Mathematical Economics (ECON 600)
Summer-Fall 2011

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Schedule:
Summer August 15 - Sept 2 (9am-12am) Dennison 130 (Except Aug 17 1427 MH)
Exam on Sept 2 (Friday)
Fall TuTh 10:00AM - 11:30AM E1530 BUS

Suggested Textbook:
- Simon and Blume, Mathematics for Economists, 1994. (S & B)

Other Texts Useful but NOT Required for this Course:
- Sundaram, A First Course in Optimization Theory, 1996.

Course website:
You may access the course website at: https://ctools.umich.edu/ On the web site you can find updates to the syllabus, supplementary notes, problem sets, and other material related to the course. Lecture notes will also be provided as the course progresses. Please check the web site regularly to remain up to date.
Brief Description and Aim:

This course is concerned with developing the basic mathematical tools needed for advanced study in economics. It will also improve your understanding of economic theory; make your other economics courses much easier.

Do we have to study math in order to do economics? Yeah. You got to have a quantitative mind. It might even be fun. We should consider “math” as a language which is a way of representing and conveying information. You might not like to learn another language but you have to if you want to communicate with others. Now I am guiding you to learn and love (if possible) a different language, math. Math helps us to understand much more complicated material.

In this course, we will not only solve problems but also prove things, and that is a significant conceptual part of this course. This will require you to take a more formal approach to mathematics. Not only will you need to know these, but you will have to understand them, and be able (through the use of them) to demonstrate that you understand them. Simply learning the definitions without understanding what they mean is not going to be adequate.

I highly recommend you to study for this course on a daily basis to produce the best outcome. Doing assigned exercises is essential for your success. Since each topic is built on preceding topics, make sure that you understand the core of the material before we move to the next topic. Do not hesitate to contact me and/or your GSI for your questions.

Organization and Grading:
The course has two elements: a summer session and a fall session. The summer session will represent the bulk of our course hours. During the summer session there will be three graded problem sets, one ungraded problem set, and one test. During the fall session, there will be regular problem sets and a final exam. All exams are closed book. The problem sets can, and should, be worked on in groups, though each student is required to turn in his or her own problem set. Problem sets are due at the beginning of class. Late problem sets will not be accepted.

The grading weights are as follows:

- Problem sets 20
- Summer test 35 (Sep 2)
- Final exam 45 (Oct 6)

Summer Problem Set:

- Problem Set I is due August 17
- Problem Set II is due August 22
- Problem Set III is due August 25
- Problem Set IV is due September 1

The following schedule will guide us. In the course, we will undoubtedly skip over some of this material, and cover additional material that is not in the texts but will be in the lecture notes.
| # 1 | **Introduction & Basics** | Elements of Set Theory and Logic  
How to do “proofs”? |
| # 2 | **Mappings** | Relations,  
Functions,  
Sequences,  
Correspondences,  
Vectors,  
Matrices |
| # 3 | **Analysis in R** | Sequences in R,  
Lim Inf and Lim Sup,  
Limits Sequences in R, |
| # 4 | | Functions in R,  
Continuity,  
Differentiation and Integral, |
| # 5 | **Metric Spaces** | Definition and Examples,  
Open and Close Sets |
| # 6 | | Compact Sets,  
Completeness, |
| # 7 | **Linear Spaces** | Introduction,  
Linear Subspaces,  
The Span of A Set of Vectors,  
Linear Independence and Basis, |
| # 8 | | Hyperplanes,  
Orthogonal Projections, |
| # 9 | | Subsets of Linear Spaces,  
Affine Sets,  
Convex Sets and Convex Hulls,  
Simplex and Convex Cone,  
Eigenvalues and Eigenvectors, |
| #10 | Optimization | Existence  
|     |             | Unconstrained Optimization  
|     |             | First Order Conditions  
|     |             | Second Order Conditions  
| #11 | Constrained Optimization | Equality Constraints  
|     |             | The Theorem of Lagrange  
|     |             | Constraint Qualifications  
| #12 | Inequality Constraints | The Kuhn-Tucker Theorem  
|     |             | Mixed Constraints  
| #13 | Parametric Maximization | The Maximum Theorem  
|     |             | Fixed Point Theorem  
| #14 | Differential Equations | Linear differential equations  
|     |             | Nonlinear differential equation  
|     |             | Systems of differential equations  
| #15 | Optimal Control | The Hamiltonian and the maximum principle  
|     |             | the transversality condition  
|     |             | When are necessary conditions also sufficient  
|     |             | Infinite planning horizons  
| #16 | Difference Equations | Deterministic difference equations  
|     |             | Rational expectations and uncertainty  
|     |             | Nonlinear difference equations  
| #17 | Dynamic Programming | Deterministic finite-horizon problems  
|     |             | Deterministic infinite-horizon problems  
|     |             | Dynamic programming and optimal control  
|     |             | Stochastic dynamic programming  

Oct 6 Final