

Carnegie Mellon

47-865 Seminar in Game Theory
Professor Paul J. Healy
Office: GSIA 331
Email: phealy@cmu.edu

Mini I 2005
Lecture: M,W 3:30-5:20
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 first lecture or two will come from Kreps' book, 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. Economics PhD students in particular are highly encouraged to buy all of the recommended texts (except maybe the *Handbook*,) as each is an excellent resource.

Required Texts:

- *Game Theory*, by Drew Fudenberg & Jean Tirole ("FT"). This is the standard encyclopedic text book for graduate-level game theory.
- *Notes on the Theory of Choice*, by David Kreps ("Kreps"). Game theory is built on expected utility theory, but game theory texts brush it aside. This book fills in the gap, plus it explains Savage's subjective expected utility theory.

Recommended Texts:

- *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 the hard core student interested in doing research in game theory. A collection of surveys on a wide range of topics by experts in the field. (I don't even own these yet!)

Problem Sets: Worth 25% 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 Wednesday, it is due by the beginning of class the following Wednesday.) 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.*

Final Exam: Worth 75% of your grade.

This will be a take-home exam. It will be graded only by me.

Schedule:

- PART I: EXPECTED UTILITY THEORY
 - Preferences (Kreps 1)
 - Ordinal utility representation (Kreps 3)
 - Expected Utility Theory (EUT) (Kreps 5)

- PART II: GAMES IN STRATEGIC FORM
 - Dominated strategies (FT 1.1)
 - Nash equilibrium (FT 1.2)
 - Existence of equilibrium (FT 1.3)
 - Rationalizability (FT 2.1)
 - 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)
 - A Quick Intro to Cooperative Game Theory (L&R 6.1,6.2)

- PART III: GAMES IN EXTENSIVE FORM
 - Mixed and Behavioral Strategies (FT 3.3,3.4.1)
 - Perfect Recall, Representation (FT 3.4.2,3.4.3)
 - Backward Induction & Subgame Perfection (FT 3.5)

- PART IV: STATIC GAMES OF INCOMPLETE INFORMATION
 - Bayes-Nash Equilibrium (FT 6.1-6.4)
 - Purification (FT 6.7)

- Examples and Applications (FT 6.5)
- PART V: MULTISTAGE GAMES OF INCOMPLETE INFORMATION
 - Perfect Bayesian Equilibrium (FT 8.1,8.2)
 - Sequential Equilibrium (FT 8.3)
- PART VI: REPEATED GAMES & REPUTATIONS
 - 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)
- PART VII: TOPICS & EXTENSIONS (Time permitting)
 - Learning, Stability, & Evolutionary Game Theory
 - Axiomatic Bargaining/Cooperative Game Theory
 - Reputations & Stereotyping
 - Experimental Evidence
 - Fairness Models
 - Much, much more!