Econ 411: Game Theory
Spring 2024

Instructor: Peter Norman Gardner 300C, normanp@email.unc.edu
Logistics: We meet 12:30-1:45 Tuesdays and Thursdays in Gardner 307.
Office Hours 11:00-12:00 Tuesdays and Thursdays or by appointment.
Honor Code: As all other UNC classes the honor code applies. See https://studentconduct.unc.edu for details.
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 a large 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 (February 22 and March 26) and a final exam (May 6 at 4:00PM). There will also be a number of rather substantial homework problems (probably 5 or 6) that will be assigned through the semester. These will be graded mainly on effort and you should not expect much personal feedback on your performance on them. The grading scale is also rather crude (A, B, F). Solutions will be provided for you to see where you went wrong by yourself, and you are welcome to ask questions either right after class or in office hours.

- 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, and you are allowed to hand in homeworks for a group of at most 3 students (you can also hand in for a group of 2 or individually). The main role of the homework problems is **not** for me to evaluate you, but for **you** to learn the material. It is therefore a **bad** strategy to divide up the homework assignments. A **good** strategy is to attempt all problems individually, but to discuss the solutions in a small group before handing in the homework.

Syllabus Changes: Exam dates and other aspects of the syllabus may be changed if necessary.

Textbook: I strongly recommend that everyone purchases *An Introduction to Game Theory*, by M.J Osborne (Oxford University Press, 2003, ISBN-13: 978-0195128956). 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 recommended for students who want some more depth on (and cheap). 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:

References to the textbook is for the edition I have. There may be slight discrepancies for other editions, but you should be able to find the right place by looking at the Chapter headings. This outline is subject to minor changes.

1. Games in Normal Form [*January 10-February 9*]

   - Dominant and dominated strategies, the prisoner's dilemma (2.2, 2.9)
   - Rationality, coordination of beliefs, Nash equilibrium (2, 12)
   - Best responses (2.8)
   - Expected utility theory (4.12)
   - Mixed strategies (4)
   - Oligopoly: Cournot vs. Bertrand competition vs. cartels (3.1, 3.2)

2. Games in Extensive Form [*February 14-March 9*]

   - Non-credible threats and backwards induction (5.1-5.4)
   - Oligopoly: Cournot vs. Stackelberg (3.1, 6.2)
   - Bargaining (16).
   - Repeated games (14-15)

3. Games of Incomplete Information [*March 21-April 27*]

   - Static games of incomplete information, Bayesian Nash equilibrium (9).
   - Purification as a reinterpretation of mixed strategies.
   - First and second price auctions. When should you shade your bid? (9.6, 9.8.1)

- Dynamic games of incomplete information (10)
- Signalling, playing poker, advertising, the value of unproductive education (10.5, 10.7).
- Cheap talk (Not covered in textbook. Slides are self-contained, but the book by Gibbons covers this well)
- Adverse selection in product, labor market and insurance (Not covered in textbook. Slides are self-contained)