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
Phone: 519-888-4567 ext. 33169
Email: r22georg@uwaterloo.ca

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 he/she 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.*

**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:
University Press, 2000. [dLF]

Daniel Leonard and Ngo Van Long. *Optimal Control Theory and Static Optimization in

**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:

<table>
<thead>
<tr>
<th>Date</th>
<th>Lecture Topic</th>
<th>Reading Material</th>
<th>Problem Sets</th>
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</thead>
<tbody>
<tr>
<td><strong>Week One</strong></td>
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<tr>
<td>September 13</td>
<td>Sets, proofs, real numbers;</td>
<td>SB A1 – Sets, Numbers and Proofs;</td>
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<tr>
<td>September 15</td>
<td>Vectors and linear independence</td>
<td>SB 10.1-10.3; 11</td>
<td>PS 1 posted</td>
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<td><strong>Week Two</strong></td>
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<tr>
<td>September 20 and 22</td>
<td>Functions, Correspondences, sequences, metric spaces, norms and limits</td>
<td>SB 13.1, 13.5, 12.1-12.2, 10.4</td>
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<td><strong>Week Three</strong></td>
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<tr>
<td>September 27 and 29</td>
<td>Open, Closed sets; Cauchy sequences, Compact sets;</td>
<td>SB 12.3-12.5, 29</td>
<td>PS 1 Due Sept 27th; PS 2 posted</td>
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<td><strong>Week Four</strong></td>
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<tr>
<td>October 4</td>
<td>Continuity, Contraction Mapping and Fixed Point Theorems</td>
<td>SB 13.4,</td>
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<td>October 6</td>
<td>Existence of Walrasian Equilibrium</td>
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<td><strong>Week Five</strong></td>
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<tr>
<td>October 11</td>
<td>Multivariate Calculus</td>
<td>SB 14</td>
<td>PS 2 Due Oct 11th</td>
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<tr>
<td>October 13</td>
<td>Implicit Function Theorem and Comparative Statics in Economics</td>
<td>SB 15</td>
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<td><strong>Week Six</strong></td>
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<td>October 18</td>
<td>MIDTERM EXAM</td>
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<tr>
<td>October 20</td>
<td>Concave Functions and Definite Matrices</td>
<td>SB 16, 21.1-3</td>
<td>PS 3 posted</td>
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<td><strong>Week Seven</strong></td>
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<tr>
<td>October 25</td>
<td>Convex Sets and Separation</td>
<td>dlf 6 section 1</td>
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<td>October 27</td>
<td>Neoclassical Duality</td>
<td>Mas-Colell</td>
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<td><em>Microeconomic Theory</em></td>
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<td><strong>Week Eight</strong></td>
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<td>November 1 and 3</td>
<td>Constrained Optimization: Nonlinear programming</td>
<td>SB 18.2-18.6, 19.3-19.6, 21.5</td>
<td>PS 3 Due November 1; PS 4 posted</td>
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<td>Week Nine</td>
<td>November 8</td>
<td>Constrained Optimization contd.</td>
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<td>November 10</td>
<td>Value Functions and Envelope Theorems</td>
<td>SB 19.1-19.2</td>
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| 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 |

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