Political Science 451
Game Theory and Political Science
Fall 2008

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MW 5:00-6:30
Lecture Hall: McNeil 286-7
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This course provides an introduction to non-cooperative game theory and its applications to political science. The goal of the course is to provide students with the background and understanding necessary to read published game-theoretic work in political science journals. To that end, the course covers the basic concepts of game theory, including Nash equilibrium and its main refinements, simultaneous and sequential games, repeated games, evolutionary game theory, and games of incomplete and private information. In addition, we will cover some of the central models used in political science, notably models of public choice (such as the median voter theorem) and models of bargaining. In covering this material, I will aim to highlight game theory's strengths and weaknesses and to discuss what the qualities of good game-theoretic work are; this discussion should also help students to understand the merits and disadvantages of game theory in comparison to other popular approaches to modeling used in political science, of which agent-based modeling is the most prominent.

When you have learned to use it, you will find that game theory provides a remarkably powerful tool for thinking about strategic interaction. Most people, however, do not find it at all intuitive when they first encounter it—in my experience, the only way to learn game theory is to do it. For this reason, one of the central assignments for this course will be a number of problem sets over the course of the semester. Many published applications of game theory make use of matrix algebra and of differential and integral calculus, and we may at times talk about the intuitive logic of such models (without working through the math), but for the problem sets you will need only to be able to do high-school level algebra. If you are concerned about or have questions about your math background, feel free to talk to me.

Your final grade will depend on problem sets (40%), an in-class midterm exam (20%), and a comprehensive in-class final exam (40%). For the problem sets, I encourage you to work in groups of 2-4 students. Everyone must however turn in an individual problem set—I ask only that you identify the other members of your group when doing so. That said, I will note that you will benefit most from group interaction if you attempt to do all problems before meeting with the group and if you verify that you can replicate the group's final answer before turning the problem set in. In general, you will have one week from the time the problem set is distributed to the day on which it is due. Late problem sets will only be accepted in exceptional circumstances

and with prior approval. I will however drop your lowest problem set score when calculating your grade.

The following textbooks are available at the Penn bookstore:

- Avinash Dixit and Susan Skeath. *Games of Strategy.* (2nd edition, 2004)
- Joel Watson. *Strategy: An Introduction to Game Theory.* (2nd edition, 2007)

You are required to purchase one of these texts and are encouraged to acquire both. The Dixit and Skeath text aims for an intuitive understanding of concepts and is light on math; as such, students generally find it to be more accessible, but it is less precise and will be less useful for mathematical formalization. The Watson text is also relatively accessible, but makes greater use of math in its presentation. This approach allows for greater precision, but some students may find it harder to understand. In the problem sets I will assign questions from both texts, so you will need to have access to both; those of you who do not choose to purchase both texts (a perfectly understandable decision) will be able to make use of the copy that is available from the reserve desk at Lippincott Library (found on the western half of the second floor of Van Pelt).

Course Plan

To increase flexibility, the syllabus lists topics in the order that we will cover them, but without specific dates listed for topics. I will indicate when we move from one topic to another as we progress through the course so that you know when you should do the readings for a given topic. I may add additional substantive readings over the course of the semester; I am most likely to do so in the final section. Problem sets will be distributed over the course of the semester, generally at a rate of about one every two weeks; you will have one week from the time the problem set is distributed until it is due. The midterm will take place at some point around section 3 of the course, likely in late October or early November—although the specific timing is not fixed, I will give you substantial prior warning. Finally, note that class with be cancelled on October 13 for fall break, and to accommodate Thanksgiving travel plans we will likely substitute additional reading for class on November 26.

Section 1: An Introduction to Game Theory

- Dixit and Skeath, ch. 1-2.
- Watson, ch. 1, Appendix A (review of mathematics).

Section 2: Nash Equilibrium in Basic Games

Extensive and Normal Form Games

- Dixit and Skeath, ch. 3.

- Watson, ch. 2-5.

Nash Equilibrium and Solving Simple Games

- Dixit and Skeath, ch. 4-5.
- Watson, ch. 6-7, 9.

Mixed Strategy Equilibria

- Dixit and Skeath, ch. 7-8.
- Watson, ch. 11.

Subgame Perfect Equilibrium

- Dixit and Skeath, ch. 6.
- Watson, ch. 14-15.

Models of Public Choice

- Dixit and Skeath, ch. 15.
- Watson, ch. 10.

Section 3: Repeated Games and Evolutionary Game Theory

Repeated Games

- Dixit and Skeath, ch. 11.
- Watson, ch. 22.

Evolutionary Games

- Dixit and Skeath, ch. 13.

Section 4: Dealing with Information

Bayesian Nash Equilibrium

- Dixit and Skeath, ch. 9.
- Watson, ch. 24, 26-27.

Signaling and Perfect Bayesian Equilibrium

- Watson, ch. 28-29.

Bargaining and Conflict

- Dixit and Skeath, ch. 14, 17.
- Watson, ch. 18-19.

Section 5: Conclusions and Reflections