

Syllabus

MATHEMATICAL ECONOMIC ANALYSIS

Course: Econ 521.01

Term: Fall 2002

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Course Objective

This course is concerned with developing the basic mathematical tools needed for advanced study in economics. Topics include the following. Sets and methods of proof. Sets in the theory of choice. Sets in the theory of knowledge. Functions and economic models. Linear models and matrix algebra. Comparative static analysis of linear models. Differential calculus. Comparative static analysis of non-linear models. Univariate and multivariate optimization. Comparative dynamic analysis. Some computer applications of these mathematical methods.

General comment: This is a *math* course. Some students find they must struggle because their math skills are not up to snuff. Some students are frustrated because they cannot understand why they are studying math when they have entered an *economics* program. Occasionally a student who is both struggling and frustrated will start to blame the world rather than take personal responsibility. This is no fun for anyone: please do not let this happen to you. Economics has been mathematized in order to allow discussions that otherwise cannot take place. You will encounter these discussions in your theory and field courses. By the standards of the profession, the mathematical level of this course is very modest. Improving your mathematical understanding is a necessary part of preparing yourself to enter your chosen profession.

Specific comment to this semester:

This is a course for entering Ph.D. students, who have been brushing up their math skills all summer. I was very surprised to see some students registered in this class who are not currently in the Ph.D. program in economics. This is *very* unlikely to be a good idea. Please consider Econ-505 instead. Last year I had to give some failing grades, which is very unpleasant for all concerned.

Course Organization

Discussion and exams will reward those who prepare in advance. The exams will draw heavily on the homework assignments given throughout the semester. Homework is not always "required" in the sense of being collected and graded; even so, it is preparatory for subsequent classes and exams. Ongoing study groups to work on the uncollected homework problems are therefore highly recommended. You are also free to discuss the collected homeworks individually or in groups, as long as you do the write-up on your own and, in accord with the canons of academic honesty, acknowledge help received (in writing, on your assignment).

Let me repeat: you are to do the write-up on your own. Copied algebra or computer code is a violation of academic ethics and is grounds for dismissal from the program.

We will use the GAUSS programming language in this course. GAUSS is available on campus, but there is a free student version that you can use at home. You will need to **download it**.

This class will use the **Blackboard CourseInfo** software. Look there for the syllabus, lecture notes, and homework. We will also use a listserv mailing list. You must **subscribe**: send an email to listserv@listserv.american.edu containing the single line of text:
subscribe econ-521-f02-L Your Name

All students are expected to monitor the class email list, which may contain homework problems and reading assignments.

Course Prerequisites

The prerequisite for this course is two semesters of calculus. (You may take the second semester concurrently.) Admission to the Ph.D. program in Economics is strongly recommended. Concurrent enrollment in econometrics is recommended. I also consider a commitment to upholding the **Academic Integrity Code for American University** to be prerequisite to participation in this course. Be sure to read it. If you feel you may have violated this code of ethics, please talk with me immediately. In cases where there has been a violation of the code of ethics, it will be far better if you contact me, rather than vice versa. I understand the pressure that you may experience in graduate school, and I will try to help you.

Grading

Grading will be based on homework and classroom preparedness (15 percent), a midterm exam (35 percent), and a cumulative final exam (50 percent). Exams are taken without the aid of textbooks or of notes of any kind, and no collaboration will be allowed on exams. I offer no extra credit, and there will be no makeup exams. (Exams may be missed with a doctor's excuse; the grade will then be calculated from the remaining exams.) Exams presume a thorough knowledge of the graded and ungraded homework assignments given throughout the semester.

MIDTERM EXAMINATION: 17 October

FINAL EXAMINATION: 12 December

(The AU schedule of classes **always** determines the date of the final, so please check your schedule of classes.)

All homework should be typed and submitted to my teaching assistant by email. (I will post my TA's email address to the class email list.) Always copy me on any email to my teaching assistant, including these assignment submissions. Be sure to include the course number and assignment number in the subject of your email. For programming assignments, you should submit a working program file. (Run it right before sending it, since I will not grade programs that do not run.) For analytic and algebraic exercises, I prefer to receive them as Scientific Notebook files. **LaTeX** and PDF formats are also acceptable. I do not accept files in proprietary word-processor formats (.doc, .wpd, etc.).

My TA grades the homework. You may request supplementary comments from the TA, but do not request grade changes. If you wish to contest a homework grade, you may submit your homework to me for regrading of the entire assignment. It is only fair to note that although I instruct my TA to be quite generous in grading, I do not feel so constrained.

Ongoing study groups are highly recommended. Study groups are an excellent means of mastering the course material. They are also a core part of the experience of graduate education. Besides, they are fun. I encourage you to discuss the problem sets with others, but there are strict terms for such collaboration. You must cite all of your collaborators at the front of your submitted solutions. Also, you must write up solutions on your own. **To repeat: your write-up of any problem solution must be entirely your own.** The use of pre-packaged sources of solutions to the assigned problems is not permitted. You may neither copy solutions nor provide solutions to be copied. Plagiarism, cheating, and other anti-intellectual behavior will be dealt with severely and can lead to dismissal from the university.

REQUIRED TEXTS

We will use only parts of the following texts, which should be available on reserve. Nevertheless, I strongly encourage you to add the required texts to your professional library.

Carter, Michael, *Foundations of Mathematical Economics* (MIT Press 2001) ISBN: 0-2262-53192-5

Velleman, Daniel J. *How To Prove It: A Structured Approach* Cambridge University Press, Cambridge, England, 1994. ISBN: 0521446635

Recommended Texts

I have requested that some additional texts be put on reserve in the University Library. Consider purchasing any that you find useful. Please note that I consider any marking, underlining, or writing in pencil, pen, or highlighter on any library materials to be defacement of university property, a violation of academic integrity, and grounds for a reduction in your final grade. Please treat all library materials as precious intergenerational resources that you are privileged to share.

Klein, Michael, *Mathematical Methods for Economics, 2/e* (Addison-Wesley 2002) ISBN: 0-201-72626-2

Chiang, Alpha, *Fundamental Methods of Mathematical Economics* (McGraw-Hill)

de la Fuente, Angel, 1999, *Mathematical Methods and Models for Economists* (Cambridge) isbn: 58529-5

Hefferon, Jim, *Linear Algebra* (A free online text.)

Hoy, Micahel et al., 2001, *Mathematics for Economists* (Cambridge, MA: MIT Press) isbn: 0-262-08294-2

Topics And Readings

New articles may be added to the readings during the course. The suggested timing of topics and extent coverage is very tentative and will be revised as the semester progresses.

Week 1
Why Use Math In Economics?

Required: Klein ch.1

Recommended: Chiang ch. 1; Hoy ch. 1;

Week 2-3
Sets And Logic

Required: Carter 1.1, 1.2., 1.3, 1.6; Velleman ch.1,2; de la Fuente 1;

Recommended: Klein ch.2; Chiang 2; Hoy ch. 2;

Week 4
Relations And Functions

Required: Carter 2.1; Klein ch.2; Velleman ch.4,5

Recommended: Chiang 2,3; de la Fuente 1;

Week 5-6
Functions

Required: Carter 2.1; Klein ch.2;

Recommended: Chiang 2,3; de la Fuente 1;

Week 7
Exponents And Logarithms

Required: Carter 2.2; Klein ch.3;

Recommended: Klein ch.7; Chiang ch. 10.1-10.4;

Week 8
An Introduction To Matrix Algebra

Required: Carter 3.1, 3.5; Klein ch.4,5

Recommended: Chiang ch. 4;

Week 9
Economic Models

Required: Chiang ch. 2,3;

Recommended:

Week 9-10
The Comparative Statics Of Linear Models

Required: Klein ch.4,5;

Recommended: Chiang ch. 5;

Week 11-12
Continuity

Required: Carter 2.3;

Recommended: Chiang ch. 6; Klein ch.6;

Week 11-12
Continuity, Differentiability, And Optimization

Required: Carter 4.1, 4.2, 4.3;

Recommended: Klein ch. 6,7,9; Chiang ch. 6;

Week 13
The Comparative Statics Of Non-Linear Models

Required: Carter 4.5;

Recommended: Klein ch. 6,7,8; Chiang ch. 6,7,8;

Week 14
Multivariate Optimization

Required: Carter 5.1, 5.2, 5.3;

Recommended: Klein ch.9,10,11; Chiang ch. 9,11,12,21;

If Time Remains

Polynomials

Required: Carter 4.4;

Recommended: Bezier Curves

Difference Equations

Required: handout

Recommended: Klein ch.13; Chiang ch. 12,14;

Differential Equations

Required: handout

Recommended: Klein ch.14; Chiang ch. 12,14;

Dynamic Optimization

Required: handout

Recommended: Klein ch.15;