Management Science and Engineering 233
Networked Markets

Tuesdays and Thursday, 2:15-3:30 PM
Hewlett 101
3 units

Instructor:

Ramesh Johari
Associate Professor
Management Science and Engineering
Huang Engineering Center, Room 311
E-mail: ramesh.johari@stanford.edu
Office hours: Mondays, 2:00-3:00 PM; additional office hours by appointment

Course assistant:

Apaar Sadhwani
E-mail: apaars@stanford.edu
Office hours: Location and time TBA

Note:

The course is held every Tuesday and Thursday.

However, there will be no class on April 17 or June 5 (I may set up guest lectures for these days however).

Course webpage:

Course materials will be available at `http://eeclass.stanford.edu/msande233`.

Course description:

This course provides an introduction to economic analysis for modern online services and systems. There are three primary goals in the class. First, I intend to cover several significant online services of interest, and discuss economic questions of interest that arise for such services. Second, we will spend time developing some basic theory for these economic questions. Finally, we will familiarize ourself with recent research related to these services, particularly on the more

applied side. Each "unit" of the class will reflect these goals: we will discuss an online service, discuss theory related to basic economic questions that arise for that service, and then discuss insights from applied researchers studying those services.

Tentative outline of topics:

1. Course introduction (1 lecture)
2. Game theory basics: dominant strategies, Nash equilibrium (2 lectures)
3. Online auction marketplaces (4 lectures)
   (a) Basic auction theory: auction formats and reserve prices
   (b) Reputation models in economics: signaling games, the market for lemons
   (c) Empirical studies of the eBay market
   (d) Open questions
4. Sponsored search (3-4 lectures)
   (a) A matching model of markets
   (b) The VCG and GSP mechanisms for sponsored search
   (c) Empirical studies of the sponsored search market
   (d) Open questions
5. Social networks (4 lectures)
   (a) Models of network effects
   (b) Models of diffusion in social networks
   (c) Social learning and herd behavior
   (d) Empirical studies of network effects in social networks
6. Crowdsourcing (3 lectures)
   (a) All-pay auction models of crowdsourcing
   (b) Economic analysis of crowdsourcing systems
   (c) Open questions
7. Additional applications (time permitting)
   (a) Information markets and information aggregation
   (b) Platforms for digital goods

Note that this is the first time this course is being offered; as a result, the guideline of topics above is representative of what I will try to cover, and the approximate attention given to each topic. However, depending on how things unfold during the course of the quarter, some topics may take more or less time than noted here.

Prerequisites

This course is intended for master's students and advanced undergraduate students. Although some of the material will be mathematically technical, I will develop most of the mathematics needed as we go along. Two indispensable prerequisites are *Math 51* (i.e., an adequate background in calculus), and *MS&E 220* (i.e., an adequate probability background). Students without these prerequisites can only enroll with permission of the instructor.

If you have taken these courses elsewhere and would like to know if you satisfy the prerequisite, contact Prof. Johari via e-mail prior to registering for the course.

Note that students seeking a more mathematical treatment of some of the topics in this course should consider taking either Prof. Matthew Jackson's course Economics 291, Prof. Amin Saberi's course MS&E 337, or my own course MS&E 336. This course is *not* intended for advanced doctoral students.

Notably, this course will *not* assume you have had prior exposure to game theory. If you already have had some game theory background, you may find some parts of the course somewhat redundant with your existing knowledge, but you are welcome to audit the class or register as you see fit.

Grading

You are responsible for keeping up with all announcements made in class and for all changes in the schedule that are posted on the class website.

The grade will be based on the following:

- 30% problem sets
- 70% final project

There will be 3 problem sets for the course. Each problem set will include problems related to the basic theory we cover in class, and will also ask you to read and briefly comment on at least one of the applied papers we discuss.

All assignments will be posted to the course website. Depending on their length and difficulty, the total number of points in each set might vary. You can discuss the assignments among yourselves, but everybody must turn in his/her own written solutions in his/her own words. If you are having difficulty, find help right away— *do not wait until you fall even further behind!*

Late assignments will receive no credit; no exceptions will be made.

Please familiarize yourself with the Stanford Honor Code; violations will be prosecuted to the fullest extent of the (Stanford) law.

Readings

There are no formal textbooks for the course; I will post lecture notes as we progress. Some handouts will be drawn from the textbook *Networks, Crowds, Markets* by Jon Kleinberg and David

Easley; available from:

`http://www.cs.cornell.edu/home/kleinber/networks-book/`

Other readings (including relevant papers) will be posted on the course website.
For an introduction to game theory, some of the following texts might be helpful:

1. *Game Theory for Applied Economists*, Gibbons. This is a basic undergraduate level text in game theory, appropriate if you have never seen the subject before; it provides an elementary treatment of most of the major topics.

2. *Microeconomic Theory*, Mas-Colell, Whinston, and Green. This very large textbook is an encyclopedic reference on the subject, and likely very useful for many parts of this course.

3. *Game Theory*, Fudenberg and Tirole. This reference should be on the shelf of every game theorist, but it is not necessarily the easiest book to learn from.

4. *A Course in Game Theory*, Osborne and Rubinstein. This is a good introductory level text in game theory, that still is quite rigorous. Although many game theory books are out there, I have found that this one is a good introduction for engineers.

5. *Game Theory: Analysis of Conflict*, Myerson. This is a more mathematically sophisticated treatment of the subject.