Introduction to Deductive and Analytic Approaches to Political Phenomena

Instructor: David A. Siegel
TA: Gloria Cheung

Course information:
Course Number: POLSCI 631
Time: T. TH 1:45 PM–3:00 PM
Place: Allen 326
Course website: Sakai
Lab Time: F 10:15 AM–11:05 AM
Lab Place: French Science 2237

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Course Description

Game theoretic models are widely employed in political science research, contributing to the theoretical core of topics in every subfield of the discipline. They help scholars maintain logical consistency in theoretical arguments and derive novel conclusions relevant to strategic interactions between political actors. Becoming a good consumer of game-theoretic research is thus necessary to understand both where the discipline has been and where it is going. The primary purpose of this course is to help you become such a consumer by instructing you in the basics of non-cooperative game theory. By the end of the semester, students should be able to understand a wide variety of the game-theoretic models that populate the major disciplinary journals. Lectures, labs, and regular problem sets will help you get to that point, and exams will assess your progress to it.

The secondary purpose of this course is to help you use game-theoretic models to structure your own thinking. Throughout the semester we will highlight how models help to clarify thinking and/or lead to novel insights, and near the end of the semester you will have the opportunity to write a simple model of your own.

Game theory is a deductive, mathematical enterprise that requires abstract, symbolic reasoning. One-dimensional calculus is a prerequisite for the course, and you frequently will be asked to solve systems of (mostly linear) equations. More challenging, however, will be internalizing concepts that may make abundant sense to you in class, but then become muddled when you attempt to apply them. Such a response to the material in this class is common, and expected. The only way to get past it and build your game-theoretic intuition is by practice, and there will be numerous opportunities to do so. Engaging fully in this practice is key: while group work is encouraged on the problem sets, you will not get much out of this course if you don't make sure you can also solve each problem on your own. It also helps to be exposed to the same material from different sources. Accordingly, lectures will frame topics differently from the textbook, and I will provide several additional sources as well.

Readings

There is one required textbook for the course, which is available at the campus bookstore and elsewhere: Tadelis, Steven. 2013. *Game Theory: An Introduction.* Princeton University Press. My lectures will diverge in some ways from the textbook; this is an opportunity to see the same topic from different angles, strengthening your understanding. I suggest reading assigned chapters after the corresponding classes.

There are many online sources for game theory as well. For example, I have a brief series of modules introducing game theory at the introductory undergraduate level here: `https://www.youtube.com/playlist?list=PLfbqimfWu_yMZhPWbY-uyCrKT9iZR6loJ`. William Spaniel has an entire course here: `https://www.youtube.com/playlist?list=PLKI1h_nAkaQoDzI4xDIXzx6U2ergFmedo`. And there are many more. You should feel free to consult as many sources as you desire until the material clicks for you. Do not hesitate to approach me with questions as well: I welcome interruptions for questions.

Course Requirements

- Problem Sets (30%): There will be nine problem sets that will vary in length. Each problem set will be worked in two steps. First, you will have a week (Tuesday to Tuesday) to complete a first draft of each problem set, before turning it in to Sakai (typewritten answers or clear pictures of handwritten answers are fine). I strongly encourage you to work together on the problem sets; however, the final version you turn in must represent your own work, and you should understand the solution of every problem you turn in. To help ensure the latter, you will get another go at the problem set after you have turned in your first draft. I will release answers to each problem set as soon as it is due. You will then have a week to go over your problem set solutions and the answers I have provided, discern any place you might have gone wrong, figure out how to correct any such errors, and then write up and turn in those corrections by the following Tuesday, also to Sakai. Thus, at most times you will be working on two problem sets: one new one, ideally with a group, and one old one, on your own with solutions by your side. Friday labs will be available for problem set help at either stage, as well as my and the TA's office hours. Your grades on problem sets will be based on both your first draft and on your final version. Do not put assignments off to the last minute! The earlier you start, the more help you can expect.

- Midterms (30%, 15% each): There will be two midterms during the semester. Each will be a three hour take-home exam that will become available on a Thursday, as listed in the schedule below. You may start the exam any time from after class Thursday until 5 pm the following Monday. Once you have started, you will have 3 hours to complete the exam and turn it in to Sakai. You may use your own notes, problem sets, and textbooks, but may not consult other sources, including but not limited to other people or the internet, and you will attest that you have not done so when turning in your exam.

- Modeling Paper (5%): Near the end of the semester, you will write an exceedingly short paper (no more than three single spaced pages, plus model solution) that does one and only one thing: suggests a simple model that you believe would bring insight to a substantive question that interests you. The format of the paper is as follows: 1) describe the research question (no literature review is needed), 2) describe and justify the model you want to use to bring insight to the question, 3) discuss and substantively interpret the model's solution. The solution itself can either be typed up in the text, if it's short, or attached at the end. A picture of a handwritten solution is fine for that purpose.

- Final Exam (35%): The final exam for the class has the same format as each midterm—take-home, open notes, problem sets, and book but no other sources—save that it is longer: you will have 8 hours to finish it from the time you start it. See the schedule below for dates.

Tentative Course Schedule (Subject to Change with Advance Notice):

Building Blocks

Jan 6: What's a Model and Why Do We Write Them?

Jan 11: Choice Under Certainty. Read Ch 1. PS 1 Handed Out.

Jan 13: Choice Under Uncertainty. Read Ch 2.

Jan 18: Rationality and Common Knowledge. Read Ch 3, 4. PS 2 Handed Out, PS 1 First Draft Due.

Games of Complete Information

Simultaneous Games

Jan 20: Nash Equilibrium in Pure Strategies: the Discrete Case. Read Ch 5.

Jan 25: Nash Equilibrium in Pure Strategies: the Continuous Case. More Ch 5. PS 3 Handed Out, PS 2 First Draft Due, PS 1 Final Version Due.

Jan 27: Mixed-Strategy Nash Equilibrium. Read Ch 6.

Sequential Games

Feb 1: Nash Equilibria in Extensive Form Games. Read Ch 7. PS 3 First Draft Due, PS 2 Final Version Due. (no new PS)

Feb 3: Additional Examples of Nash Equilibria, Exam Q&A. **Exam 1 Available**, must be started no later than 5 pm Monday, Feb 7.

Feb 8: Subgame Perfect Equilibrium: the Discrete Case. Read Ch 8. PS 4 Handed Out, PS 3 Final Version Due.

Feb 10: Subgame Perfect Equilibrium: the Continuous Case. More Ch 8.

Feb 15: Additional Examples of Subgame Perfect Equilibria I. PS 5 Handed Out, PS 4 First Draft Due.

Feb 22: Additional Examples of Subgame Perfect Equilibria II and an Introduction to Comparative Statics.

Repeated Games

Feb 22: Multistage Games and the One-Stage/One-Shot Deviation Principle. Read Ch 9. PS 6 Handed Out, PS 5 First Draft Due, PS 4 Final Version Due.

Feb 24: Repeated Games and the Folk Theorem. Read Ch 10.

Mar 1: Additional Examples of Repeated Games and an Introduction to Bargaining. Skim Ch 11. PS 6 First Draft Due, PS 5 Final Version Due. (no new PS)

Mar 3: Additional Examples of Repeated Games, Exam Q&A. **Exam 2 Available**, must be started no later than 5 pm Monday, Feb 8, but I expect you'll want to tackle it more quickly due to Spring Break.

Mar 8, 10: Enjoy Spring Break!

Games of Incomplete Information

Bayesian Games

Mar 15: Incomplete and Imperfect Information; Actor Types. Read Ch 12. PS 7 Handed Out, PS 6 Final Version Due.

Mar 17: Bayesian Nash Equilibrium. More Ch 12.

Mar 22: Additional Examples of Bayesian Nash Equilibria. PS 8 Handed Out, PS 7 First Draft Due.

Mar 24: Incentive Compatibility, Individual Rationality, and an Introduction to Mechanism Design. Skim Ch 14.

Dynamic Games of Incomplete Information

Mar 29: Beliefs and Their Updating. Read Ch 15. PS 9 Handed Out, PS 8 First Draft Due, PS 7 Final Version Due.

Mar 31: Perfect Bayesian Equilibrium. More Ch 15.

Apr 5: Additional Examples of Perfect Bayesian Equilibrium. PS 9 First Draft Due, PS 8 Final Version Due. (no new PS)

Apr 7: Introduction to Signaling Models. Skim Ch 16.

Apr 12: Final Exam Q&A. PS 9 Final Version Due, Modeling Paper Due. (no new PS)

Apr 13: Final Exam Available, must be started no later than 5 pm Monday, Apr 18.