

**V53.0840: Introduction to Game Theory in Political Science**  
**Fall 2004, New York University**  
**Mondays & Wednesdays, 11:00am-12:15pm**  
**805 Silver**

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**Course Description:** Game theory is a mathematical tool used to study strategic interactions. Whenever the choices made by two or more distinct decision makers have an effect on each others' outcomes, the interaction between them is game-theoretic in nature. As suggested by its recent emergence into popular culture (such as in the film *A Beautiful Mind*), game theory has been applied widely, in attempts to address phenomena in a variety of academic disciplines, including political science, economics, and biology. Within political science, the basic description of a game that is provided above can be found in a wide variety of settings. In elections, the policy platforms selected by political candidates are a strategic choice that can bear heavily on the candidates' outcomes—winning or losing. In international relations, the level of investment that governments choose to make in military hardware is a strategic choice that can have an impact on matters of war, peace, and the control of territory. Because much of politics is about the allocation of scarce goods, such as power and wealth, and the competition for these goods, much of politics would seem to be a natural fit for the language of game theory.

The basic objectives of this course are twofold. First, it introduces the basic concepts of elementary non-cooperative game theory in a way that allows you to use them in solving simple problems. And second, it gives a flavor of how game theory can be used in the study of political science by presenting a wide array of example applications. In addition, throughout the course we will discuss evidence from experiments and from other sources that bears on when we should expect game theory to be most useful in applied studies, and when we might reasonably have doubts about the types of predictions that it makes about human behavior.

Students should also be aware of another game theory-based course, "Games, Strategy, and Politics," (V53.0844) that is also being offered this semester, by Prof. Brams. There is not much overlap between the two courses: this course describes "non-cooperative game theory" (which will be defined in class) and its basic applications in political science, while "Games, Strategy, and Politics" covers social choice theory, some cooperative game theory, the theory of moves, uses of strategy in voting (and in other areas) that are not covered in this course, fair-division procedures, and other topics. Potentially interested students are encouraged to examine the syllabus of "Games, Strategy, and Politics" in addition to this syllabus.

**Course Prerequisites:** There are no formal prerequisites for this course. No mathematical knowledge beyond what is typically taught in high school (such as algebra) is required; additional concepts that may be used in class (such as basic use of probability) will be introduced and discussed at length as we go along.

**Course Requirements:** Your course grade will be determined by a combination of the following factors: (1) Problem Sets, which will be assigned most weeks (40%); (2) an in-class mid-term exam (20%); and (3) a (comprehensive) final exam (40%). Problem sets will typically be handed out on Wednesdays, and will be due at the beginning of class one week from the date they are assigned. Late problem sets will not be accepted unless the circumstances are exceptional and permission is obtained in advance. However, a certain degree of flexibility is built into the system: your lowest problem set score will be dropped from the calculation of your overall problem set grade. Because game theory is an additive subject, problem sets will tend to become more difficult over the course of the semester; as such, it is to your advantage not to rely on dropping a problem set too early in the semester. Students are permitted to work in small groups on the assignments, but (1) students must seriously attempt all the problems on their own before working in groups; (2) students are required to list any other students with whom they have collaborated on the top of their homework assignment; and (3) it is expected that students only hand in work that they could, after completing the assignment, reproduce on their own.

**Course Books:** The following books, both of which are required, are available for purchase in the NYU bookstore:

- Dixit, Avinash and Susan Skeath. 2004. *Games of Strategy*. W.W. Norton & Company.
- Osborne, Martin. 2004. *An Introduction to Game Theory*. Oxford Univ. Press.

Both of these two books cover similar ground, but their styles are very different; Dixit and Skeath is more informal, using relatively little math, but in places tends towards oversimplification, while Osborne has the opposite virtues and vices. Depending on your tastes, you may find Dixit and Skeath somewhat too chatty, while others may find Osborne too mathematical. In general, the level of the lectures from a mathematical point of view will be pitched somewhere in between the two texts. In any event, both books take great care in explaining the intuitions behind the concepts they discuss, and both employ a wide range of examples from political science as well as from other disciplines, such as economics and biology, and it is recommend that you refer to both of them often as you confront new concepts for the first time.

In addition to the material covered in the two textbooks, you will of course also be responsible for any material presented in lecture. While the basic mathematical concepts of game theory that will be discussed in class are the same as those in the books, many of the political science examples that will be described in lecture are not in the books. As such, good class attendance is essential for complete exposure to the material you will need to know for problem sets and exams.

## **Course Outline**

The lengths of time to be spent treating each subject are approximate. It may be that class will proceed a bit more slowly than the syllabus suggests. The midterm exam will be held on a date to be scheduled later.

### **Week 1 (Sept. 8, 2004): Introduction**

Dixit & Skeath Chapter 1.  
Osborne Chapter 1.

### **Week 2 (Sept. 13 & 15, 2004): Preferences, Utility, Decision Theory, & Games**

Dixit & Skeath Chapter 2.

### **Weeks 3 & 4 (Sept. 20, 22, 27, & 29, 2004): Simultaneous-Move Games & Nash Equilibrium**

Dixit & Skeath Chapter 4 & 5.  
Osborne Chapters 2 & 3.

### **Weeks 5 & 6 (Oct. 4, 6, 11, & 13, 2004): Extensive-Form Games, Backward Induction, & Subgame-Perfect Nash Equilibrium**

Dixit & Skeath Chapter 3.  
Osborne Chapters 5, 6, & 7.

### **Week 7 (Oct. 18 & 20, 2004): Credibility and Commitment**

Dixit & Skeath Chapters 6 & 10.

### **Week 8 (Oct. 25 & 27, 2004): Games Involving Mixed Strategies**

Dixit & Skeath Chapter 7 & 8.  
Osborne Chapter 4.

### **Week 9 (Nov. 1 & 3, 2004): Repeated Games**

Dixit & Skeath Chapter 11.  
Osborne Chapters 14 & 15.

### **Week 10 (Nov. 8 & 10, 2004): Collective Action and Public Goods**

Dixit & Skeath Chapter 12.

### **Weeks 11-12 (Nov. 15, 17, & 22, 2004): Games of Imperfect Information I: Bayes' Rule, Uncertainty, and Bayesian Games**

Dixit & Skeath Chapter 9.  
Osborne Chapter 9.

### **Weeks 12-13 (Nov. 24, 29, & Dec. 1, 2004): Games of Imperfect Information II: Signalling, Reputation, and Perfect Bayesian Equilibrium**

Dixit & Skeath Chapter 9.  
Osborne Chapter 10.

### **Week 14 (Dec. 6 & 8, 2004): Evolutionary Games**

Dixit & Skeath Chapter 13.  
Osborne Chapter 13.

### **Week 15 (Dec. 13, 2004): Review and Wrap-up**

