Economics 7808  
Quantitative Analysis  
Fall 1997

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Phone: 492-8145  
Meeting Times: T/TH, 3:30-4:45 p.m.

Location: Econ 2  
Office Hours: Wednesday 2-4 and by appointment

Textbooks:  
- Optimization in Economic Theory by A.K. Dixit  
- Analysis with an Introduction to Proof by S.R. Lay plus supplemental readings

Course Purpose

Contemporary economics is highly mathematical. Pick up any top journal such as the American Economic Review or Econometrica and you will find that most articles use quite sophisticated mathematics. It is imperative that you attain a high comfort level in applied mathematics in order to succeed as a scholar. This course is intended to serve as a primer in the attainment process. My vision of the course is that it will serve two purposes: (1) to equip you with basic skills that are necessary for completing the Ph.D.; and (2) to provide you additional tools that will help you later apply mathematical reasoning to your own research.

Teaching Philosophy

To most beginning economic Ph.D. students, the biggest shock upon entering the program is the emphasis on mathematics. My pledge to you is that I will make every effort to make the material accessible to you and to be available for help during difficult times.

Your Philosophy (ideally)

Do not get hung up on how much more or less knowledgeable others are relative to you. Approach the course in a mature manner. Participate in class by asking questions and providing your own insights. Help fellow students and allow yourself to be helped by other students. Your fellow students will turn out to be one of your greatest assets throughout graduate school. Start developing ties today. Do all required and suggested assignments. DO NOT PANIC! Rather than fall into despair, come see me when in doubt. Be nice to fellow students and me.

Course Description

The course will be taught in five sections.

Section 1 - Logic and Proof (Lay, chap. 1)  
This section will provide the basis for doing mathematical proofs. Note that it is not listed in the University's course description. Many economists know optimization well, but are ignorant regarding logic and proof techniques. This ignorance often results in unnecessary torture (on the part of both writers and readers). This section is provided on the behalf of humanity. Topics will include establishing logical equivalences through truth tables, proof by induction, proof by contradiction, proof by contraposition, and direct methods of proof.
Section 2 - Static Optimization (Dixit chaps. 1-5)
Static optimization provides the bread and butter for most economists. Therefore it is a must that you thoroughly understand the basic class of static optimization problems typically applied in economics. Special emphasis will be placed on the Kuhn-Tucker theorem and the conditions provided therein.

Section 3 - Dynamic Optimization (Dixit chaps. 10, 11, and supplemental readings)
Problems in macro and natural resource economics are typically developed in a dynamic framework because choices over time are the subject of interest. This general class of problems is admittedly more difficult than static choices. However, several key theorems provide the basis for examining dynamic problems using our static intuition (you’ll see when we get there). This section will cover basic dynamic optimization techniques and provide you the opportunity to practice these techniques. Topics to be covered include the maximum principal, the Hamiltonian in discrete and continuous time, and dynamic programing under certainty and uncertainty.

Section 4 - Topics in Probability and Statistics
Basic econometric techniques rely on optimization for estimating models. In estimation problems we typically want to find the “best” model from a given model class. The trick is defining what we mean by best in a precise manner and then using this criterion to select from the model class. This section will provide an introduction to maximum likelihood estimation. You will be introduced to the philosophy of maximum likelihood and the general large-sample properties of maximum likelihood estimators.

Section 5 - Real Analysis (Lay, chaps. 4-6)
Most economic models rely on differentiable techniques. Without differentiability, we would have no marginal economic intuition. Real analysis lies at the heart of differentiability and therefore some basic knowledge of this topic is extremely helpful. It will also provide you the opportunity to apply the proof techniques and logic from section 4. Topics will include real-valued functions, sequences, limits, continuity, differentiation, and theorems relevant to optimization.

Evaluative Criteria

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<th>Evaluative Criteria</th>
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<tr>
<td>Midterm I</td>
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<td>Midterm II</td>
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<td>Homework</td>
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<td>Final Exam</td>
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The midterm examinations and final will be in-class examinations. Make-up exams will be allowed only under exceptional circumstances. Homeworks will be graded and on many occasions, you will be called upon (randomly) to present homework results on the board. There will also be group exercises that will be done in and out of class. The subjective evaluation will be based on class participation and your demonstration of dedication to the class.
Important Dates

September 5- Last day to drop without professor's signature
September 10- Last day to drop without being assessed fees and receiving W on transcript
September 25- Midterm I
October 8- Last day to drop without petitioning the dean
October 30- Midterm II
November 27-30- Thanksgiving Holiday
December 10 (Wednesday)- Last Day of Class
Final Exam- December 15 (Monday) 3:30 - 6:30 p.m.