theorem, Inverse and Implicit function theorems

Convex analysis: Convex sets, Separating hyperplane theorem, Continuous and Differentiable functions on convex sets, Concave functions, Quasi-concave functions.

Set valued mappings & Continuity.

Maximum theorem and Fixed point theorems.

III. Classical Optimization Theory:

Unconstrained optimization: Necessary and sufficient conditions for Local and Global Maximum, the Method of Least Squares and the Envelope Theorem.

Constrained Optimization: Necessary conditions for a local maximum, the Arithmetic Mean-Geometric Mean inequality, Sufficient conditions for a local and a global maximum.

IV. Modern Optimization Theory.

Concave programming: Constrained Global Maxima and Saddle Points, the Kuhn-Tucker conditions, Constrained Local and Global Maxima.

Quasi-concave programming: the Sufficiency Theorem of Arrow-Enthoven

The Necessity Theorem of Arrow-Enthoven.

Linear Programming: the Primal and Dual problems, Optimality Criterion, the Basic Duality Theorems, Complementary Slackness.

Monotone comparative statics.

Other rules:

• Disability Accommodations: Students needing academic accommodations for a disability must first register with Disability Accommodations & Success Strategies (DASS). Students can call 214-768-1470 or visit http://www.smu.edu/Provost/ALEC/DASS to begin the process. Once registered, students should then schedule an appointment with the professor as early in the semester as possible, present a DASS Accommodation Letter, and make appropriate arrangements. Please note that accommodations are not retroactive and require advance notice to implement.

• Religious Observance: Religiously observant students wishing to be absent on holidays that require missing class should notify their professors in writing at the beginning of the semester, and should discuss with them, in advance, acceptable ways of making up any work missed because of the absence. (See University Policy No. 1.9.)

• Excused Absences for University Extracurricular Activities: Students participating in an officially sanctioned, scheduled University extracurricular activity should be given the opportunity to make up class assignments or other graded assignments missed as a result of their participation. It is the responsibility of the student to make arrangements with the instructor prior to any missed scheduled examination or other missed assignment for making up the work. (University Undergraduate Catalogue)