Econ 6390  
Workshop in Research Methods 1:  
Mathematics for Economics

Course Description: This is a first year graduate course that focuses on the structure of economic analysis. Economists extensively use mathematics to help them analyze economic problems and this course covers the mathematics that is most frequently used by economists. The course starts with a brief review of some fundamental math concepts and of one-variable calculus. Topics to be covered in depth include multivariate calculus and optimization (both constrained and unconstrained), convexity, the envelope theorem, matrix algebra, comparative statics, and differential equations. The course emphasizes applications with some attention to proofs. The PC computer program Mathematica may occasionally be used.

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COURSE REQUIREMENTS:  
Midterm 1 (tentatively Fri. Sept. 22)  25%  
Midterm 2 (tentatively Fri. Oct. 27)  25%  
Final Exam (during week of Dec. 5-13)  40%  
Homeworks  10%

Note: Midterms will be held Friday afternoons. The final will be comprehensive. Homeworks will be periodically assigned, but it is highly recommended that you do many of the exercises on your own in Grafton & Sargent, Simon & Blume, Chiang, Silberberg, and Solow.

REQUIRED TEXTS

Carl P. Simon and Lawrence Blume, Mathematics for Economists, Norton, 1994. (more advanced; also on 2-hour reserve in the library) [SB]

Knut Sydsaeter, Arne Strom, and Peter Berck, Economists' Mathematical Manual, Springer-Verlag, 3rd. ed., 1999. (this is a great reference manual that will be useful for all of your courses)
RECOMMENDED TEXTS (available in bookstore)

Alpha Chiang, *Fundamentals of Mathematical Economics*, 3rd. ed., McGraw-Hill, 1984. (highly recommended; is less rigorous than SB; also on 2-hour reserve in the library) [C]


Eugene Silberberg and Wing Suen, *The Structure of Economics: a Mathematical Analysis*, Irwin, McGraw-Hill, 3rd. ed., 2001. (this is a classic text with one of the most painstaking treatments of comparative statics; useful background material for many courses). [SS]

OTHER USEFUL TEXTS (on two-hour reserve; located on the third floor of M. D. Anderson library)


COURSE OUTLINE

note: items in square brackets, [], are optional

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<td>3.  Algebraic Approach to Convexity and Quasiconvexity</td>
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6. One Variable Functions and Calculus  
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   SS 2; SB 3, 4  
   -Taylor series  
   C 9.5; SS 2.5  
   SB 30.2

7. Maxima, Minima, and Convexity I  
   C 9; SB 3.5, 3.6  
   [GS 4]

8. Multivariate Functions  
   SB 14.1-14.5  
   C 11.1-11.2  
   SS 3.1-3.5, 15.1-15.2  
   SS 5.3  
   SS 3.6, 9.1-9.2  
   SB 20; [GS 3]

9. Integration  
   C 13  
   [SB A4; GS 10]

10. Matrices and Determinants  
    SB 7.1-7.4, 8.9  
    C 4, 5  
    [GS 2]  
    -vector spaces  
    SB 10.1-10.3, 10.7  
    SB 11.1  
    SB 23.1, 23.3  
    C pp. 326-330

11. Maxima, Minima, and Convexity II  
    SB 16, 17  
    C 9, 11  
    SB 21.1-21.3  
    S 4, 6  
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12. Constrained Optimization with Equality  
    Constraints  
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    SB parts of 18-19;  
    [D 2, 4]  
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13. Envelope Theorem, Value Functions,  
    and Duality  
    SS 7  
    [GS 6]

14. Constrained Optimization with Inequality  
    and Nonnegativity Constraints  
    SS 14  
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15. Differential Equations

[D 3,4; C 21.1-21.3]
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