PS 232-A: Formal Models in Political Science

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UC Berkeley
Location: 706 Barrows
Time: M 9:00 am – 12:00 pm
Office hours: by appointment

This is a first course on game theory and its application in political science research. It covers elements of utility theory, representations of static and dynamic games under complete and incomplete information, and analysis of games based on concepts of Nash equilibrium and refinements. We will study the application of these concepts to simplified versions of models commonly encountered in research on politics. Game theory is easily the most common mode of analysis in the field of formal political theory, and so we will also spend some time discussing the intuition modelers deploy in constructing game theoretic models, as well as the application of standard tools to analyze them. We will also work on developing students' ability to state and prove formal propositions.

232A AND B: Starting in fall 2015, the Department is offering an "advanced" game theory course, 232B. Our present course, 232A, is a basic overview of all the standard topics in noncooperative game theory. 232B will cover many of the same topics but in greater depth, and with more applications as well as attention to theory development. Ideally, students will be able to digest simple applications of game theory in the literature after 232A, and will be able to digest more involved applications, as well as begin to understand how to develop their own, after 232B.

REQUIRED SKILLS: Students should have completed math camp or its equivalent, and passed the math camp exam. Students should have a working knowledge of arithmetic, algebra, elementary calculus, and elementary probability. The course is suitable for students with a large range of prior exposure to mathematics. Students with Ph.D.-level training in modern microeconomics from an economics department may find that this course reinforces, but does not push, their capabilities; students with less background than this should find at least some challenges, conceptual or technical. *All students capable of gaining admission to a Berkeley Ph.D. program can fully succeed in this class regardless of prior technical preparation other than the required skills listed above.*

Reading and Class Sessions

The required text for the course is *Game Theory: An Introduction* by Steven Tadelis (2013, Princeton University Press). I will also occasionally distribute articles or handouts. Whether you complete readings before the associated lecture session or after is up to you, though given the formal nature of the course, most people get more out the conjunction of lecture and reading by doing the reading first, than vice versa.

A recommended supplementary text is *How to Think Like a Mathematician: A Companion to Undergraduate Mathematics* by Kevin Houston (2009, Cambridge University Press). This text will improve your ability to state and prove formal propositions, which we will develop in this course.

Most of the class sessions will consist of lectures, and mostly on theory, concepts, and simple examples. In general, readings will cover more material than the associated lecture. Readings and lecture are complements, not substitutes.

Grades

The course grade will be determined as follows:

1. Problem sets (about 4 total): 60%
2. Participation: 10%
3. Final exam: 30%

1. There will be required problem sets roughly every two-three weeks throughout the term, each equally weighted in the final grade. Problem sets will help students develop facility with important theoretical concepts, as well as the ability to solve games.

2. Class sessions, while primarily composed of lectures, will require extensive student involvement and participation. I will use the whole 10% range for these scores. If you are attentive and ask informed questions you will score close to the maximum. If I do not know what your voice sounds like you will score close to the minimum.

3. There will be a comprehensive take-home final exam at the end of the semester. It will be available at the start of finals week and you will have 48 hours to complete it. It must be completed by 5 p.m. on Friday of finals week. Beyond these stipulations you can take the exam whenever you choose.

GSI and Discussion Section

The GSI is Ryan Hübert. His email address is ryanhubert@berkeley.edu. Ryan will grade problem sets and exams, hold office hours to provide advice on concepts and problem sets, and will conduct a weekly discussion section. The weekly discussion section will consist of review of concepts and lingering issues from class and readings, and demonstration of concepts by working through new problems. It will also focus on refining students' ability to formally state and prove mathematical propositions.

Sequence of Topics and Readings

NOTES. "T" refers to the course text by Tadelis. Some topics will require more time than allotted below, so this schedule is a rough guide and will be adjusted as we progress.

Session 1 Utility theory and rationality; representations of strategic form games
- T chapters 1, 2, and 3

Session 2 Strategic form games: dominance; Nash equilibrium
- T chapters 4 and 5

Session 3 Strategic form games: Nash equilibrium in pure and mixed strategies
- T chapter 6

Session 4 Extensive form games: representation and subgame perfect Nash equilibrium
- T chapters 7 and 8

Session 5 Extensive form games: subgame perfect Nash equilibrium
- T chapter 9

Session 6 Repeated games
- T chapter 10

Session 7 Bargaining games
- T chapter 11

Session 8 Static games of incomplete information: representation and Bayes Nash equilibrium
- T chapter 12

Session 9 Static games of incomplete information: mechanism design theory
- T chapter 14

Session 10 Dynamic games of incomplete information: perfect Bayesian and sequential equilibrium
- T chapter 15

Session 11 Dynamic games of incomplete information: signaling games
- T chapter 16

Session 12 Dynamic games of incomplete information: Sender-receiver (cheap talk) games
- T chapter 18