ADVANCED MICRO THEORY: MARKET DESIGN

This class studies the design and use of market-based mechanisms to solve problems of economic resource allocation. The goal is to sustain, mentor research experience of students who are major in economics. First, we will re-examine the rational choice theory which you have seen in Intermediate Microeconomics. In particular, we will provide a very formal (mathematical) treatment of rational choice model. The second part of the class will focus on matching markets, in particular the use of centralized market mechanisms to assign campus houses, offices and courses to students, workers to jobs, kidneys to transplant patients and so forth.

Prerequisites
The course catalog lists the prerequisites as: Economics 400 and 410. Ideas you brushed with in microeconomics (Econ 101, 410) will be extensively revisited. Some parts of the class will require familiarity with basic set theory, calculous, linear algebra, probability theory and some amount of symbol manipulation. It is helpful to have some game theory background but not necessary.

Class Requirements
There will be 5 problem sets. It is strongly recommended that you attempt the problem sets yourself. You may discuss difficulties with your classmates, and myself (in that order) if you are stuck.

Further, there will be 2 in-class closed-book midterms, a closed-book final exam. The 2nd midterm will only cover material since the first midterm. I will make 'sample' mid-terms available about 1 week in advance. The final exam is cumulative.

Grades for the class will be based on:

- Midterm (20% each) (In class, on Sep 26th, Oct 24th)
- Problem sets (20%)
- Final Exam (40%) (TBA)

Readings
There is no required textbook for this class. Below I list some *advanced readings*- they develop the underlying theory at a more sophisticated level than we will attempt in this course. However they may be worth a read, especially if you develop a strong interest in the area and/or want to study further.

- Roth, Alvin, *Who Gets What — and Why: The New Economics of Matchmaking and Market Design*, Eamon Dolan/Houghton Mifflin Harcourt, 2015.
- Roth, Alvin and Marilda Sotomayor, *Two-Sided Matching Markets*, Cambridge University Press, 1989.

You are also recommended to read Alvin Roth's blog: http://marketdesigner.blogspot.com

Class Logistics
The class meets on Tuesday and Thursday 11:00-12:15pm at Gardner Hall 008. You are expected to attend all classes. There is no lecture on the following dates: Oct. 12th (University day ceremony), Oct. 19th (fall break), and Nov. 23rd (Thanksgiving).

Course materials (assignments and handouts) will be posted on Sakai.

Contacting Us
 My e-mail is lifei@email.unc.edu. My office is Gardner 300B. My office hours are Tuesday 4:45-5:30pm or by appointment.

Tentative Agenda

Below is a list of topics we would like to cover in this course, in the order we will see them. However, this may be adjusted over the course of the semester to account for time constraints, and to adjust for class interests.

In terms of exams, you *will not be responsible* for material we do not cover, and I will update this list to account for changes.

1. Introduction to Market Design
    a. Logistics for course
    b. Why design markets

2. Rational Decision Theory
    a. Rational preference
    b. Utility theory
    c. Expected utility theory

3. Introduction to Two-Sided Matching Problems

4. Two-sided Matching Theory
    a. Stability as a solution concept
    b. Existence of stable matching/ stability of proposal algorithm

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   c. Man-optimality of men proposing
   d. Incentives
   e. Rural hospitals theorem

5. Applications: National Residency Matching Program
   a. History of NRMP
   b. How 2-sided matching is applied
   c. Complication 1: matching with couples
   d. Complication 2: incentives
   e. Complication 3: anti-trust case

6. Theory of Allocation (One-Sided Matching without Transfer)
   a. Serial dictatorship mechanism
   b. Top trading cycles mechanism
   c. YRMH-IGYT mechanism

7. Applications: Kidney Exchange
   a. Top trading cycles and chains
   b. Pairwise exchange and multi-way exchange.

8. Applications: School Choice
   a. Strict Priority: DAA vs TTC
   b. Constrained Choice
   c. Tie-Breaking

9. Random Assignment
   a. Ordinally efficiency
   b. Probabilistic serial mechanism

10. Matching with Monetary Transfer
   a. Stable allocation
   b. Salary adjustment process

11. Auction Theory and Applications
   a. Single-Unit Auction
   b. Multi-Unit Auction
   c. Sponsored Search Auctions used by Google.