

POS 6933 FORMAL THEORY – UFL – FALL 2005

GAME THEORY

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Place & Time: MAT 10, R 3:00-5:30pm.

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Office hours: Monday, Wednesday 3:00 – 5:30pm.

DESCRIPTION

Game theory is a formal (mathematical) framework that scholars use to analyze strategic situations involving two or more actors who find themselves in interdependent decision making. In this course we will cover situations of conflict, cooperation, coordination, bargaining, and more. Game theory has proven to be a powerful tool in analyzing these and many other strategic situations. However, this course is essentially focusing on the fundamentals of game theory. This means among other things that it will be a rigorous introduction which would not shy away from technical details while at the same time emphasizing practical modeling issues and solution concepts, as well as real applications. Students should understand from the beginning that the hard part of game theory is not the mathematic aspects of it – rather, it is the logic behind it. Mastering this logic demands time, effort, and serious thinking and ingenuity. Nonetheless, students are expected to have a sound knowledge of algebra and calculus, as well as introductory probability.

Game theory is a highly stylized approach to the study of politics. Hence, at times there is a danger that the students (and, in fact, game theorists in general) might lose touch with “reality.” Therefore, students need to constantly remain clear on what a model can do and where it is expected to fail. Moreover, although game theory is included in the realm of formal theory and methods, it depends on the important task of interpretation and qualitative thinking. Indeed, beyond and underneath the turf war of quantitative-qualitative disputation no approach can avoid – or should avoid – the power of human interpretation.

REQUIREMENTS:

There will be numerous problem sets, roughly one every week, which will expand on the lectures. Some of the solutions will be covered in class. The final exam will be comprehensive.

Advice:

1. Do all assigned problems.
2. Do not delude yourself by working in groups.
3. Invest your time and effort intelligently.
4. Do not get frustrated.

REQUIRED TEXTS

1. Morrow, James D. 1994. *Game Theory for Political Scientists*. Princeton University Press.
2. Additional readings collected in an electronic course package.

RECOMMENDED TEXTS

1. Roger B. Myerson. 1997. *Game Theory: Analysis of Conflict*. Harvard University Press.
2. Martin J. Osborne and Ariel Rubinstein. 1994. *A Course in Game Theory*. MIT Press.

RECOMMENDED (INTRODUCTORY-LEVEL) TEXTS

1. Watson, Joel. 2002. *Strategy: An Introduction to Game Theory*. Norton Publishers.
2. Dixit, Avinash, and Susan Skeath. 2004. *Games of Strategy*, 2nd ed. Norton Publishers.

OVER-ALL GRADING POLICY

1. Combined together the ten homework assignments count for 40% of the grade. Each homework is worth 4% of the overall grade.
2. Each of the two in-class exams counts for 30% of the overall grade.

RULES OF UNIVERSITY OF FLORIDA

6C1-4.017 Student Affairs: Academic Honesty Guidelines.

- (1) All students are required to abide by the Academic Honesty Guidelines which have been accepted by the University and are set forth in this rule.
- (2) The conduct set forth hereinafter constitutes a violation of the Academic Honesty Guidelines. Those adjudged to have committed such conduct shall be subject to the sanctions provided in Rule 6C1-4.016, F.A.C.
 - (a) Cheating — The improper taking or tendering of any information or material which shall be used to determine academic credit. Taking of information includes, but is not limited to, copying graded homework assignments from another student; working together with another individual(s) on a take-home test or homework when not specifically permitted by the teacher; looking or attempting to look at another student's paper during an examination; looking or attempting to look at text or notes during an examination when not permitted. Tendering of information includes, but is not limited to, giving your work to another student to be used or copied; giving

someone answers to exam questions either when the exam is being given or after having taken an exam; giving or selling a term paper or other written materials to another student; sharing information on a graded assignment.

(b) Plagiarism — The attempt to and/or act of representing the work of another as the product of one's own thought, whether the other's work is published or unpublished, or simply the work of a fellow student. Plagiarism includes, but is not limited to, quoting oral or written materials without citation on an exam, term paper, homework, or other written materials or oral presentations for an academic requirement; submitting a paper which was purchased from a term paper service as your own work; submitting anyone else's paper as your own work.

(c) Bribery — The offering, giving, receiving or soliciting of any materials, items or services of value to gain academic advantage for yourself or another.

(d) Misrepresentation — Any act or omission of information to deceive a teacher for academic advantage. Misrepresentation includes using computer programs generated by another and handing it in as your own work unless expressly allowed by the teacher; lying to a teacher to increase your grade; lying or misrepresenting facts when confronted with an allegation of academic dishonesty.

(e) Conspiracy — The planning or acting with one or more persons to commit any form of academic dishonesty to gain academic advantage for yourself or another.

(f) Fabrication — The use of invented or fabricated information, or the falsification of research or other findings with the intent to deceive for academic or professional advantage.

WEEKLY READING ASSIGNMENTS AND OUTLINE OF THE COURSE

WEEK 1 / SEPTEMBER 1

TOPIC 1: REVIEW: PROBABILITY THEORY, FORMAL LOGIC, SETS

Morrow: Appendix 1: Basic Mathematical Knowledge

- Algebra
- Set Theory
- Relations and Functions
- Probability Theory
- Limits
- Differential Calculus
- Partial Derivatives and Lagrange Multipliers
- Integral Calculus
- The Idea of a Mathematical Proof

WEEK 2 / SEPTEMBER 8

TOPIC 2: INTRODUCTION: WHY STUDY GAME THEORY?

Morrow: Chapter 1: Overview

- What Is Game Theory?
- What Can You Do with Game Theory?
- Four Problems in Political Science
- Why Model?
- The Rational Choice Approach to Social Modeling

Articles:

1. John Ferejohn and Debra Satz. 1994. Rational Choice and Social Theory. *The Journal of Philosophy* 91 (2) (February): 71-87.
2. Duncan Snidal. 1985. The Game Theory of International Politics. *World Politics* 38 (1) (October): 25-57.

PROBLEM SET 1

WEEK 3/ SEPTEMBER 15

TOPIC 3: UTILITY THEORY AND DECISION THEORY

Morrow: Chapter 2: Utility Theory

- The Concept of Rationality

- How Do Utility Functions Predict Actions?
- An Example: Nixon's Christmas Bombing
- Certainty, Risk, and Uncertainty
- Utility Theory under the Condition of Risk
- Some Common Misconceptions about Utility Theory
- Utility Functions and Types of Preferences
- A Simple Example: The Calculus of Deterrence
- Another Simple Example: The Decision to Vote
- Why Might Utility Theory Not Work?

Articles:

1. David W. Rohde. 1979. Risk-Bearing and Progressive Ambition: The Case of Members of the United States House of Representatives. *American Journal of Political Science* 23 (1): 1-26.

PROBLEM SET 2

WEEK 4/ SEPTEMBER 22

TOPIC 4: SPECIFYING A NORMAL FORM GAME AND NASH EQUILIBRIA

Morrow: Chapter 3: Specifying a Game

- Formalizing a Situation: Deterrence in the Cuban Missile Crisis
- Games in Extensive Form
- Games in Strategic Form

Morrow: Chapter 4: Classical Game Theory

- Defining the Terms of Classical Game Theory
- Domination, Best Replies, and Equilibrium
- Mixed Strategies
- The Minmax Theorem and Equilibria of Two-Person, Zero-Sum Games
- Characteristics of Nash Equilibria
- Nash Equilibria and Common Conjectures
- Rationalizability
- Political Reform in Democracies
- Candidate Competition in the Spatial Model of Elections
- A Very Brief Introduction to Cooperative Game Theory

Articles:

1. Barbara Geddes. 1991. A Game Theoretic Model of Reform in Latin American Democracies. *American Political Science Review* 85 (2) (June): 371-392.
2. Joseph Grieco. 1988. Realist Theory and the Problem of International Cooperation: Analysis with an Amended Prisoner's Dilemma. *Journal of Politics* 50 (3): 600-24.

3. Duncan Snidal. 1991. Relative Gains and the Pattern of International Cooperation. *American Political Science Review* 85 (3) (September): 701-726.

PROBLEM SET 3

WEEK 5/ SEPTEMBER 29

TOPIC 5: SPECIFYING EXTENSIVE FORM GAMES, BACKWARDS INDUCTION, AND SUBGAME PERFECTION

Morrow: Chapter 5: Solving Extensive-Form Games: Backwards Induction and Subgame Perfection

- Backwards Induction
- Subgame Perfection
- Sophisticated Voting
- Agenda Control
- Legislative Rules and Structure-Induced Equilibria
- The Rubinstein Bargaining Model
- Bargaining in Legislatures
- Why Might Backwards Induction Yield Counterintuitive Results?

Dixit and Skeath: Chapter 14: Brinkmanship: The Cuban Missile Crisis

Articles:

1. John Ferejohn and Charles Shipan. 1990. Congressional Influence on Bureaucracy. *Journal of Law, Economics, and Organization* 6 (Special Issue): 1-20.
2. R. Michael Alvarez, Geoffrey Garrett, and Peter Lange. 1991. Government Partisanship, Labor Organization, and Macroeconomic Performance. *American Political Science Review* 85 (2) (June): 539-556
3. Torben Iversen. 1998. Wage Bargaining, Central Bank Independence, and the Real Effects of Money. *International Organization* 52 (3) (Summer): 469-504

PROBLEM SET 4

WEEK 6/ OCTOBER 6

TOPIC 6: BELIEFS, BAYES' THEOREM, AND GAMES WITH UNCERTAINTY

Morrow: Chapter 6: Beliefs and Perfect Bayesian Equilibria

- Bayes' Theorem
- The Preference for Biased Information
- Perfect Bayesian Equilibria
- Nuclear Deterrence

Articles:

1. Randall Calvert. 1985. The Value of Biased Information. *The Journal of Politics* 47 (2) (June): 530-555.
2. John Ginkel and Alastair Smith. 1999. So You Say You Want a Revolution: A Game Theoretic Explanation of Revolution in Repressive Regimes. *Journal of Conflict Resolution* 43 (June): 291 - 316.

PROBLEM SET 5

WEEK 7/ OCTOBER 13

TOPIC 7: GAMES OF LIMITED INFORMATION I

Morrow: Chapter 7: More on Noncooperative Equilibrium: Perfect and Sequential Equilibria

- Elimination of Weakly Dominated Strategies
- Perfect Equilibrium
- Sequential Equilibrium
- Deterrence and the Signaling of Resolve
- "Why Vote?" Redux

Articles:

1. Ethan Bueno de Mesquita. 2005. The Terrorist Endgame: A Model with Moral Hazard and Learning. *Journal of Conflict Resolution* 49 (April): 237 - 258.
2. Leonard Wantchekon and Andrew Healy. 1999. The "Game" of Torture. *Journal of Conflict Resolution* 43 (October): 596 - 609.

PROBLEM SET 6

WEEK 8/ OCTOBER 20

TOPIC 8: GAMES OF LIMITED INFORMATION II

Morrow: Chapter 8: Games of Limited Information and Restrictions on Beliefs

- Signaling Games
- The Informational Role of Congressional Committees
- Bargaining under Incomplete Information
- Deterrence and Out-of-Equilibrium Beliefs
- An Introduction to Restrictions on Beliefs
- "Cheap Talk" and Coordination

Articles

1. James Fearon. 1995. Rationalist Explanations for War. *International Organization* 49 (3): 379-414.

2. William Roberts Clark. 1998. Agents and Structures: Two Views of Preferences, Two Views of Institutions. *International Studies Quarterly* 42: 245-270.
3. Daniel G. Arce M. and Todd Sandler. 2005. Counterterrorism: A Game-Theoretic Analysis *Journal of Conflict Resolution* 49 (April): 183 - 200.

PROBLEM SET 7

WEEK 9/ OCTOBER 27

FIRST IN-CLASS EXAMINATION

WEEK 10/ NOVEMBER 3

TOPIC 9: REPEATED GAMES

Morrow: Chapter 9: Repeated Games

- Thinking about Repetition: Iterated Prisoner's Dilemma
- Folk Theorems
- Finite Repeated Games: The Chain Store Paradox
- Stationarity
- Retrospective Voting and Electoral Control

Articles

1. Barry Weingast. 1997. The Political Foundations of Democracy and the Rule of Law. *American Political Science Review* 91 (2) (June): 245-263.
2. Avinash Dixit. 2000. A Repeated Game Model of Monetary Union. *The Economic Journal* 110 (October): 759-780.
3. Harel Goren and Gary Bornstein. 2000. The Effects of Intragroup Communication on Intergroup Cooperation in the Repeated Intergroup Prisoner's Dilemma (IPD) Game. *Journal of Conflict Resolution* 44 (October): 700 - 719.

PROBLEM SET 8

WEEK 11/ NOVEMBER 10

TOPIC 10: COALITIONAL GAMES

Myerson: Chapter 10: Coalitions in Cooperative Games

- Introduction to Coalitional Analysis
- Characteristic Functions with Transferable Utility
- The Core
- The Shapley Value
- Values with Cooperation Structures
- Other Solution Concepts

- Coalitional Games with Nontransferable Utility
- Cores without Transferable Utility
- Values without Transferable Utility Exercises

Osborne and Rubinstein: Chapter 13: The Core

- Coalitional Games with Transferable Payoff
- The Core
- Nonemptiness of the Core
- Markets with Transferable Payoff
- Coalitional Games without Transferable Payoff
- Exchange Economies

Osborne and Rubinstein: Chapter 14: Stable Sets, the Bargaining Set, and the Shapley Value

- Two Approaches
- The Stable Sets of von Neumann and Morgenstern
- The Bargaining Set, Kernel, and Nucleolus
- The Shapley Value

Osborne and Rubinstein: Chapter 15: The Nash Solution

- Bargaining Problems
- The Nash Solution: Definition and Characterization
- An Axiomatic Definition
- The Nash Solution and the Bargaining Game of Alternating Offers
- An Exact Implementation of the Nash Solution

Articles

1. Brent Simpson and Michael W. Macy. 2004. Power, Identity, and Collective Action in Social Exchange. *Social Forces* 82 (4): 1373-1409.
2. Robert M. Hayes. 2003. Cooperative Game Theoretic Models for Decision-Making in Contexts of Library Cooperation. *Library Trends* 51 (3): 441-442.
3. Todd Sandler. 1999. Alliance Formation, Alliance Expansion, and the Core. *Journal of Conflict Resolution* 43 (December): 727 - 747.

PROBLEM SET 9

WEEK 12/ NOVEMBER 17

TOPIC 11: APPLICATIONS TO SPECIFIC STRATEGIC SITUATIONS

Dixit and Skeath: Chapter 13: Evolutionary Games

1. The framework
2. Prisoner's Dilemma
3. Chicken

4. The Assurance Game
5. Interactions across Species
6. The Hawk-Dove Game
7. Three Phenotypes in the Population
8. Some General Theory
9. Playing the Field
10. Evolution of Cooperation and Altruism

Articles:

1. Peter John. 2003. Is There Life After Policy Streams, Advocacy Coalitions, and Punctuations: Using Evolutionary Theory to Explain Policy Change? *The Policy Studies Journal* 31 (4): 481-498.
2. Alberto Bisin. 2004. Cooperation as a Transmitted Cultural Trait. *Rationality and Society* 16 (4): 477-507.
3. Giovanni Ponti and Robert M. Seymour. 1999. Evolutionary Stability of Inequality Structures. *Rationality and Society* 11 (1): 47 - 77.

PROBLEM SET 10

WEEK 13/ DECEMBER 1

TOPIC 12: CONCLUSION, WHY STUDY GAME THEORY? REVISITED

Morrow: Chapter 10: Conclusion: Where Do We Go from Here?

- How Do Formal Models Increase Our Knowledge?
- The Weaknesses of Game Theory
- How Does One Build a Model?