Econ 411: Game Theory

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Office Hours TBD
Logistics: TBD.
Prerequisites: ECON 410.
Course Description: Game theory is the study of *strategic interactions*. That is, unlike traditional price theory, we are interested in situations where the best choice for the individual depends directly on what other individuals are doing. A few examples are:

- When a small number of sellers compete in the same market, each seller needs to factor in what they think other sellers are doing when deciding on what price to charge or how many units to produce.

- In a seal bid auction, every bidder needs to take bidding strategies of other bidders into consideration when deciding on how to bid.

- In war, the best location for an invasion depends on how the enemy positions its troops for defense.

- In poker, the decision to raise or fold depends on what cards other player that don't fold may hold, which in part depends on how the other players are playing.

- The decision to accept a job offer or a marriage proposal may depend on what alternative offers are likely to materialize in the future.

In this course we will formalize strategic interactions like the examples above as mathematical games. To do so we will define and examine the concept of a strategy, examine what it means to be rational or irrational, and define solution concepts that correspond to different assumptions about how well players can coordinate play as well as differences in assumptions about the sequential and informational structure. Most of these ideas will be illustrated in terms of applications such as auctions, bargaining, signalling, oligopoly, repeated interactions and dynamic pricing.

Game theory was initially developed as a branch of mathematics, initially to understand how certain card games should be played. However, it has had the largest impact in economics and is now a central part of every professional economists' training. It has also had influence in political science (understanding voting strategies and political bargaining), computer science (strategies being algoritms/computer programs), evolutionary biology (formalizing Darwinian selection), and been directly applied to many strategic problems in warfare.

Exams and Grades: All graded components fall under the jurisdiction of the Honor Code. If you have any questions concerning the Honor Code Policy for this course, please ask.

There will be two in class midterms and a final exam. There will also be 8 graded homework problems.

- The final accounts for 40% of the grade.

- Each midterm accounts for 25% of the grade.

- The homework problems account for the remaining 10% of the grade.

You are encouraged to cooperate when solving the problems, but you should hand in individually. The homework problems will be important for learning the material, so it is a very bad strategy to divide up the homework assignments. A good strategy is to attempt all problems individually, but to meet and discuss the solutions in a small group before handing in the homework.

Textbook: *An Introduction to Game Theory*, by M.J Osborne (Oxford University Press, 2003, ISBN-13: 978-0195128956) is required. You can get a used copy for less than $15 online and there is also a newer UK edition. It doesn't matter which version you get. R. Gibbons, *Game Theory for Applied Economists* (Princeton University Press, Princeton NJ, 1992, ISBN-13: 978-0691003955) is also recommended. S. Tadelis, *Game Theory: An Introduction* (Princeton University Press 2013) contains many good discussions and examples, but does not cover all the material in the class.

Outline:

1. Games in Normal Form

   - Dominant and dominated strategies, the prisoner's dilemma.
   - Rationality, coordination of beliefs, Nash equilibrium.
   - Mixed strategies.
   - Oligopoly: Cournot vs. Bertrand competition vs. cartels.

2. Games in Extensive Form

   - Non-credible threats and backwards induction.
   - Oligopoly: Cournot vs. Stackelberg.
   - First mover advantage vs. first mover disadvantage.
   - Bargaining.

3. Games of Incomplete Information

   - Bayesian Nash equilibrium.
   - First and second price auctions. When should you shade your bid?
   - Signalling, playing poker, advertising, the value of unproductive education.
   - Adverse selection in product, labor market and insurance.
   - Information disclosure.

4. Repeated Games

   - Sustaining cooperation, credible vs non-credible threats.
   - Repeated oligopoly, sustaining a cartel using credible threats.