

**Mathematics for Economists**

**ECO 740**

**Section 1**

**S 8:30 to 11:15 AM**

**CBC C313**

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**Fall 2004**

**Text:** *Mathematical Economics*, by Jeffery Baldani, James Bradfield and Robert Turner (BBT), Thomson Learning, Southwestern, 2001 and *Introduction to Mathematical Economics* by Edward Dowling (D), Schaum Outline Series, 2001.

**Office Hours:** TR 3:30 to 5:00 PM and by appointment

**Objective:** Students who successfully complete this course will learn the basic tools of differential calculus, matrix algebra, and game theory used in our MA program. In addition, all of the tools receive illustration with economic examples from both microeconomic and macroeconomic theory as well as other specific field courses such as industrial organization.

**Evaluation:** The course evaluation for each student involves two separate components. First, each student must do the 14 homework assignments. I drop the four lowest scores. Homework assignments are due in the Saturday class. Second, each student will take the three in-class exams. The first two exams are given in the Saturday class. The final exam is not comprehensive, but only covers the material not covered in exams 1 and 2. The final exam is given during the exam week on Saturday during the regular class time. While I prefer to maintain some flexibility in the weights assigned to the components in the final course grade, I will weight the component parts as follows: 35% for the graded homework assignments, 15% for the first exam, and 25% each for the last two exams.

**WebCT:** This course is a WebCT course. I will post the course outline, homework assignments, other handouts, and so on at the WebCT site. You can access this site 24/7, except for scheduled maintenance on the system and unexpected downtimes due to technical glitches.

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**Academic**

**Dishonesty:** Academic dishonesty (e.g., cheating and plagiarism) will not be tolerated. At the instructor's discretion, a student suspected of academic dishonesty may receive an F for the course and be expelled from the class. Additional penalties, up to expulsion from the University, are possible.

**Disabilities:** If you have a documented disability that may require assistance, you will need to contact the Disability Resource Center (DRC) for coordination in your academic accommodations. Disabilities Services is located within Learning Enhancement Services (LES), in the Reynolds Student Services Complex, Suite 137. The phone number is 895-0866 or TDD 895-0652. The e-mail address is [drcssc@cmail.nevada.edu](mailto:drcssc@cmail.nevada.edu).

**Course Outline**

	<b>Topics Covered</b>	<b>Assigned Readings and Homework Problems</b>
<b>Week 1</b>	Review of derivatives Rules for derivatives Partial derivatives Concavity and convexity Marginal analysis Elasticities Economic models Optimization Examples of optimization <ul style="list-style-type: none"> <li>• Labor unions</li> <li>• Profit maximization               <ul style="list-style-type: none"> <li>○ Competitive firm</li> <li>○ Monopoly</li> <li>○ Duopoly</li> <li>○ Oligopoly</li> </ul> </li> </ul> Simple macroeconomic model: <ul style="list-style-type: none"> <li>• Keynesian multipliers</li> </ul>	BBT: Chapters 1 and 2. D: Chapters 1, 2, 3, 4, 7, and 8. Practice Problems: A1(a),(b), (f),(h); A2(a),(f); A3(a),(d); A6(a),(c), 2.3, 2.5 Homework 1: 2.9
<b>Week 2</b>	System of equations <ul style="list-style-type: none"> <li>• Matrix form</li> </ul> Definition of scalars, vectors, and matrices <ul style="list-style-type: none"> <li>• Addition, subtraction, and multiplication</li> </ul> Identity matrix Inverse matrix Cramer's rule	BBT: Chapter 3. D: Chapters 10, 11, and 12. Practice Problems: 3.2, 3.3, 3.10 Homework 2: 3.7, 3.12 Homework 1 due.
<b>Week 3</b>	Applying matrix algebra <ul style="list-style-type: none"> <li>• One competitive market</li> <li>• Two competitive markets</li> <li>• Two firms with differentiated products</li> <li>• Simple and complex duopoly</li> <li>• Simple and complex triopoly</li> <li>• Simple Keynesian model</li> <li>• IS-LM model</li> </ul>	BBT: Chapter 4. D: Chapters 10, 11, and 12. Practice Problems: 4.1, 4.5 Homework 3: 4.8 Homework 2 due.
<b>Week 4</b>	Partial derivatives Differentials Total differentials Implicit function theorem Level curves Homogeneity, Euler's theorem, and corollary <b>Exam 1 (weeks 1 to 3)</b>	BBT: Chapter 5. D: Chapters 5, 6, and 9. Practice Problems: 5.7(a),(b); 5.8(a),(b) Homework 4: 5.5(c), 5.6(c) Homework 3 due.

<b>Week 5</b>	<p>Applications of multivariate calculus</p> <ul style="list-style-type: none"> <li>Balanced budget multipliers</li> <li>IS-LM-(AD)-AS model</li> <li>Fiscal and monetary policy effectiveness in IS-LM model</li> <li>Excise tax on monopolist</li> <li>Multi-market equilibrium</li> <li>Duopoly</li> <li>Labor supply</li> <li>Utility maximization</li> <li>Homogeneity of consumer demands</li> <li>Homogeneity of input demands</li> </ul>	<p>BBT: Chapter 6. D: Chapters 5, 6, and 9. Practice Problems: 6.6, 6.14, 6.16, 6.28 Homework 5: 6.5 Homework 4 due.</p>
<b>Week 6</b>	<p>One-variable optimization: Review Two-variable optimization Hessian determinants Multiple-variable optimization Concavity, convexity, and optimization Comparative static analysis</p>	<p>BBT: Chapter 7. D: Chapters 5, 6, and 9. Practice Problems: 7.4(a), 7.9(b) Homework 6: 7.1(a), 7.9(a) Homework 5 due.</p>
<b>Week 7</b>	<p>Examples of multivariate optimization</p> <ul style="list-style-type: none"> <li>Competitive firm input choice</li> <li>Efficiency wages</li> <li>Multi-plant firm profit maximization</li> <li>Multi-market monopoly profit maximization</li> <li>Deriving least squares estimates</li> </ul>	<p>BBT: Chapter 8. D: Chapters 5, 6, and 9. Practice Problems: 8.2, 8.4, 8.10 Homework 7: 8.9 Homework 6 due.</p>
<b>Week 8</b>	<p>Constrained optimization Lagrangian method Bordered Hessian determinants Multiple constraints Quasi-concavity, quasi-convexity, and constrained optimization Comparative static analysis Value functions: Preview</p>	<p>BBT: Chapter 9. D: Chapters 5, 6, and 9. Practice Problems: 9.1(c), 9.2(e), 9.3(e), 9.4(e), 9.5 Homework 8: 9.1(d), 9.3(d) Homework 7 due.</p>
<b>Week 9</b>	<p>Examples of constrained optimization</p> <ul style="list-style-type: none"> <li>Cost minimization and input demands</li> <li>Profit maximization and input demands</li> <li>Utility maximization and individual demands</li> <li>Intertemporal consumption: Time preference</li> <li>Labor supply</li> <li>Utility maximization with two constraints</li> <li>Pareto efficiency and Pareto optimality</li> </ul>	<p>BBT: Chapter 10. D: Chapters 5 and 6. Practice Problems: 10.3(a), (c),(d), 10.17(c) Homework 9: 10.17(a) Homework 8 due.</p>
<b>Week 10</b>	<p>Professor Viner and the cost curves Value function Envelope theorem Interpretation of Lagrangian multiplier Applications of value function and envelope theorem</p> <ul style="list-style-type: none"> <li>Duality</li> <li>Roy's identity</li> <li>Shepard's lemma</li> <li>Slutsky equation</li> <li>Cost curves and Professor Viner: Revisited</li> <li>Reciprocity relations</li> <li>Two-part tariffs</li> <li>Ramsey tax</li> </ul> <p><b>Exam 2 (weeks 4 to 9)</b></p>	<p>BBT: Chapters 13 and 14. D: Chapter 13. Practice Problems: 13.4, 13.7, 14.1 Homework 10: 13.6 Homework 9 due.</p>

<b>Week 11</b>	Applications of value function and envelope theorem <ul style="list-style-type: none"> <li>• Duality</li> <li>• Roy's identity</li> <li>• Shepard's lemma</li> <li>• Slutsky equation</li> <li>• Cost curves and Professor Viner: Revisited</li> <li>• Reciprocity relations</li> <li>• Two-part tariffs</li> <li>• Ramsey tax</li> </ul> Static games: Complete information Games in normal form Dominance and iterated elimination Nash equilibrium Mixed strategies	BBT: Chapter 14 and 15. D: Chapter 13. Practice Problems: 14.4, 14.5, 15.1(b), 15.2(d) Homework 11: 14.3 Homework 10 due.
<b>Week 12</b>	Static games: Complete information Games in normal form Dominance and iterated elimination Nash equilibrium Mixed strategies Applications of static games <ul style="list-style-type: none"> <li>• Two-firm investment in natural monopoly setting</li> <li>• Cournot duopoly model revisited</li> <li>• Bertrand duopoly model</li> <li>• Rent-seeking behavior</li> <li>• Public goods</li> </ul>	BBT: Chapter 15 and 16. Practice Problems: 16.2, 16.13, 16.15 Homework 12: 15.4 Homework 11 due.
<b>Week 13</b>	No Class	
<b>Week 14</b>	Applications of static games <ul style="list-style-type: none"> <li>• Two-firm investment in natural monopoly setting</li> <li>• Cournot duopoly model revisited</li> <li>• Bertrand duopoly model</li> <li>• Rent-seeking behavior</li> </ul> Public goods Dynamic games: Complete information Games in extensive form Equilibrium in extensive-form games Sub-game perfect Nash equilibrium Two-stage games Repeated games	BBT: Chapter 16 and 17. Practice Problems: 17.1(c), 17.2(c), 17.11 Homework 13: 16.4, 17.1(b) Homework 12 due.
<b>Week 15</b>	Applications of dynamic games <ul style="list-style-type: none"> <li>• Sequential bargaining models</li> <li>• Trade policy and oligopoly</li> <li>• Duopoly leadership models</li> <li>• Repeated games and oligopoly</li> </ul>	BBT: Chapter 18. Practice Problems: 18.1, 18.2, 18.5 Homework 14: 18.10 Homework 13 due.
<b>Week 16</b>	<b>Exam 3 (weeks 10 to 15)</b>	Homework 14 due.