Economics 890(5): Quant Techniques II Fei Li
Fall, 2013 lifei@email.unc.edu

# QUANTITATE TECHNIQUES II

## Class Requirements

There will be **5** problem sets. These will be graded coarsely (P+, P, P-). It is **strongly** recommended that you attempt the problem sets yourself. You may discuss difficulties with your classmates, the TA, myself (in that order) if you are stuck.

Further, there will be 2 in-class midterms and a final exam (all are close book). The 2nd midterm will only cover material since the first midterm. The final exam is cumulative. I will make sample exams available about a week before the actual exam.
Grades for the class will be based on:

1. Midterm (20% each) (In class, on September 26rd, October 31st)
2. Problem sets (10%)
3. Final Exam (50%) (In class, December 3rd)

## Readings

There is no required textbook for the class, but you are encouraged to have one of the following real analysis textbooks:

- A. Kolmogorov, and S. Fomin, *Introductory Real Analysis*, Dover Publications, 1975.
- C. Pugh, *Real Mathematical Analysis*, Springer, 2001
- W. Rudin, *Principles of Mathematical Analysis*, McGraw-Hill, 1976.

You might find the following books are also useful for certain topics:

- D. Corbae, M. Stinchcombe, and J. Zeman, *An Introduction to Mathematical Analysis for Economic Theory and Econometrics*, Princeton Univ. Press, Princeton, 2009.
- E. Ok, *Real Analysis with Economic Applications*, Princeton Univ. Press, 2007.
- N. Stokey, and R. Lucas, *Recursive Methods in Economic Dynamics*, Harvard Univ. Press, Cambridge, Massachusetts, 1989.
- R. Sundaram, *A First Course in Optimization Theory*, Cambridge Univ. Press, Cambridge, 1996.
- R. Vohra, *Advanced Mathematical Economics*, Routledge, 2005.

In addition, previous instructor of this course, Peter Norman, has an excellent lecture notes on his website.

## Class Logistics

The class meets on Tuesday and Thursday 12:30-1:45 pm at Murphey Hall 105. You are expected to attend all classes. There is no lecture in the following date: Oct. 17th, and Nov. 28th.

Assignments will be circulated via email. There will be weekly review sessions (Friday 3:00-4:15pm, Gardner Hall 007). Assignments are due in review session at the beginning

of the lecture on the due date.

**Contacting Us**

My e-mail is lifei@email.unc.edu. My office is Gardner 305B. My office hour is Wednesday 1:30-2:30pm. Your TA is Sam Flanders. His email is samf1986@gmail.com.

**Tentative Agenda**

1. Set Theory and Functions (~1-2 weeks)
    a. Operations on Sets
    b. Functions and Mappings
    c. Finite and Infinite Sets
    d. Countability
2. Topology in Metric Space (~2-3 weeks)
    a. Open and Closed Sets
    b. Sequences, Limits and Convergence
    c. Continuity
    d. Compactness and Weierstrass Theorem
    e. Completeness
    f. Connectness and Intermediate Value Theorem
3. Function Space (~1 weeks)
    a. Uniform Convergence in $C^0[a,b]$
    b. Compactness and Equicontinuity in $C^0[a,b]$
    c. Uniform Approximation in $C^0[a,b]$
4. Contraction Mapping Theorem and Its Applications (~1-2 weeks)
    a. Contraction Mapping Theorem
    b. Implicit Function Theorem
    c. Ergodic Distribution of Markov Process
    d. Picard Theorem
5. Linear Space (~2weeks)
    a. Definition and Properties of Linear Space,
    b. Half Space, Hyperplane
    c. Hyperplane Separation (Supporting) Theorem
    d. Farkas Lemma
    e. Applications
6. Optimization in $R^n$ (~2-3 week)
    a. Problem and Existence
    b. Linear Programming
    c. Convex, Concave, and Quasi-Concave Functions
    d. Convex Programming
    e. Maximum Theorem
    f. Envelop Theorem
7. Dynamic Optimization (optional)
    a. Dynamic Programming
    b. Stopping Time Problem and Applications
    c. Optimal Control