# Game Theory in International Relations
## Political Science 410
## Spring 2008
## Monday and Wednesday 4:15-5:30, 067 Willard

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International relations—and politics in general—are complex. The events we observe at the macro-level (e.g., wars, trade, terrorism) are driven by the confluence of many events and decisions that occur at the micro-level (e.g., in war: elite decision-making, domestic politics, culture, state alliances, and so on). The tool that political scientists use to make sense of this complexity is modeling. A model is a simplification of real-world phenomena into a more theoretically tractable form, through which we may better make sense of the world. There are a variety of different types of models that may be used, including non-mathematical, computer, and mathematical models. In this course we will investigate one type of mathematical model: game theory. You may have heard of game theory before if you have seen the movie *A Beautiful Mind*, a biographical account of an important game theorist, John Nash, or if you have ever watched the TV show Numb3rs, in which Charlie (Professor of Mathematics) helps his brother Don (FBI agent) solve crimes using mathematical models, including game theory. We won't be solving murder mysteries in this course, but it will be exciting nonetheless. Over the past twenty years game-theoretic models have been increasingly used to study international relations, including war, terrorism, crisis bargaining, deterrence, and economic sanctions. These models have provided novel insights into how and why outcomes in the political world look as they do.

This course introduces students to game theory, a mathematical tool that is used to examine the strategic behavior between economic, political, or social actors. Game-theoretic models are used to provide insight into outcomes (e.g., conflict and cooperation) that are jointly produced by choices made by distinct actors (e.g., states, groups, or individuals). Those choices are viewed as resulting from a decision process that is based on assumptions about the goals actors have, about the knowledge those actors have about the goals of other actors, and about what those other actors may know in turn. By reducing real-world situations to a (necessarily over-simplified) system of actors and decisions, we reveal important political patterns that help us understand phenomena like war, terrorism, and trade.

The course consists of a combination of lectures and in-class model building and solving, the primary objectives of which are to introduce students to game theory and to demonstrate how game-theoretic models can provide insights into international relations. However, since game theory is a mathematical tool, we will also be using mathematics. Mathematical knowledge that is typically taught in high school algebra should be sufficient. Any additional

mathematics that is needed will be introduced in class and discussed at length. That being said, the focus will be on the intuition behind game-theoretic concepts and the application of these concepts to international relations. Additionally, since game-theoretic models produce predictions in the form of hypotheses (i.e., if-then statements) we will be examining empirical evidence (e.g., case studies, statistical analysis, and laboratory experiments) to see how well game-theoretic models predict real-world behavior.

## Readings

There is one assigned book for this course, which is available in the campus bookstore, but can be purchased online for a potentially lower price (try www.amazon.com or www.addall.com). NOTE: if you purchase the book online you should make sure that you get the second edition, which is very different from the first edition.

Avinash Dixit and Susan Skeath. 2004. *Games of Strategy*, 2nd edition. New York: W.W. Norton & Company.

In addition to the Dixit and Skeath book, we will be reading journal articles and book chapters which will be available on ANGEL.

## Evaluation

Your grade for this course will consist of 3 parts:

1. Exams (40%)

   There will be two exams, which are scheduled to be given on March 24 and during the final exam period. Both exams will be in-class and closed book. The final exam is given during the period scheduled by the university. Each student is responsible for knowing when and where the final exam is to be given. We will discuss together in class the format of the exams. Each exam will count as 20% of your final grade.

   NOTE: Make-up exams will be given only in very extreme circumstances. Students needing to take a make-up exam must have received approval by me well before the exam date. A missed exam is assigned a grade of 0. If you miss an exam due to an illness or death in the family, I will require written verification.

2. Problem Sets (50%)

   There will be ten homework assignments during the semester. These assignments must be handed in **before** the start of class on their due dates, which are listed on the course schedule below. Each of these assignments will count as 5% of the course grade.

   Late assignments will be marked down the equivalent of a full letter grade for each 24 hour period in which they are late. I will only make an exception to this policy if 1) you contact me in writing at least 7 days in advance to discuss a conflict, or 2) you provide documentation of a severe illness or family emergency that prevented you from completing the assignment on time.

   NOTE: Following the lectures will not be enough to do well in this class. You must be able to work through the problems yourselves. In short, do the homework assignments.

Not only will it count against your grade if you do not do well on the homework assignments, but you will be asked to solve similar game-theoretic problems on the exams. You can only learn this material by practice.

3. Class Participation (10%)
   Class participation consists of attending class and participating in discussion. Both are vital to develop a full understanding of the material. I expect you to have read the assigned chapter or journal article prior to coming to the class for which it is assigned.

Final course letter grades will be assigned based upon the scales shown below:

A: 92.5 and above
A-: 90-92.5
B+: 87.5-90
B: 82.5-87.5
B-:80-82.5
C+: 77.5-80
C: 70-77.5
D: 60-70
F: 0-60

## Class Schedule

| Date | Topic |
|---|---|
| January 14 | **Course Overview** |
| January 16 | **Basic Ideas and Examples**<br>Dixit & Skeath, Ch. 1<br><br>Robert Powell. 1999. *In the Shadow of Power*. Princeton, NJ: Princeton University Press. p. 23-39 |
| January 21 | *No Class: MLK Day* |
| January 23 | **How to Think About Strategic Games**<br>Dixit & Skeath, Ch. 2 |
| January 28 | **Games with Sequential Moves**<br>Dixit & Skeath, Ch. 3 |
| January 30 | **Games with Sequential Moves**<br>Barry R. Weingast. 1998. Political Stability and Civil War: Institutions, Commitment, and American Democracy. In *Analytic Narratives*, edited by Robert H. Bates, Avner Greif, Margaret Levi, Jean-Laurent Rosenthal, and Barry R Weingast. Princeton, NJ: Princeton University Press. |
| February 4 | **Simultaneous-Move Games with Pure Strategies I: Discrete Strategies**<br>Dixit & Skeath, Ch. 4<br><br>**Problem Set 1 DUE** |
| February 6 | **Simultaneous-Move Games with Pure Strategies I: Discrete Strategies**<br>Roger B. Myerson. 1999. Nash Equilibrium and the History of Economic Theory. *Journal of Economic Literature* 37(3): 1067-1082.<br><br>John F. Nash. 1950. Equilibrium Points in n-Person Games. *Proceedings of the National Academy of Sciences* 36(1): 48-49.<br><br>John Nash. 1951. Non-Cooperative Games. *The Annals of Mathematics* 54(2): 286-295. |
| February 11 | **Simultaneous-Move Games with Pure Strategies I: Discrete Strategies**<br>George W. Downs, David M. Rocke, and Randolph M. Siverson. 1985. Arms Races and Cooperation. *World Politics* 38(1): 118-146. |
| February 13 | **Simultaneous-Move Games with Pure Strategies II: Continuous Strategies** |

Dixit & Skeath, Ch. 5

**Problem Set 2 DUE**

February 18    **Simultaneous-Move Games with Pure Strategies II: Continuous Strategies**
Todd Sandler. 2005. Collective Versus Unilateral Responses to Terrorism. *Public Choice*
124: 75-93.

February 20    **Combining Sequential and Simultaneous Moves**
Dixit & Skeath, Ch. 6

**Problem Set 3 DUE**

February 25    **Combining Sequential and Simultaneous Moves**
Barry R. Weingast. 1997. The Political Foundations of Democracy and the Rule of Law.
*American Political Science Review* 91(2): 245-263.

February 27    **Probability and Expected Utility**
Dixit & Skeath, Ch. 7 (p. 221-232)

How to Win At Poker, and Other Science Lessons. *The Economist.* October 12, 1996.

**Problem Set 4 DUE**

March 3    **Simultaneous-Move Games with Mixed Strategies I: Zero-Sum Games**
Dixit & Skeath, Ch. 7

March 5    **Simultaneous-Move Games with Mixed Strategies I: Zero-Sum Games**
George Tsebelis. 1989. The Abuse of Probability in Political Analysis: The Robinson
Crusoe Fallacy. *American Political Science Review* 83(1): 77-91.

March 10    *No Class: Spring Break*

March 12    *No Class: Spring Break*

March 17    **Simultaneous-Move Games with Mixed Strategies II: Non-Zero-Sum Games**
Dixit & Skeath, Ch. 8

**Problem Set 5 DUE**

March 19    **Simultaneous-Move Games with Mixed Strategies II: Non-Zero-Sum Games**
Brett Ashley Leeds. 1999. Domestic Political Institutions, Credible Commitments, and
International Cooperation. *American Journal of Political Science* 43(4): 979-1002.

March 24    **EXAM**

March 26    *No Class: ISA*

March 31    **Movie: TBA**

April 2     **Movie: TBA**

April 7     **Uncertainty and Information**
            Dixit & Skeath, Ch. 9

            **Problem Set 6 DUE**

April 9     **Uncertainty and Information**
            Andrew Kydd. 2000. Trust, Reassurance, and Cooperation. *International Organization* 54(2): 325-357.

April 14    **Strategic Moves**
            Dixit & Skeath, Ch. 10

            **Problem Set 7 DUE**

April 16    **Strategic Moves**
            Navin A. Bapat. 2006. State Bargaining with Transnational Terrorist Groups. *International Studies Quarterly* 50(1): 213-229.

April 21    **The Prisoners' Dilemma and Repeated Games**
            Dixit & Skeath, Ch. 11

            **Problem Set 8 DUE**

April 23    **The Prisoners' Dilemma and Repeated Games**
            Robert Axelrod. 2006. *The Evolution of Cooperation.* New York, NY: Basic Books. ch. 1-3.

April 28    **Bargaining**
            Dixit & Skeath, Ch. 17

            **Problem Set 9 DUE**

April 30    **Bargaining**
            Robert Powell. 2002. Bargaining Theory and International Conflict. *Annual Review of Political Science* 5: 1-30.

            John F. Nash. 1950. The Bargaining Problem. *Econometrica* 18(2): 155-162.

John Nash. 1953. Two-Person Cooperative Games. *Econometrica* 21(1): 128-140.

**Problem Set 10 DUE**

**Academic Dishonesty**[1]
The Department of Political Science, along with the College of the Liberal Arts and the University, takes violations of academic dishonesty seriously. Observing basic honesty in one's work, words, ideas, and actions is a principle to which all members of the community are required to subscribe.

All course work by students is to be done on an individual basis unless an instructor clearly states that an alternative is acceptable. Any reference materials used in the preparation of any assignment must be explicitly cited. In an examination setting, unless the instructor gives explicit prior instructions to the contrary, whether the examination is in class or take home, violations of academic integrity shall consist of any attempt to receive assistance from written or printed aids, or from any person or papers or electronic devices, or of any attempt to give assistance, whether the one so doing has completed his or her own work or not.

Other violations include, but are not limited to, any attempt to gain an unfair advantage in regard to an examination, such as tampering with a graded exam or claiming another's work to be one's own. Violations shall also consist of obtaining or attempting to obtain, previous to any examinations, copies of the examination papers or the questions to appear thereon, or to obtain any illegal knowledge of these questions. Lying to the instructor or purposely misleading any Penn State administrator shall also constitute a violation of academic integrity.

In cases of a violation of academic integrity it is the policy of the Department of Political Science to impose appropriate penalties that are consistent with University guidelines.

**Disabilities**
The Pennsylvania State University encourages qualified people with disabilities to participate in its programs and activities and is committed to the policy that all people shall have equal access to programs, facilities, and admissions without regard to personal characteristics not related to ability, performance, or qualifications as determined by University policy or by state or federal authorities. If you anticipate needing any type of accommodation in this course or have questions about physical access, please tell the instructor as soon as possible. Reasonable accommodations will be made for all students with disabilities, but it is the student's responsibility to inform the instructor early in the term. Do not wait until just before an exam to decide you want to inform the instructor of a learning disability; any accommodations for disabilities must be arranged well in advance.

**Visit our web site**
The Political Science Department is in the process of upgrading its web site and will continue to do so during this and future academic years. In the undergraduate section you will find a wealth of information including course schedules, faculty office hours, faculty home

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[1]Much of the text above has been directly obtained from the sections of the Princeton University website hftp://www.princeton.edu/pr/pub/rrr/99/pages/Ol.htm ) concerning academic integrity (Rights, Rules, Responsibilities introductory text as well as pages 55-69) as well as from the website of the Department of Economics at The Pennsylvania State University.

pages describing their areas of teaching and research activities, answers to questions about advising, internship opportunities, announcements, and much, much, more. Check back often: we will continuously update our information about internships and career opportunities: **http://polisci.la.psu.edu/**