Spring 2020

Economics 682: Game Theory and Applications

This class is the second half of a sequence covering the foundations of modern microeconomic theory at a graduate level. It will provide an introduction to the principles of game theory. Game theory has two parts. First, it is a language to describe a strategic interaction. It formalizes a problem such as: Firm A sets its price, then Firm B sets its price, then customers decide where to buy. Second, game theory proposes solution concepts, which try to predict what players would do if they were faced with a specific game. In the example above: Which price should Firm A set? How should Firm B respond to Firm A's price? The goal of the course is to provide you with sufficient knowledge of game theory to be able to read applied research papers. Also we will discuss why economists have chosen these solution concepts, and what limitations they have.

Instructors

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Please put ECON682 *as part of the subject line when you email us.*

Class Schedule and Deadlines

Lecture.   M 2-5pm, PCPE 101

Our first class is on Wednesday, January 15. We do not meet on Monday, January 20 due to MLK day.

Exams.

- Midterm 1: Monday, February 17 (in class).

- Midterm 2: Monday, March 30 (in class).

- Final: Wednesday, May 6, 9-11am.

You are expected to attend all classes. There will be review sessions before each midterm and final. These will be hosted by your TA and scheduled about a week in advance. Attendance of these is recommended, but is at your discretion.

Class Requirements.

Problem Sets. There will be several problem sets (roughly every other week). They are due at the beginning of class and will be graded coarsely (P+, P, P-). It is strongly recommended that you attempt the problem sets yourself. You may discuss difficulties with the TA, myself and your classmates if you are stuck. While you are free to talk to classmates, I recommend doing this only after you have seriously attempted the problems yourself. In particular, a division of labor strategy is not advisable.

Submit hard copy in class or pdf file to akambh@sas.upenn.edu.

Exams. There will be two in class midterms and a final exam (all are open book, open notes, anything but the internet). The 2nd midterm will only cover material since the first midterm. The final exam is cumulative. I will make a sample exam available about a week before the actual exam.

All course materials will be posted on Canvas. Check regularly!

Grade Breakdown.

- Midterms: 20% each

- Problem sets: 15%

- Final Exam: 45%

Textbook. The required textbooks for the class are:

> S. Tadelis, Game Theory: An Introduction, Princeton University Press, 2013.
> R. Gibbons, Game Theory for Applied Economists, 3rd Edition, Prentice Hall, 1992.

Graduate level economics requires familiarity with some tools from mathematics. The Tadelis text is self-contained in that the Mathematical Appendix (Chapter 19) goes over the needed tools.

The supplementary texts listed below are not required. However, you might want to invest in them. A more advanced and complete text, often used in graduate programs, is:

> A. Mas-Colell, M. Whinston and J. Green, Microeconomic Theory, New York: Oxford, 1995

If you are planning to continue with more graduate level microeconomics, it is probably worth buying MWG now, but it will rarely be directly referenced in this course. Another options is:

> G. Jehle and P. Reny, Advanced Microeconomic Theory, Princeton University Press, 2011.

This text was used in past iterations of this course, but is now out of print (it is still readily available online).

Prerequisites. I will assume a certain amount of facility with mathematics: multivariate calculus, basic analysis, probability, and constrained optimization. It is *very important* if you are not familiar with this (roughly at the level of the Mathematical Appendix in the course text) that you invest extra time at the beginning of the semester to get yourself up to speed.

No previous economic knowledge is assumed, however intuitions from (undergraduate) intermediate microeconomics can be helpful. If you do not have much of an economics background, I recommend picking up an intermediate level textbook and skimming through it.

Course Policies The Economics Departmental Course Policies has a standardized list of policies for rules about exam attendance, grading appeals, academic integrity, etc. You are responsible for familiarizing yourself with these policies. If you miss a midterm for an *excused* reason (as specified in the course policies), there will be one cumulative make-up midterm in May.

Outline of Topics

Below is a list of topics I will cover, in the order you will see them. This may be adjusted over the course of the semester to account for time constraints.

1. Static Games with Complete Information

    (a) Strategic interaction, normal-form games, utilities
    (b) Elimination of dominated strategies, Nash equilibrium for two-player games
    (c) Market games: monopoly, Cournot, Bertrand and minimum-price guarantee
    (d) Nash equilibrium for N-player games, competitive limit
    (e) Mixed-strategy equilibrium
    (f) Existence of Nash equilibria

2. Dynamic Games with Complete Information

    (a) Extensive-form games, non-credible threats, backward induction
    (b) Subgame-perfect equilibrium
    (c) War of attrition
    (d) Nash bargaining solution
    (e) Rubinstein-Stahl's bargaining model
    (f) Repeated Games

3. Static Games with Incomplete Information

    (a) Bayesian Games
    (b) Auctions
    (c) Mechanism Design

4. Dynamic Games with Incomplete Information

   (a) Perfect Bayesian equilibrium and sequential equilibrium

   (b) Signaling

   (c) Reputation

5. Contract Theory (if time allows)

   (a) Moral hazard

   (b) Adverse selection