

BASIC QUANTITATIVE TECHNIQUES

Class Description

This course is also called the “math camp” for the PhD program in economics. The purpose of this course is twofold. First, it provides the necessary mathematical preparation for the Ph.D core sequences in economics. Second, it helps students to develop and to improve their ability to read and write formal proofs. 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 in your daily group meeting (in zoom or in person), and the TA (**in that order**) if you are stuck. Further, there will be two midterm and one 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 calculus, linear algebra, real analysis, and constrained optimization. There is no required textbook. But the following books are helpful.

- 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.

The following books are useful references for real analysis (math 521 and 522), linear algebra (math 347 and 577), and optimization theory.

- W. Rudin, *Principles of Mathematical Analysis*, McGraw-Hill Education, 1976.
- C. Pugh, *Real Mathematical Analysis*, Springer, 2001.
- T. Tao, *Analysis*. Vol. 185. Hindustan Book Agency, 2009.
- G. Strang, *Introduction to Linear Algebra*, Wellesley Cambridge Press, 2016

- Sundaram, Rangarajan K. *A first course in optimization theory*. Cambridge university press, 1996.

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, [Free online copy](#).

Class Logistics

The class meets on Monday-Friday 9:00-10:15am and 10:45-12:00pm at **Kenan Labs B-125**. There will be recitations almost every afternoon 1:30-2:15pm at the same location. You are expected to attend all classes and recitations.

Contacting Us

My e-mail is lifei@email.unc.edu. My office is Gardner 300B.

The TA for this course is David Sun Kim. His email is dskim10@ad.unc.edu.

Tentative Agenda

1. Set Theory (2 lectures)
2. Real Number (2.5 lectures)
3. Function and Cardinality (1.5 lectures)
4. Sequence and Limit (3 lectures)
5. **Midterm I (July 29)**
6. Topology (2 lectures)
7. Continuity (2 lectures)
8. Linear Algebra (4-5 lectures)
9. **Midterm II (August 5)**
10. Differentiation (3-4 lectures)
11. Concave and Quasi-Concave Functions (2 lectures)
12. Constrained Optimization (3 lectures)
13. **Final (TBA)**