Carnegie Mellon

47-817 Game Theory

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Mini I 2006

Lecture: T,Th 10:30-12:20

Room: GSIA 318

Office Hrs: W 10-11AM

Syllabus

This is a game theory course aimed primarily at PhD students in economics, finance, and related fields. The goal is to provide a student with the tools necessary to use game theoretic models in a wide variety of applications and a foundation for research within the field of game theory. The only required text is Fudenberg & Tirole's *Game Theory*, but I will also lecture out of some of the recommended texts from time to time.

The first lecture or two will come from Kreps' book or other sources, but the bulk of the material will follow Fudenberg & Tirole's text. The other recommended texts are particularly good for developing further understanding, working through additional examples, and discovering extensions to the topics covered in class. Students interested in game theory research are highly encouraged to buy all of the recommended texts (except maybe the *Handbooks*,) as each is an excellent resource.

Required Text:

- *Game Theory*, by Drew Fudenberg & Jean Tirole ("FT"). This is the standard encyclopedic text book for graduate-level game theory.

Recommended Texts:

- *Notes on the Theory of Choice*, by David Kreps ("Kreps"). Game theory is built on expected utility theory, but game theory texts often brush it aside. This book fills in the gap, plus other well-known models of choice under certainty and uncertainty.

- *The Theory of Learning in Games* by Drew Fudenberg & David Levine ("F&L").

- *Games and Decisions*, by Luce & Raiffa ("L&R"). This is a classic text (now available as an inexpensive Dover book) that has great exposition and shows how people thought about game theory shortly after it was developed. Particularly honest about the limitations of the theory. Covers some cooperative game theory.

- *Game Theory: Analysis of Conflict*, by Roger Myerson. Quite technical, but also surprisingly readable. Good for additional examples and understanding beyond FT.

- *A Course in Game Theory*, by Osborne & Rubinstein. Also a good substitute for FT, with a better treatment of repeated games and extensive form games.

- *Thinking Strategically*, by Dixit & Nalebuff. Nontechnical and entertaining. A great book if you want to figure out what game theory is about, but don't want to work through all the math.

- *The Strategy of Conflict*, by Schelling. Also nontechnical and entertaining. Good on coordination issues and bargaining problems.

- *The Handbook of Game Theory*, ed. by Aumann and Hart. Expensive, three-volume set for researchers in game theory. Contains a collection of surveys on a wide range of topics by experts in the field.

Problem Sets: Worth 40% of your grade.*

In this class, "homework" and "problem sets" are two distinct entities. During lecture, I will point out questions or proofs that you should work out on your own at home. This is homework and it will not be collected or graded. Once every 3 or 4 lectures, I'll hand out a problem set that you must complete and turn in within 1 week of it being assigned (if it is assigned on Tuesday, it is due by the beginning of class the following Tuesday.) Turn in your problem set solutions to the TA, who will mark them. I will then look them over and assign a grade from 1 to 5. A score of 5 is reserved only for excellent, thorough work.

Many homework problems will appear on the problem sets, so if you do your homework, you'll already be partially finished with the upcoming problem set.

If you do not make a reasonable attempt at every problem set, you will not pass the course.

Presentation: Worth 10% of your grade.

Each enrolled student must give a brief presentation (15 minutes) of a paper in the last 1–2 weeks of class. The list of papers will be made available at some point during the mini.

Final Exam: Worth 50% of your grade.

This will be an in-class exam. It will be graded only by me.

Schedule: Topics will be covered as time permits. The tentative list of topics is as follows:

DECISION THEORY
Preferences (Kreps 2)
Ordinal utility representation (Kreps 3)
Expected Utility Theory (EUT) (Kreps 5)
STRATEGIC FORM GAMES
Dominated strategies (FT 1.1)
Rationalizability (FT 2.1)
Nash equilibrium (FT 1.2)
Existence of equilibrium (FT 1.3)
Trembling-Hand Perfection (FT 8.4.1)
Proper Equilibrium (FT 8.4.2)
Common Knowledge (FT 14.2,14.3)
Correlated Equilibrium (FT 2.2)
Cooperative Game Theory (L&R 6.1,6.2)
EXTENSIVE FORM GAMES
Mixed and Behavioral Strategies (FT 3.3,3.4.1)
Perfect Recall, Representation (FT 3.4.2,3.4.3)
Subgame Perfection (FT 3.5)
INCOMPLETE INFO: STATIC
Bayes-Nash Equilibrium (FT 6.1-6.4)
Purification (FT 6.7)
Examples and Applications (FT 6.5)

INCOMPLETE INFO: MULTISTAGE
Perfect Bayesian Equilibrium (FT 8.1,8.2)
Sequential Equilibrium (FT 8.3)
REPEATED GAMES
Infinitely Repeated Games (FT 5.1.1,5.1.2)
Finitely Repeated Games (FT 4.3.1,5.2)
Reputations (FT 9.1,9.2.1)
LEARNING DYNAMICS
Cournot Dynamics (F&L)
Fictitous Play (F&L)
Replicator Dynamics (F&L)
Supermodularity & Dynamics (Notes)
TOPICS & EXTENSIONS
Global Games
Potential Games
More on Repeated Games
Axiomatic Bargaining
Cooperative Game Theory
Reputations & Stereotyping
Experimental Evidence
Fairness Models