Economics 700: Math Camp
Summer, 2019

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BASIC QUANTITATIVE TECHNIQUES

Class Description

This course is the so called "math camp" for the PhD program in economics. The purpose of this course is twofold. First, it provides (or reviews) the necessary mathematical preparation for the Ph.D core sequences in economics. Second, it helps students to develop (or to improve) their ability to read and write formal proofs. The treatment of this course is necessary but not sufficient. The course titled *Analytical Methods for Mathematical Economics* (Econ 701) is the continuation of the current course.

Class Requirements

There will be 3 problem sets. It is strongly recommended that you attempt the problem sets yourself before the solution is posted. You are also encouraged to work in groups., but you need to hand in individual copy of your answer. You may discuss difficulties with your group members, other classmates, and the TA (**in that order**) if you are stuck. Further, there will be 2 in-class midterm and a final exam (all are closed book). The 2nd midterm will only cover material since the first midterm. The final exam is cumulative. Grades for the class will be based on:

- Midterm (10% each)
- Problem sets (30%)
- Final Exam (50%)

Readings

The class covers calculous, linear algebra, optimization theory and real analysis. There is no required textbook, each of the following books almost cover all the topics in the class.

- A. de la Fuente, *Methods and Models for Economists*, Cambridge Univ. Press, 2000.
- C. Simon and L. Blume, *Mathematics for Economists*, W. W. Norton & Company, 1994.
- M. Osborne, *Mathematical methods for economic theory*. online textbook.

In the first two weeks, we focus on real analysis and linear algebra. Here is a list of some references.

- W. Rudin, *Principles of Mathematical Analysis*, McGraw-Hill Education, 1976.
- C. Pugh, *Real Mathematical Analysis*, Springer, 2001.
- G. Strang, *Introduction to Linear Algebra*, Wellesley Cambridge Press, 2016

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In the third week, we will study convex analysis and optimization theory. A short (and sufficient for this course) summary in optimization theory is contained in the appendix of Mas-Colell, Whinston, Green (MWG): *Microeconomic Theory.* It is the required textbook of Econ 710 and 711. The following books provide not only more rigorous theoretical treatment but also many applications.

- R. Sundaram, *A First Course in Optimization Theory*, Cambridge Univ. Press, Cambridge, 1996.
- R. Vohra, Advanced Mathematical Economics, Routledge, 2005

We will use the first recitation to go over some basic techniques of proofs. A reader-friendly treatment of proof methods can be found in the following books.

- R. Hammack, *Book of Proof,* Richard Hammack, 2013

Class Logistics

The class meets on Monday-Friday 9:00-10:15am and 10:45-12:00pm at Gardner RM (TBD). There will be recitations almost every afternoon 1:30-2:20am at Gardner RM (TBD). You are expected to attend all classes and recitations. There is no recitation on Aug. 15th (graduate school orientation) and 17th.

Contacting Us

My e-mail is lifei@email.unc.edu. My office is Gardner 300B.
Your TA for this course is Martin Braun, his e-mail address is mjbraun@live.unc.edu.

Tentative Agenda

1. Set Theory (2 lectures)
2. Real Number (2 lectures)
3. Function and Cardinality (1.5 lectures)
4. Sequence and Limit (2.5 lectures)
5. Midterm I (August 2)
6. Basic Topology (2 lectures)
7. Continuity (2 lectures)
8. Linear Algebra (3 lectures)
9. Differentiation and Implicit Function Theorem (2.5 lectures)
10. Midterm II (August 9)
11. Convex Analysis and Separation Theorem (2 lectures)
12. Concave, Convex and Quasi-Concave Function (2 lectures)
13. Constrained Optimization (3 lectures)
14. Correspondence and Maximum Theorem (2 lectures)
15. Final (August 17)