POLITICAL SCIENCE 505: THEORIES OF INDIVIDUAL AND COLLECTIVE CHOICE I

Washington University
Department of Political Science
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This course provides an introduction to non-cooperative game theory and its application to research in political science. Students will learn how to represent static and dynamic games under complete and incomplete information and how to analyze them using appropriate methods and solution concepts. Applications to political science are emphasized as much as possible but the primary focus will be on gaining a solid foundation in game theory.

There is no required textbook for this course but I recommend that every student pick up a copy of a game theory textbook that suits their learning needs. There are many excellent game theory texts and I list recommendations with some details about each book below.

- Game Theory: An Introduction by Steven Tadelis. This is a good default and is one of the books I use most heavily when preparing lecture notes. This is a good middle-of-the-road game theory text which provides enough precision to prepare you to use game theory in some realistic applications but stopping short of the most technical books that may be appropriate for a more advanced course.
- Martin Osborne's (2004) An Introduction to Game Theory. This is a useful book for beginning students without significant mathematical background since it introduces the concepts without the use of much calculus, etc. I draw some examples from this book in lectures.
- Game Theory for Political Scientists by James Morrow. This is another good book for those without much mathematical background and, as the title suggests, was created for political scientists.
- Political Game Theory by Nolan McCarty and Adam Meirowitz. This is a more advanced text but one that is designed to focus on political science applications.
- Several more advanced texts are available. Osborne and Rubinstein's A Course in Game Theory, Roger Myerson's Game Theory: Analysis of Conflict, or Fudenberg and Tirole's Game Theory, which are all fantastic but very technical. Osborne and Rubinstein's book has the added virtue of being available for free online. These are great references but very difficult relative to what we'll cover in this course.

For any of these books it should be quite easy to follow along and match topics to book chapters since the basic topics covered by each are the same. Outside of core game theory texts, there

are some other books that students may find useful. For students who require a refresher on algebra, elementary calculus, or basic probability theory, I recommend Simon and Blume's (1994) Mathematics for Economists or Moore and Siegel's (2013) A Mathematics Course for Political and Social Research. I will use many examples from Gehlbach's Formal Theories of Domestic Politics which I enthusiastically recommend but does not substitute for a game theory textbook and you do not need to purchase it for the course.

FORMAT OF THE COURSE

This course will be taught as a virtual course this semester. This will entail the following:

- **Lectures.** I will upload lectures in the form of short videos. Students can watch them on Canvas at your own pace. This means we will not generally have "live" lectures at the scheduled time. An exception is that I will do a live introduction to the course at the scheduled time on Week 1.
- **Meetings.** Students will have required one-on-one virtual meetings with me every week to discuss the course material. These meetings will typically be scheduled on Fridays. My expectation is that students come prepared for the meetings and help direct our discussion. This means in particular that students have:
  - Attempted each problem on the problem set for that week. Students do not need to have correct answers to every problem at this stage but should have done enough work on each problem to explain how they approached the problem and can explain points of confusion.
  - Watched the lectures associated with the topic for that week and are prepared to ask questions if needed.
  - I recommend that students come to the meeting with a list of items to discuss in order to use time efficiently.

  The idea is for these one-on-one meetings to serve as a substitute for class time rather than as a substitute for office hours. Therefore I will also hold optional office hours by appointment.
- **Problem Sessions.** The Assistant Instructor will hold problem sessions on Monday. These are optional but highly recommended. The purpose of the problem sessions will be (a) to work through additional example problems, (b) to help you complete the homework, and (c) to (much more rarely) cover additional optional material in order to fill in gaps in knowledge that may arise throughout the semester.
- **Problem Sets.** I have not found a way to learn game theory that works as well as solving a lot of games, so the problem sets will be frequent and challenging. Some notes on problem sets for this semester:
  - There will be a problem set almost every week.
  - I will make problem sets available on Monday and they will be due the Wednesday of the next week (i.e. a week and a half later). This means there will be some overlap in problem sets – students will receive Problem Set n+1 before they are required to have turned in Problem Set n.

  - The reason for the timing is so that students have ample time to work on problems in between interactions with the Professor and Assistant Instructor. Students have from Monday-Friday to attempt each problem before the required meeting with the Professor, from Friday-Monday to incorporate input from the Professor and pose additional questions in the problem session with the Assistant Instructor, and Monday-Wednesday to incorporate this second round of feedback into their final solutions.
  - I strongly recommend that students work together on problem sets, though all students must write up their own solutions. Unfortunately this will not happen organically as it does in a normal semester when everyone is in the office, so students should plan ahead to collaborate virtually.
  - Problem sets should be typeset in LaTeX or something similar[1] and uploaded to Canvas in PDF format.

- **Exams.** We will have two exams. Both will be "open book, open notes" but collaboration (with other students or with people online) is not allowed. Students will be given a full week to complete the exam.

GRADES AND REQUIREMENTS

The course grade will be determined as follows:

- Problem sets: 50%
- Exams:
  - Exam 1: 25%
  - Exam 2: 25%

There will be two in-class exams, the timing of which will depend on how quickly we move through the material. The exams will be similar to the problem sets except that they must be completed in class without collaboration or reference materials.

COURSE POLICIES AND EXPECTATIONS

- Academic Integrity. I take academic integrity very seriously. You may review the University's policies here.
- Late assignments. Late assignments may be accepted with a 10% deduction before graded assignments have been returned to students. After that time, late assignments will not be accepted.
- Accommodations due to disability. If you have a documented disability that requires academic accommodations, please see me as soon as possible during scheduled office hours.

[1] RMarkdown/pandoc or LyX/Scientific Workplace are alternatives that some people prefer. I do not care what you use as long as you produce a pdf with legible equations.

ORDER OF TOPICS

A list of topics is below. Dates are not listed since the timing of topics will be more fluid than in a typical semester. The first exam will cover Unit 1 and will be scheduled when we have completed the topics in Unit 1.

- Unit 0: Individual decisionmaking
- Unit 1: Games of complete information
  - Games and Nash equilibria in pure strategies
  - Extensive games and subgame perfect Nash equilibria
  - Repeated games
- Unit 2: Games of incomplete information
  - Bayesian games and Bayesian Nash Equilibria
  - Dynamic games of incomplete information and Perfect Bayesian Equilibria