THE UNIVERSITY OF CHICAGO
Harris Public Policy

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PPHA 41501: Game Theory

Fall 2022
Tuesday/Thursday 9:30-10:50am

Instructor:
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Office: Keller 2021
Office hours: appointment by email. Please have the prefix "PPHA 41501" in the Subject line.

TAs:

Course Description:
This class is a PhD-level introduction to game theory, a branch of applied mathematics, the primary tool of strategic analysis in economics, politics, international relations, computer science, law, and elsewhere. The course introduces basic concepts of game theory and discusses applications to political economy issues. Though I will give mathematically rigorous definitions and formally state all the results, some proofs, e.g., of the Nash existence theorem and the Folk Theorem, will be sketched, rather than fully exposed. A working command of basic calculus and probability is required, but that of real analysis is not.

Readings:
I will mostly rely on Roger Myerson's *Game Theory* (Harvard UP, any edition), which is a standard PhD level textbook.

Martin Osborne's *An Introduction to Game Theory* (Oxford UP, any edition), an undergraduate text, contains a lot of good examples. Martin Osborne and Ariel Rubinstein's *A Course in Game Theory* is a bare-bones mathematical introduction to game theory. You might find useful a number of other excellent textbooks.

I will use *Formal Models of Domestic Politics* (Cambridge UP, 2013) by Scott Gehlbach, *Political Game Theory: An Introduction* (Cambridge UP, 2014) by Nolan McCarty and Adam Meirowitz, and *International Relations Theory: the Game-Theoretic Approach* (Cambridge UP, 2015) by Andrew Kydd for applications in political economy.

Although this is not a required read, you will greatly benefit from reading Thomas Shelling's *The Strategy of Conflict* (any edition) and Kenneth Shepsle's *Analyzing Politics* (Norton, 2010), non-technical introductions into strategic analysis and formal political economy, respectively.

TA Sessions:
TAs will hold weekly sessions. In sessions, TAs will explain solutions to problem sets and demonstrate how to work with sample exercises. In addition, TAs will hold office hours each week. Use these office hours to ask questions that were not discussed in class or TA sessions.

Slides:
I will post slides for each lecture on Canvas. They contain all notions, definitions, and results used in this class.

Problem Sets:

There will be four home assignments. You may discuss problems with each other, but you must turn in your own work.

Each assignment has four parts, three of which are obligatory, and one is for those who find the material too easy.

You will need to hand in only one part of the assignment. For this part, you are required to use a formulae-processing software instead of handwriting. TAs will grade the problem sets on a scale of 1 to 100. Late home assignments will be heavily discounted.

Midterm Exam:
We will have a short midterm exam on Week 5 (covering material of weeks 1-5).

The Final Project:
During weeks 8-9, you will need to complete the final project, a short theory paper, based on one of the four problem sets.

Grades:
Your course grade will be based on the following weights: problem sets 40%, the midterm exam 15%, and the final project 45%.

Please direct any re-grade requests to me rather than the TA. In such case, submit your work and a brief written explanation of your argument. Following this re-evaluation, your grade may go up or down.

Academic integrity:
All University of Chicago students are expected to uphold the highest standards of academic integrity and honesty. Among other things, this means that students shall not represent another's work as their own, use un-allowed materials during exams, or otherwise gain unfair academic advantage. All students suspected of academic dishonesty will be reported to the Harris Dean of Students for investigation and adjudication. The disciplinary process can result in sanctions up to and including suspension or expulsion from the University. In addition to disciplinary sanctions, there will be a proportionate and dissuasive grade penalty. Here are the relevant resources: The Harris policy and procedures related to academic integrity and The University of Chicago Policy on Academic Honesty & Plagiarism.

Additional readings:
Occasionally, I will post additional reading, both academic and policy-related, on Canvas. You might read (or not read) them to get a better understanding of how concepts we discuss in class apply in policy analysis and public discourse.

Course Plan:

Lecture 1 (Tu 09/27): Strategic-Form Games
- Myerson, 2.2
- Osborne, 1.1-1.3, 2.1-2.5, 5.1-5.2, 6.1-6.2, 7.1
- Osborne and Rubinstein, 2.1

Lecture 2 (Th 09/29): Games in Extensive Form
- Myerson, 2.1, 2.3
- Osborne, 5.1-5.2
- Osborne and Rubinstein, 6.1

Lecture 3 (Tu 10/4): Nash Equilibrium
- Myerson, 3.2
- Osborne, 2.1-2.9
- Osborne and Rubinstein, 2.1

Lecture 4 (Th 10/6): Nash Equilibrium in Extensive-Form Games
- Osborne, 5.3-5.5
- Osborne and Rubinstein, 6.1-6.2

Lecture 5 (Tu 10/11): Nash Equilibrium Examples: A Model of Political Competition
- Osborne, 3.3

Lecture 6 (Th 10/13): Nash Equilibrium Examples: Committee Decision-Making
- Myerson, 4.10
- Osborne, 7.4

Lecture 7 (Tu 10/18): Existence of Nash Equilibrium
- Myerson, 3.12
- Osborne, 4.10
- Osborne and Rubinstein, 2.4

Lecture 8 (Th 10/20): Games of Imperfect Information
- Myerson, 2.8
- Osborne, 9.1-9.3
- Osborne and Rubinstein, 2.6, 11.1

Lecture 9 (Tu 10/25): Signaling Games
- Myerson, 6.7
- Osborne, 10.5
- Osborne and Rubinstein, 12.3

Lecture 10 (Th 10/27): Bayesian Persuasion

Midterm

Lecture 11 (Tu 11/1): Repeated Games
- Myerson, 7.1-7.2
- Osborne, 14.1-14.11
- Osborne and Rubinstein, 8.1-8.3

Lecture 12 (Th 11/3): The Folk Theorem
- Myerson, 7.5
- Osborne, 14.1-14.11
- Osborne and Rubinstein, 8.5

Lecture 13 (Tu 11/8): Markov Games and Markov Perfect Equilibrium

Lecture 14 (Th 11/10): Bargaining and Coalition Formation
- Myerson, 8.7
- Osborne, 8.1, 16.1-16.4
- Osborne and Rubinstein, 7.1-7.3, 13.1

Lecture 15 (Tu 11/15): Cooperative Games
- Myerson, 9.1-9.4
- Osborne, 8.2-8.7
- Osborne and Rubinstein, 13.1-13.2, 14.1-14.2

Lecture 16 (Th 11/17): Matching
- Osborne, 8.2-8.7
- Osborne and Rubinstein, 13.1-13.2, 14.1-14.2

Thanksgiving break

Lecture 17 (Tu 11/29): Social Choice and Mechanism Design
- Osborne and Rubinstein, 10.1-10.3

Lecture 18 (Th 12/1): Auctions
- Myerson, 3.11
- Osborne and Rubinstein, 10.4

Final exam