Duke University

Game Theory in Political Science

Instructor: Pei-Yu Wei (pei.yu.wei@duke.edu)
Class hours: Mon. & Wed. 9:25-10:15am
Class location: Gross Hall 270
TA:

Course Overview:

Why do countries go to war with each other even though war is costly both economically and in terms of human lives? When do people decide to join in mass protests? What are the considerations of justices when confronted with judicial reviews? How do political candidates decide what ideological platform to run on? These questions all include complex strategic interactions, where the best strategy of one actor depends on the strategy of the other actor, and so on. This *strategic* uncertainty is different from the uncertainty you may have learned before in statistics, but it may be even more important. Strategic uncertainty

This course is aimed at providing you with an introduction to game theoretic methods, particularly in their application to political science. Throughout the semester, you will be introduced to concepts such as rationality, Nash Equilibrium, time-consistency, credibility, and signaling through a highly interactive class environment. The "lecture" portion of the class, which will be held twice a week, covers the more technical aspects of game theory. During the lectures, you will be able to participate in in-class games, discuss the intuition and logic they learn through playing games, and translate the logic and intuition into formal representations of models. In discussion sections, which are held once a week, you will have the opportunity discuss how models have been used to answer political science questions, and to apply models to real-life phenomena and current events.

As this is an undergraduate introductory political methods class; there are no prerequisites to taking this course. However, familiarity with basic algebra and calculus will help in solving problem sets, which may be technically challenging if the student is uncomfortable with the skills mentioned. By the end of this semester, you should be familiar with most of the commonly encountered games in political science and be able to apply the models to real life situations. Moreover, the students should be equipped with the foundation for taking more advanced game theory courses in the future.

Note: If you are uncertain whether your math foundations are suitable for taking this class, please email the instructor to discuss classes you have previously taken. For anyone who would like to brush up on basic algebra and calculus, a good free resource is Mathematics for Political and Social Research, the syllabus of which is accessible here and also uploaded onto Sakai under "Resources." Links to video lectures are included, and you are encouraged to be familiar with the material up to Lecture 3.

Learning Objectives:

By the end of this course, you should:

- Be familiar with the basic and most common game theoretic models and concepts in political science, such as Nash Equilibrium, Prisoners' Dilemma, rationality, credibility and time consistency, agenda-setting, etc.
- Be able to find the equilibrium solutions of the models introduced in this class.
- Be able to appropriately apply models to understand and assess real-life events and phenomena.
- Have the ability to construct your own simple models.
- Have the foundation needed to take more advanced game theory classes.

Assessments:

1) Problem Sets (25%):
   Although a large part of game theory relies on intuition, logic and deductive reasoning, it is ultimately still a method of analysis to help scholars better understand social phenomena. Therefore, just as is with other methods such as statistics, the best way to learn game theory is to do game theory. Over the course of the semester, there will be bi-weekly problem sets of 3-4 questions each. The goal of these problem sets is to help you gain a greater mastery over the technical aspects of game theory – how to find the equilibrium, how to calculate how changes in input affects how each actor behaves, and so on. You are encouraged to work in groups, though you must write up your own answers.

2) Two short notes (20%; 10% each)
   One of the most important objectives of this class is to learn how to recognize strategic interactions in the realm of political science, and how to apply models to real-world events. Therefore, over the course of the semester, you must submit two short notes of about 500 words in length. Each note has to describe an event that was reported in the news the previous week and apply a game that has been covered in class to the event, including game trees of payoff matrices whenever applicable. You can submit the short notes anytime during the semester, with the last possible submission date being the last day of class. The submissions must be electronic, saved either in a Word or PDF file, and uploaded to your Sakai Dropbox, and they must include a link to the news article of the event that you are writing about.

3) In-Class Exercises (10%)
   Game theory helps further the understanding of the intuition and logic behind complex social interactions. The best way to understand these social interactions is to participate in the interactions. In class, you will be able to play games against each other. To incentivize you to think carefully about your own strategies in each of the situations, the exercises will count towards your grades. You must score a higher payoff than the class average in each game to get credit for each exercise (5%). Moreover, there will be two in-class case studies, which are aimed to help you get a taste of what is expected in the final presentation. During the in-class case studies, I will describe the case for you. In groups of 5~7, you will have 30 minutes to discuss what model learned so far would be the most applicable to the case. This is followed by brief presentations by each group and a discussion. You are graded by group, based on your effort and participation (5%).

4) Discussion Section Participation (10%)
   Each week, you will participate in a discussion section led by the TA. These discussion sections are intended for you to learn how apply abstract game theory concepts and models to real-world situations and events. You should read the assigned article(s) for the week's discussion section beforehand and come to each session prepared to discuss the article(s).

5) Presentation (35%)
   The final project for this class is a five-minute in-class presentation, where each of you has the opportunity present a case study and an original game theoretic model that best explains the case. The case can be historic or current event; the only requirement is that it must be within the realm of political science. To facilitate the selection of an appropriate topic, you should make an appointment with the professor to discuss the topic chosen before [date]. The presentation has to include a) a brief description of the case, b) the game (this can be in any form – payoff matrix, game tree, etc.), and c) justifications of the payoffs and explanations of why the game explains the case. You will present in two groups on the last two days of class. You will be graded both on your presentation and its contents.

Office Hours:

Office hours are scheduled every Thursday, 2 – 4pm. Please make appointments via Doodle (sign-up sheet link here) prior to meeting with the instructor. All appointments should be made 24 hours prior to the meeting time. If it is not possible for you to meet with the instructor during office hours, please e-mail the instructor to arrange an alternate meeting time.

Required Reading Materials/Textbooks:

There is no required textbook for this class. Lecture notes that include the more technical aspects of the course will be uploaded onto Sakai every Monday, and the slides used by the instructor will be uploaded after every class. Students can use these two resources to review the materials covered in the lectures. If the student wishes to learn the material covered in more depth, he/she may refer to Martin J. Osborne's *An Introduction to Game Theory* (2004). The syllabus will include the chapter(s) the students could refer to if they choose to also read the Osborne textbook. Moreover, two copies of the textbook will be held on reserve at the library for students of this class.

The weekly discussion section readings are usually available online. If possible, links to the readings will be included. If the link of an article is not included in the syllabus, students should be able to find the article under the "Resources" tab in their Sakai account.

Grading Scale:

The scale that will be applied for each graded element, and for the final grade, is listed below. There will be no rounding up of the weighted cumulative numerical score in calculating the final letter grade.

98-100	A+
93-97	A
90-92	A-
87-89	B+
83-86	B
80-82	B-
77-79	C+
73-76	C
70-72	C-
67-69	D+
63-66	D
60-62	D-
< 60	F

Special Note on Academic Integrity

Students taking this class are expected to comply with the Duke Community Standard, which is available to view at http://www.integrity.duke.edu/ugrad/student.html.

Additional Resources:

TWP Writing Studio:
The Thompson Writing Program's Writing Studio provides writing resources to students at any stage of the paper-writing process. The Studio is located at Bivins 107 on Duke's East Campus, and at Perkins 112 on Duke's West Campus. You can schedule face-to-face appointments with a reader, who will help guide you and give you feedback on your work. For more information, visit http://twp.duke.edu/twp-writing-studio.

Student Disability Access Office (SDAO):
Everyone learns in different ways, and I will try to ensure that my class is accessible in different mediums. However, if there is an accommodation that I could make to make the learning experience, including the course materials, lectures, discussion sections, etc. more inclusive, please let me know. Alternatively, you can also contact the SDAO. More information can be found at http://access.duke.edu/.

Counseling and Psychological Services (CAPS):
College can be stressful. During the semester, if you find that you are having challenges due to health problems, life stressors, or emotional difficulties, please consider consulting CAPS. More information can be found at: http://studentaffairs.duke.edu/caps/about-us.

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Class Schedule:

Topic 1: Introduction
Jan. 6   Introduction: Game theory and political science.
                Recommended Osbourne chapters: Chapter 1.1

Section   Cassidy, John, and Alec Wilkinson. "The Triumph (and Failure) of John Nash's
                Game Theory." *The New Yorker*, 27 May 2015,
                www.newyorker.com/news/john-cassidy/the-triumph-and-failure-of-
                johnnashs-game-theory.

Topic 2: Rationality and Utility
Jan. 11   Defining rationality, actors, preferences, utility functions, expected utility, and
                risk preferences.
                Recommended Osbourne chapters: Chapter 1.2, 1.3

Topic 3: Strategic Games with Perfect Information
Jan. 13   Introducing strategic (normal form) games
                Recommended Osbourne chapters: Chapter 2.1-2.5
Section   Watch the following videos:
                "A Battle of Wits" https://www.youtube.com/watch?v=EZSx3zNZOaU
                "Split or Steal?" https://www.youtube.com/watch?v=TKaYRH6E36U

Jan. 18   MLK Day. No class.
Jan. 20   Nash equilibrium
                Recommended Osbourne chapters: Chapter 2.6 – 2.9
Section   Newkirk, Vann R. "Is Climate Change a Prisoner's Dilemma or a Stag Hunt?"
                The Atlantic, Atlantic Media Company, 21 Apr. 2016,
                www.theatlantic.com/notes/2016/04/climate-change-game-
                theorymodels/479340/.

Jan. 25   Mixed strategies
                Recommended Osbourne chapters: Chapter 4.1-4.5
Jan. 27   Equilibrium refinement
                Recommended Osbourne chapters: Chapter 4.7-4.9
Section   Akpan, Nsikan. "How the Shutdown Might End, According to Game Theory."
                PBS, Public Broadcasting Service, 17 Jan. 2019,
                www.pbs.org/newshour/science/how-the-shutdown-might-end-accordingto-
                game-theory.

Topic 4: Dynamic Games with Perfect Information
Feb. 1   Introducing dynamic (extensive) form games
                Recommended Osbourne chapters: Chapter 5.1-5.3
Feb. 3   Stackelberg and Cournot Models
                Recommended Osbourne chapters: Chapter 6.2

Section	Choi, Charles Q. "Yes We Scan: Have Post-9/11 Airport Screening Technologies Made Us Safer? [Slide Show]." *Scientific American*, Scientific American, 9 Sept. 2011, www.scientificamerican.com/article/have-new-airport-screeningtechnologies-inspired-by-9-11-made-us-safer/.
Feb. 8	Subgame perfect equilibria *Recommended Osbourne chapters: Chapter 5.4*
Feb. 10	Repeated games and strategies *Recommended Osbourne chapters: Chapter 5.5, 14.1-14.5*
Section	Antonioni, Peter. "Game Theory of Thrones: How Strategy Might Decide Who Rules Westeros." *The Conversation*, 10 Apr. 2015, theconversation.com/gametheory-of-thrones-how-strategy-might-decide-who-rules-westeros-39963. Trakman, Leon E. "The Evolution of the Law Merchant: Our Commercial Heritage - Part I: Ancient and Medieval Law Merchant." *Journal of Maritime Law and Commerce,* vol. 12, no. 1, October 1980, p. 1-24.
Feb. 15	Discounting and Folk Theorem *Recommended Osbourne chapters: Chapter 14.7-14.11*
Feb. 17	Discounting and Folk Theorem (Part 2) *Recommended Osbourne chapters: Chapter 15.1-15.3*
Section	Fox, Alex, et al. "First Ever High-Seas Conservation Treaty Would Protect Life in International Waters." *Science*, 4 Apr. 2019, www.sciencemag.org/news/2019/04/first-ever-high-seas-conservationtreaty-would-protect-life-international-waters.
Feb. 22	Bargaining models and Agenda-setting *Recommended Osbourne chapters: Chapter 6.1*
Feb. 24	Bargaining models and Agenda-setting (Part 2) *Recommended Osbourne chapters: Chapter 7.4*
Section	Contributor, Quora. "Why Did the British Invade the Falkland Islands?" *Slate Magazine*, Slate, 19 Mar. 2015, slate.com/human-interest/2015/03/why-didthe-british-invade-the-falkland-islands.html.
Mar. 1	Bargaining models and Agenda-setting (Part 3) + Buffer session *Recommended Osbourne chapters: Chapter 16.1*
Mar. 3	Case Study Exercise (Nuclear stockpiling) *Recommended Osbourne chapters: N/A*
Section	Rainey, Rebecca, and Eleanor Mueller. "Congress, White House Close on 4th Aid Package." *POLITICO*, 20 Apr. 2020, www.politico.com/newsletters/morning-shift/2020/04/20/congress-whitehouse-close-on-4th-aid-package-786974.

Mar. 5 – Mar. 14 Spring break

Topic 5: Games and Uncertainty/Imperfect Information

Mar. 15   Introducing incomplete information
                Recommended Osbourne chapters: Chapter 9.1-9.3

Mar. 17   Bayesian Nash Equilibrium
                Recommended Osbourne chapters: Chapter 9.4-9.7

Section   Staff, NPR. "The Arab Spring: A Year Of Revolution." *NPR*, NPR, 17 Dec. 2011, www.npr.org/2011/12/17/143897126/the-arab-spring-a-year-of-revolution.

Mar. 22   Bayesian Nash Equilibrium (Part 2)
                Recommended Osbourne chapters: Chapter 10.1-10.3

Mar. 24   Candidate positioning and Hotelling game
                Recommended Osbourne chapters:

Section   Tucker, Higgins. "Ross Perot Was the Most Successful Third-Party Candidate since Teddy Roosevelt - Here's How He Stacked Up." *CNBC*, CNBC, 9 July 2019, www.cnbc.com/2019/07/09/heres-how-ross-perot-stacked-up-againstother-third-party-candidates.html.

Mar. 29   Perfect Bayesian Equilibria
                Recommended Osbourne chapters: Revisit Chapter 10.3

Mar. 31   Perfect Bayesian Equilibria (Part 2)
                Recommended Osbourne chapters: Chapter 10.4

Section   "U.S.-Taliban Peace Deal: What to Know." *Council on Foreign Relations*, Council on Foreign Relations, www.cfr.org/backgrounder/us-taliban-peacedeal-agreement-afghanistan-war.

Apr. 5   Signaling models
                Recommended Osbourne chapters: Chapter 10.5-10.9

Apr. 7   Challenger entry
                Recommended Osbourne chapters: N/A

Section   Confessore, Nicholas. "How Do the Leading Presidential Campaigns Spend Money? Differently." *The New York Times*, The New York Times, 19 Oct. 2015, www.nytimes.com/2015/10/19/insider/how-do-the-leading-presidentialcampaigns-spend-money-differently.html.

Apr. 12   Case Study Exercise (Start of Iraq War)
                Recommended Osbourne chapters: N/A

Apr. 14   Other common games in political science + buffer session

Section   *No readings – TA will help with presentation/final project issues

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Apr. 19   Presentation (Group 1)
Apr. 20   Presentation (Group 2)