Fall 2019

Department of Political Science
University of California, Berkeley, CA

Robert Powell
794 Barrows Hall
Email: RPowell@Berkeley.edu

GAME THEORY IN THE SOCIAL SCIENCES

Political Science 135/Econ110

A situation involves strategic interaction if your best course of action depends on what others are going to do and vice-versa. In a crowded primary campaign, whether a second-tier candidate directly attacks the frontrunner is likely to depend on whether or not she believes another second tier-candidates will. When China is deciding how to respond to the latest round of American tariffs, it will be concerned about the likely American response to China's actions. As tensions between Iran and the United States rise, a state's willingness to escalate by shooting down a drone or seizing a tanker may depend on how that state expects the other state to react. Speaker of the House Nancy Pelosi has said that one reason for not moving forward with impeachment is that there is virtually no chance that the Senate would convict the President and remove him from office. Facebook, according to a report in the *New York Times*, is taking steps that make it harder to break up in anticipation of efforts to break it up and possible action from the Federal Trade Commission.

Game theory is now commonly used in economics, political science and other social sciences to model strategic interaction. This course offers a non-technical introduction to game theory with a special emphasis on examples and applications drawn from these fields

The required text is: Prajit K. Dutta, *Strategies and Games* (MIT Press 2000) and should be available at the bookstore. (If you have trouble finding it be sure to look under both PS135 and Econ110.) An excellent book for those with a good background in calculus and looking for a somewhat more challenging text is Steve Tadelis, *Game Theory: An Introduction* (Princeton University Press, 2013). Detailed lecture notes will supplement the text.

The bCourses site is "PS135/Econ110". Students enrolled in the class or on the waitlist should already have access. Handouts and problem sets will be posted there. Please check the site before each lecture in case there are handouts for that lecture.

Course requirements are problem sets (15%), a midterm (35%), and a final (50%). The final is scheduled for Tuesday, December 17th, from 3 to 6 pm. *You cannot take the class if you cannot take the final at this time.*

Outline of Topics to Be Covered

I. Static Interactions and Strategic-Form Games.
II. Dynamic Interactions and Extensive-Form Games.
III. Repeated Games
IV. Asymmetric Information and Signaling Games.

Topics and Readings*

I. Static Interactions and Strategic-form Games: A static situation is one in which each actor must make one decision and does so in ignorance of what the other actors are doing. For example, two firms may have to decide how much to invest in R&D at the same time or two states may secretly decide how much to spend on defense. Sealed-bid auctions are also static interactions. In this part of the course, we will see how these situations can be represented as strategic-form games and how we can solve these games.

A. The definition and some examples of strategic-form games.
B. Dominance Arguments.
C. Nash Equilibria.

Readings: ch 3 (skip section 3.1.2); ch 4: pp. 49-53, 55-59; ch 5; ch 6: 75-84*; ch 7**, ch 27**; ch 8: 103-108, 110-115.

II. Dynamic Interactions and Extensive-Form Games: An interaction is dynamic if at least one actor can respond to another actor's decisions when making its decision. Bargaining between a buyer and seller is dynamic. The buyer can decide how to revise its previous offer in light of the seller's latest offer. Arms races are also dynamic. A state can decide how to much to spend this year in light of what the other side did last year.

Extensive-form games provide a natural setting for the analysis of dynamic interactions. An extensive form is something like a flowchart for the situation we are trying to model. The extensive form describes the order in which the actors make decisions or take actions, what options they have to choose from, and what they know when they must make a decision. In his section, we will see how to specify and analyze games in extensive form.

A. Defining game trees and strategies within trees.
B. Translating extensive-form games into their strategic form.
C. Nash equilibria for extensive-form games.
D. Solving perfect-information extensive-form games through backwards induction.
E. Applications
F. The failure of backwards induction.
G. Subgame Perfection:

Readings: ch 11; ch 12*; ch 13;

* Readings marked with a single "*" are recommended but not required. I want to call your attention to readings marked with a "**". You may not have the background to work through them as they are presented in the book, but I want you to know they are there. I will usually present the essential ideas in lecture from a different and, I hope, clearer, more accessible approach.

III. Repeated Games: One important aspect of social relations is the repeated interaction of the members of a group. In an industry with few buyers and sellers, buyers and sellers are likely to interact repeatedly. For example, United and American Airlines deal repeatedly with Boeing and Airbus. Members of the United States Senate must deal with each other repeatedly in their efforts to pass desired legislation. The Israelis and Palestinians deal repeatedly with each other as do the competing factions in Iraq.

In its simplest form, we might try to represent a situation of repeated interaction by supposing that a group of actors play the same game over and over again. How does this repeated interaction affect what we would expect to happen? Does repetition make for a larger or smaller set of possible outcomes? This section will provide some answers.

A. Infinitely-Repeated Games.
   1. Payoffs and strategies
   2. The folk theorem for Nash equilibria.
   3. The folk theorem for subgame perfect equilibria with Nash threats.

B. Finitely-Repeated Games.

Readings: ch 15: 224-234; ch 14; ch 17**.

IV. Asymmetric-Information Games: In all of the games discussed so far, there has been complete information. At the start of the game, each player knew everything there was to know about the other players. For example, each firm knew exactly how much it cost the other firms to increase their levels of output. Or each state in a crisis knew exactly how much risk of disaster the other state was willing to accept. But most situations we want to understand entail some "private" information. That is, a firm has private information about its production costs or a state knows how much risk it is willing to run but the other does not. Incomplete- or asymmetric-information games provide a way of modeling situations in which there is private information, i.e. situations in which the players do not have "complete" information about each other. In this section we will discuss some simple examples of incomplete-information games and how to analyze them.

A. Incomplete-Information Games.
B. Signaling Games
C. Perfect Bayesian Equilibria
D. The Intuitive Criterion

Readings: ch 20: 309-18; ch 19*; ch 24

Lectures

Aug. 29:	Introduction and Overview
Sept. 3-5:	Static interactions, strategic-form games, and dominance arguments
Sept. 10-12:	Nash equilibria and some applications
Sept. 17-19:	Expected utilities, mixed strategies, and mixed-strategy equilibria
Sept. 24-Oct. 8:	Dynamic interactions, extensive-form games, backwards induction, and subgame perfection.
Oct 10-22:	Applications: brinkmanship (nuclear, congressional, and otherwise) and wars of attrition, and bargaining
Oct. 24:	Midterm*
Oct. 29 –Nov 5:	Repeated Games
Nov 7-12:	Asymmetric information games and asymmetric-information bargaining
Nov.14-19:	Principal-Agent problems, Adverse Selection, and Moral Hazard
Nov 21-Dec 3:	Signaling games
Nov 22:	Thanks Giving
Dec 5:	Summary and Review
Dec 10-12:	Summary and review
Dec. 17:	Final Exam (3- 6 pm*). If you cannot take the final at this time, you cannot take the class.*

* This date for the midterm is tentative. The midterm might be one meeting before or after this date depending on how fast we move through the material. We will confirm the exact date well in advance.