UNIVERSITY OF WATERLOO

Department of Economics

Economics 311 – Mathematical Economics

Fall 2011
Lecture: Tuesday and Thursday 4:00-5:20 PAS 1241

Instructor: Ryan George
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Office: Hagey Hall, room 218
Office Hours: Tuesday 12-1:30

Course Description:

This course presents some of the tools of mathematical analysis necessary for understanding modern economic theory. We will survey areas of real analysis, advanced calculus, concave programming, and dynamic optimization and examine applications to consumer theory, existence of competitive equilibrium, comparative statics of firm behaviour, and growth theory.

Course Objectives:

The course aims to:

1. Give economics students the opportunity to develop greater sophistication in the use of mathematics and the construction of logical arguments.

2. Expose students to areas of mathematics that are especially useful to economic theory.

3. Demonstrate the use of these tools through several theoretical applications.

Evaluation: The course grade will be based on five problem sets, a midterm exam and a final exam.

Problem Sets   (5 @ 9%)   =   45%

Midterm Exam (Oct.18)   =   15%

Final Examination   =   40%

Problem Sets: In order to develop the skills that the course seeks to encourage students must work problems. A problem set will be due every week and a half (see the course schedule for due dates). The problems will be posted on UW-ACE. **The problem sets should be handed in to the instructor in class on the due date**. Since solutions will be posted the day after they are due, **no late problem sets will be accepted.** There will be

five over the term, valued at 9% of the final grade each. Each problem set will involve the topics of the preceding few weeks. Students may discuss problems but they are expected to write up the solutions themselves. Struggling with these problems is an essential means of preparing for the exams.

Midterm Exam: There will be one midterm exam worth 15% of the final grade in class on October 18th. It will test students' acquisition and dexterity with the material in the lectures and problem sets to that date.

Final Exam: The comprehensive final exam will be scheduled during the formal exam period. It will count for 40% of the final grade. Similar in structure to the midterm and problem sets, it will test students' ability to apply concepts and construct proofs of a mathematical nature and through economic applications.

Missed work with valid reasons: If a student is unable to take the midterm or submit a problem set for documented reasons her/his mark will be calculated by transferring the weight of the missed exam or assignment to the final exam.

Required Textbook: Carl Simon and Lawrence Blume. *Mathematics for Economists.* New York: Norton, 1994. [**SB**]

Additional Reading Materials In addition to the course textbook, the following two books are on reserve at Porter Library. They will be used selectively for the lectures, and may be helpful for those seeking a more extensive treatment of topics that we can only touch upon.

Angel de la Fuente, *Mathematical Methods and Models for Economists*. Cambridge: Cambridge University Press, 2000. [**dlF**]

Daniel Leonard and Ngo Van Long. *Optimal Control Theory and Static Optimization in Economics*. Cambridge: Cambridge University Press, 1992. [**LvL**]

Communicating with the instructor. The instructor will rely upon UW-ACE to make announcements, and post problem sets and their solutions. Please use email for administrative concerns. I will be available during office hours to discuss course material, or by appointment in cases where students cannot attend them.

Cross-listed course:
Please note that a cross-listed course will count in all respective averages no matter under which rubric it has been taken. For example, a PHIL/PSCI cross-list will count in a Philosophy major average, even if the course was taken under the Political Science rubric. Please note that a cross-listed course will count in all respective averages no matter under which rubric it has been taken. For example, a PHIL/PSCI cross-list will count in a Philosophy major average, even if the course was taken under the Political Science rubric.

Academic Integrity:
Academic Integrity: In order to maintain a culture of academic integrity, members of the University of Waterloo are expected to promote honesty, trust, fairness, respect and

responsibility.

Discipline: A student is expected to know what constitutes academic integrity, to avoid committing academic offences, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course professor, academic advisor, or the Undergraduate Associate Dean. When misconduct has been found to have occurred, disciplinary penalties will be imposed under Policy 71 – Student Discipline. For information on categories of offenses and types of penalties, students should refer to Policy 71 - Student Discipline,
http://www.adm.uwaterloo.ca/infosec/Policies/policy71.htm

Grievance: A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70 - Student Petitions and Grievances, Section 4,
http://www.adm.uwaterloo.ca/infosec/Policies/policy70.htm

Appeals: A student may appeal the finding and/or penalty in a decision made under Policy 70 - Student Petitions and Grievances (other than regarding a petition) or Policy 71 - Student Discipline if a ground for an appeal can be established. Read Policy 72 - Student Appeals, http://www.adm.uwaterloo.ca/infosec/Policies/policy72.htm

Academic Integrity website (Arts):
http://arts.uwaterloo.ca/arts/ugrad/academic_responsibility.html

Academic Integrity Office (UW): http://uwaterloo.ca/academicintegrity/

Accommodation for Students with Disabilities:

Note for students with disabilities: The Office for Persons with Disabilities (OPD), located in Needles Hall, Room 1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the OPD at the beginning of each academic term.

Course Schedule:

Date	Lecture Topic	Reading Material	Problem Sets
Week One			
September 13	Sets, proofs, real numbers;	**SB** A1 – Sets, Numbers and Proofs;	
September 15	Vectors and linear independence	**SB** 10.1-10.3; 11	PS 1 posted
Week Two			
September 20 and 22	Functions, Correspondences, sequences, metric spaces, norms and limits	**SB** 13.1, 13.5, 12.1-12.2, 10.4	
Week Three			
September 27 and 29	Open, Closed sets; Cauchy sequences, Compact sets;	**SB** 12.3-12.5, 29	PS 1 **Due Sept 27th;** PS 2 posted
Week Four			
October 4	Continuity, Contraction Mapping and Fixed Point Theorems	**SB** 13.4,	
October 6	Existence of Walrasian Equilibrium	**M-C**	
Week Five			
October 11	Multivariate Calculus	**SB** 14	**PS 2 Due Oct 11th**
October 13	Implicit Function Theorem and Comparative Statics in Economics	**SB** 15	
Week Six			
October 18	**MIDTERM EXAM**		
October 20	Concave Functions and Definite Matrices	**SB** 16, 21.1-3	PS 3 posted
Week Seven			
October 25	Convex Sets and Separation	**dlF** 6 section 1	
October 27	Neoclassical Duality	**Mas-Colell** *Microeconomic Theory*	
Week Eight			
November 1 and 3	Constrained Optimization: Nonlinear programming	**SB** 18.2-18.6, 19.3-19.6, 21.5	**PS 3 Due November 1;** PS 4 posted

Week Nine			
November 8	Constrained Optimization contd.		
November 10	Value Functions and Envelope Theorems	**SB** 19.1-19.2	
Week Ten			
November 15 and 17	Introduction to Dynamics	**SB** portions of 23-25 – to be announced	**PS 4 Due;** PS 5 posted;
Week Eleven			
November 22 and 24	Dynamic Programming	**dlF** 12	
Week Twelve			
November 29 and Dec.1	Optimal Control Theory	**LvL** 3 and 4	**PS 5 due Nov 29th**