

# ORIE 4350: Introduction to Game Theory

Syllabus

Fall 2015

## Course description:

In many real-life settings, a group of agents or decision makers interacts by each agent choosing an action, and the actions chosen by every agent together determine the outcome of the interaction. Each agent has a preference over which outcome is realized, and these preferences may not agree with one another. As examples, consider the following situations:

1. How should Amazon, Apple, and Google price their tablets to maximize their profit, given that the total demand depends on the prices charged by each firm?
2. How many million barrels of oil should each OPEC country produce, if the price of crude oil is determined by its total supply?
3. How should you bid in an eBay auction for a collectible (your favorite sesame street character toy), given there are other interested buyers?
4. How should you and your roommates agree to split the utilities bill each month, given the rooms are not identical, and all of you differ in your heating preferences?

Game theory involves the study of such *strategic* situations, and provides a systematic approach to describe/predict the actions of *rational* agents.

In this course, we will study the fundamental concepts of game theory, see what behaviors they imply in different settings, and look at few applications. We will focus primarily on *non-cooperative* game theory, where we assume the agents care only about their own self-interest (their profit, revenue, *utility*, well-being, happiness, etc); all other considerations are secondary. In the end, we will briefly cover *cooperative* game theory, where a group of agents come together to agree on a common course of action.

## Learning outcomes:

After taking this course, you should be able to achieve the following objectives:

1. For a wide range of multi-agent settings, recognize the strategic aspects in the interaction, and formulate it using the analytical framework discussed in class.
2. Analyze a variety of strategic settings using the concept of an equilibrium.
3. Describe the merits and drawbacks of the common rationality assumptions that underlie the various game theoretic equilibrium concepts.

## Prerequisites:

Some material in the course will require knowledge of linear programming, duality and convexity at the level of ORIE 3300. If you have not taken this course or any equivalent course that covers these topics, you must meet Prof. Iyer before **Sept 8, 2015** to get his approval. The course will also assume familiarity with probability theory, including concepts such as expectations, conditional distributions, and Bayes' rule.

## Instructor:

Prof. Krishnamurthy Iyer  
225 Rhodes Hall  
E-mail: [kriyer@cornell.edu](mailto:kriyer@cornell.edu)  
Web: <http://people.orie.cornell.edu/kriyer/>  
Office hours: Tue 2:00-3:00pm; Wed 3:30-4:30pm

## Teaching assistants:

Sin-Shuen Cheung  
E-mail: [sc2392@cornell.edu](mailto:sc2392@cornell.edu)  
Room no: Rhodes 431  
Office hours: Thu 4:30-6:30pm

David Lingenbrink  
E-mail: [dal299@cornell.edu](mailto:dal299@cornell.edu)  
Room no: TBD  
Office hours: Wed 11:15-1:15pm

## Course information:

Class time: T Th 11:40-12:55pm  
Class location: Gates Hall G01  
Recitations: Mon (Olin 218), Thu (Phillips 219) 2:55-4:25pm  
Course Website: <https://blackboard.cornell.edu/> (search for ORIE 4350)  
Piazza: [https://piazza.com/cornell/fall2015/13368\\_2015fa](https://piazza.com/cornell/fall2015/13368_2015fa)

## Class websites:

We will be using Blackboard for announcements and lecture materials. You should be enrolled automatically into Blackboard, but if not, please visit <https://blackboard.cornell.edu/> and search for ORIE 4350. All announcements for the class will be through Blackboard, so it is your responsibility to ensure that you are enrolled and receiving the announcements. Please contact the instructor or the TAs if you have any issues.

We will also use Piazza for this class, where you should direct your questions related to homework, exams, or the course content. There will be a link to the Piazza forum in blackboard. The link is [https://piazza.com/cornell/fall2015/13368\\_2015fa](https://piazza.com/cornell/fall2015/13368_2015fa).

## Text:

The required text for the course is *Playing for Real*, by Ken Binmore, published by Oxford University Press. We will (tentatively) cover these chapters of Binmore: 2–8,11,16-18. In addition to the material from Binmore, we will discuss several topics of personal and/or mutual interest, and handouts/notes will be provided in such cases.

Other recommended books include the following:

1. *Game Theory: An Introduction*, by Steven Tadelis, Princeton University Press.
2. *An Introduction to Game Theory* by Martin J. Osborne, Oxford University Press;
3. *Game Theory for Applied Economists* by Robert Gibbons, Princeton University Press.

### **Homework:**

Homework will be due on Friday at Noon in the homework mailbox (Rhodes 2nd floor lobby). There will be weekly homework, with occasional breaks for prelim and finals. In all, there will be about 8-10 homework assignments.

You may discuss the homework with other current students of the class, but showing each other written solutions is not acceptable. Each student must write their solutions independently and individually. (Sharing written solutions, or submitting copied solutions will be considered a violation of the Cornell code of academic integrity, and appropriate actions will be taken.)

If there is a dispute about grading, you may turn in the entire assignment for a regrade within a week of the work being returned, with a short explanation of the error. All of the work, not just the disputed question, will be regraded.

### **Late homework:**

Late homework will incur 20% grade reduction per day, for up to 3 days late (latest by the subsequent Monday Noon). Homework handed in after the subsequent Monday at noon will receive no points and will not be graded.

If you plan to hand in your homework late, you must email the TA (David Lingenbrink) before handing it in to let him know that your homework will be in the mailbox.

Extensions will not be granted. Excuses for late homework will be evaluated on a case-by-case basis, with points deducted as described above except in very rare circumstances. Medical reasons, with documentation, are accepted as excuses for late homework.

Your lowest homework grade will be dropped, to accommodate non-medical reasons for missing or incomplete homework, conditional on you having filled the course evaluation form at the end of the semester (see the grading section below).

### **Exams:**

The prelim will be a closed book, closed notes exam. The time and the location will be confirmed, but tentatively it will be on October 22, 2015.

The final exam will also be closed book and closed notes, and based on the material covered during the entire course. The date and the room for the final exam has not been determined yet, and will be announced after the add period has ended. See <https://registrar.cornell.edu/Sched/exams.html> for latest information.

### **Grading:**

Your grade will be based on homework (30%, approximately equally weighted), the prelim (30%), the final exam (40%).

As an incentive for you to provide honest feedback on the course and my teaching, if you fill the course evaluation form during the evaluation period, your lowest homework score will be dropped from consideration towards your final grade.

**Class schedule:**

During the semester, the instructor may be out of town for some of the class dates. To make up for these, during some weeks, we will have lectures during the one of the class recitation hours, and the recitation will be held during one of the regular class meeting times (or if this doesn't work out, a separate time would be scheduled). You will be notified well ahead of time if/when such changes will be needed.

**Academic integrity:**

Each student in this course is expected to abide by the Cornell University Code of Academic Integrity. Any work submitted by a student in this course for academic credit will be the student's own work. Complete code is available at <http://cuinfo.cornell.edu/Academic/AIC.html>.