

***SYLLABUS***

**G53.2108: Game Theory I (for PhD students)**

**Spring 2006, New York University**

**Lecture: Tuesdays 11am-12:20pm and Wednesdays 4pm-6pm  
726 Broadway, room 700**

**Prof. Eric Dickson**

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**Office Hours: Tuesdays 4:15pm-5:30pm & by app't (or just stop by)**

**TA: Leslie Johns**

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**Office: 726 Broadway, room XXX**

**Recitation Section: Thursdays 10am-12pm**

**Course Description:** This course is designed to provide a thorough introduction to non-cooperative game theory for political science PhD students. The objective of the course is to cover the basic concepts of non-cooperative game theory rigorously while allowing plenty of time to discuss applications in many different fields of political science. All of this takes a lot of time and there is much to cover, so we will be holding 3 hours & 20 minutes of lecture per week. In addition, the TA, Leslie Johns, will hold a 2 hour recitation section weekly for assistance with problem sets and for other purposes.

The course will not cover social choice theory or cooperative game theory.

**Course Prerequisites:** G53.1110 Mathematics for Political Scientists or equivalent.

**Course Requirements:**

- (1) Homework assignments will be handed out almost weekly – about 10 or so over the course of the semester – and will be due at lecture at 11am on Tuesdays. The material in a game theory course is cumulative, and it is extremely important not to fall behind. Because of this, late homework sets will simply not be accepted. Homework will consist of 50% of the course grade and will be calculated based on your highest  $n-1$  scores out of the  $n$  problem sets.
- (2) A take-home midterm will be distributed by email on 21 March 2006 and will be due at 5pm on 31 March 2006. You may refer to textbooks while taking the midterm but you must not collaborate with anyone else. The midterm counts for 15% of the class grade.

- (3) An in-class final exam worth 35% of the class grade will take place sometime in early May – precise date and time TBA.

**Course Books:**

There are two required textbooks for the course, both of which I find to be excellent. It is highly recommended that you follow along in both of them as the course progresses:

Osborne, Martin J. 2004. *An Introduction to Game Theory*. Oxford University Press.

Gibbons, Robert. 1992. *Game Theory for Applied Economists*. Princeton University Press.

In addition, there is a further, recommended textbook for the course at the bookstore, which is pitched at a higher level than either of the required books. It is recommended primarily for students who wish to go on to do advanced formal theory work:

Osborne, Martin J. and Ariel Rubinstein. 1994. *A Course in Game Theory*. MIT Press.

The outline of the first ten weeks of the course roughly follows the order of material in both Osborne and Gibbons, although lectures will contain numerous political science examples that are in neither book. In addition, certain concepts are taught in lecture at a higher level than appears in either Osborne or Gibbons. The last four weeks of the course consist of advanced or special topics that are incompletely covered by any of the texts.

**Course Outline**

**Week 1 (18 Jan 2006): Preference & Decision Theory I**

- Preference Relations
- Ordinal Utility

**Week 2 (24/25 Jan): Preference & Decision Theory II; Normal Form Games of Complete Information I**

- Cardinal Utility
- Expected Utility
- Introduction to Games in Normal Form (discrete strategy spaces)
- Dominance & Iterated Dominance
- Nash Equilibrium
- Mixed Strategies

- Osborne Chapters 2,4; Gibbons Chapter 1

**Week 3 (31 Jan/1 Feb): Normal Form Games of Complete Information II**

- Normal form games with continuous strategy spaces
- Spatial model of electoral competition
- Median Voter Theorem
- Other examples from politics
- Osborne Chapter 3; Gibbons Chapter 1

**Week 4 (7/8 Feb): Normal Form Games of Complete Information III;**

**Extensive Form Games of Complete Information I**

- Existence of Nash Equilibrium
- Brouwer's Fixed Point Theorem; Kakutani's Fixed Point Theorem
- Introduction to Games in Extensive Form (discrete strategy spaces)
- Subgame Perfect Equilibrium; backwards induction; "credible threats"
- Osborne Chapter 5; Gibbons Chapters 1 & 2

**Week 5 (14/15 Feb): Extensive Form Games of Complete Information II**

- Extensive form games with continuous strategy spaces
- Other examples from politics
- Osborne Chapters 6 & 7; Gibbons Chapter 2

**Week 6 (21/22 Feb) Normal Form Games of Incomplete Information**

- Bayesian Nash equilibrium
- Beliefs and Types
- Examples from politics
- Osborne Chapter 9; Gibbons Chapter 3

**Week 7 (28 Feb/1 Mar): Extensive Form Games of Incomplete Information I**

- Perfect Bayesian equilibrium
- Signalling Games: pooling and separating equilibria
- Examples with discrete strategy spaces
- Osborne Chapter 10; Gibbons Chapter 4

**Week 8 (7 Mar/8 Mar): Extensive Form Games of Incomplete Information II**

- Examples with continuous strategy spaces
- Osborne Chapter 10; Gibbons Chapter 4

**14 Mar/15 Mar: Spring Break**

**Week 9 (22 Mar): Extensive Form Games of Incomplete Information III**

- *NO CLASS ON TUES., 21 MARCH*
- *MIDTERM DISTRIBUTED BY EMAIL ON 21 MARCH*
- Further examples, and refinements to Perfect Bayesian equilibrium

- Osborne Chapter 10; Gibbons Chapter 4

**Week 10 (28/29 Mar) Repeated Games**

- *MIDTERM DUE by 5pm on FRI., 31 MARCH*
- Finitely repeated games
- Infinitely repeated games
- Folk Theorem
- One-shot deviation principle
- Osborne Chapters 14 & 15; Gibbons Chapter 2

**Weeks 11 & 12 (4/5 April – 11/12 April) Various Advanced Topics**

- Monotone Comparative Statics: Ashworth, Scott and Ethan Bueno de Mesquita. “Monotone Comparative Statics for Models of Politics”, *American Journal of Political Science* 50(1): 214-231.
- Revelation Principle & Mechanism Design: Gibbons Chapter 3
- Others depending on time available and class interest

**Week 13 (18/19 April): Evolutionary Game Theory**

- Evolutionary Stability
- Dynamical Systems and Stochastic Stability
- Osborne Chapter 13 + Readings to be distributed

**Week 14 (25/26 April): Behavioral Game Theory**

- Models incorporating “psychology” into game-theoretic framework exogenously
- Models of endogenous preferences
- Models in which “bounded rationality” is endogenous
- Readings to be distributed

**Final Exam in May (date/time TBA)**