BOSTON COLLEGE
Department of Economics

EC 308.02: Game Theory in Economics (Spring 2019)
Campion 200: TTh (1:30 – 2:45)

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& by arrangement

Game Theory studies strategic interactions - how players behave, or might behave, in interactive situations in which selected strategies (actions/choices/decisions) impact each player's own payoffs /consequences as well as the payoffs of other players (who are also selecting strategies).

We will cover the basic analysis of simultaneous-move and sequential-move games, and then focus extensively on applications in Economics, in a variety of areas including imperfect competition, merger analysis, bargaining, signaling, mechanism design, voting and public choice, principal-agent problems, auction design, bidding strategy, and so forth.

This course has some features perhaps unusual for an Economics course:

- **In-class games**: We will play about 20 games in class over the course of the semester. These well-known games are designed to illustrate various concepts, and to provide you with a better understanding of how to work through the strategic dimensions of different game theoretic challenges. Prizes, of differing quality, are awarded to provide incentive.
- **The *Prisoners' Dilemma* Challenge**: We will also be running a repeated play Prisoners' Dilemma challenge, perhaps the most famous repeated play game in Game Theory. This challenge will last for about five weeks, and will feature teams of students in competition with one another. Details to follow.

The insights that emerge from these games and this Challenge are *fair game* for the exams.

Prerequisites: Intermediate microeconomics (EC 201 or 203). No exceptions. I also assume that you are familiar with basic calculus, and in particular, elementary simple and partial differentiation (which will be used extensively in solving optimization problems and deriving equilibrium strategies).

Course text:

> Avinash Dixit and Susan Skeath (and for the 3rd and 4th eds., David Reiley), *Games of Strategy*, W.W. Norton & Company. (DS).[1]

I have deliberately not listed the edition; if you decide to purchase the text, feel free to buy the first or second edition. While we will cover much of the material in the text, and I will point out from time to time where we are in the text, we will not be following the text closely.

A copy of DS will be placed on reserve at the O'Neill Library.

[1] The 2012 paperback edition is also an option: ISBN-10: 9788130915456.

Some additional texts (There are a ton of books on the topic; this is just a sampling. I list them just because sometimes it is useful to see a different presentation of the material. Warning: Most of these are more technical than DS.)

- H. Scott Bierman & Luis Fernandez, *Game Theory with Economic Applications (2nd Edition)*, Addison Wesley, 1997.
- Ken Binmore, *Fun and Games — A Text on Game Theory*, D.C. Heath, 1992.
- *Game Theory- A Very Short Introduction*, Oxford University Press, 2007.
- Avinash K. Dixit & Barry J. Nalebuff, *Thinking Strategically: The Competitive Edge in Business, Politics, and Everyday Life*, W. W. Norton and Company, 1993.
- Prajit K. Dutta, *Strategies and Games: Theory and Practice*, MIT Press, 1999.
- Thomas S. Ferguson, *Game Theory*, posted at http://www.math.ucla.edu/~tom/Game_Theory/Contents.html
- Robert Gibbons, *Game Theory for Applied Economists*, Princeton University Press, 1992.
- Joseph Harrington, *Games Strategies and Decision Making*, Worth, 2015.
- Charles A. Holt, *Markets, Games and Strategic Behavior*, Addison Wesley, 2006.
- John McMillan, *Games, Strategies, and Managers: How Managers Can Use Game Theory to Make Better Business Decisions*, Oxford University Press, 1996.
- Martin J. Osborne, An Introduction to Game Theory, Oxford University Press, 2003.
- Steven Tadelis, *Game Theory: An Introduction*, Princeton University Press, 2013.
- Joel Watson, Strategy: An Introduction to Game Theory, W. W. Norton and Company, 2013.

Grading:

- Exams: 75%. Two mid-term exams and an *optional* final exam.

  If you decide to take the optional final exam, then each mid-term exam counts for 20% of your course grade, and the final exam counts for the remaining 35%. If you decide not to take the optional final exam, each mid-term exam counts for 37.5% of your course grade.

  Mid-term exams: While the dates may change, these in-class (closed book; closed notes; no cheat sheet) exams are currently scheduled for:

  - Tues. Feb 26th (the week prior to Spring Break)
  - Thurs., April 25th (the next-to-last week of classes)

  Optional final exam: The final exam is scheduled for Weds., May 8th at 9 AM. You must commit to taking the final exam at the time you pick up the exam (conditional course grades, assuming that you are not taking the Final Exam, will be posted to Canvas by the end of the day, Saturday May 4th).

There are no make-up exams in this course. If you miss either mid-term exam, then you must take the final exam (exam weights will be adjusted proportionately).

- Problem Sets: 20% (five problem sets)
- The *Prisoners' Dilemma Challenge*: 5%

Problem Sets: The Problem Sets will be very helpful to you in learning the course material. The problems are not equally difficult. Some are fairly straightforward, solely designed to give you some practice with certain techniques; others are more difficult and intended to teach you some Economics. I encourage you to work collaboratively on the Problem Sets, but please submit your own write-ups. Grades on Problem Sets are curved.

The *Prisoners' Dilemma Challenge*: This Challenge will commence after the first Mid-Term exam, and involve teams of students designing strategies for a repeated-play Prisoners Dilemma game. Using computer simulation, each team's strategy will be played a large number of times against the other teams' strategies. Each team's grade in this assignment will be their final score (average payoff) relative to the highest team score in the class. Additionally, a juicy prize will go to the team (or teams) that win(s) the most games (by outscoring the opponent). (You will discover that the team that wins the most games will not fare as well when it comes to average payoffs.)

Canvas: Course material will eventually be posted to the course's Canvas site.

Accommodations: If you are a student with a documented disability seeking reasonable accommodations in this course, please contact Kathy Duggan (x2-8093; dugganka@bc.edu) at the Connors Family Learning Center regarding learning disabilities and ADHD, or Paulette Durrett, (x2-3470; paulette.durrett@bc.edu) in the Disability Services Office regarding all other types of disabilities, including temporary disabilities. Advance notice and appropriate documentation are required for accommodations.

Academic Integrity: You will be held to Boston College's standards of academic integrity. If you have any questions as to what that means, please go to http://www.bc.edu/offices/stserv/academic/integrity.html.

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Topics: We will loosely follow the DS text, with lots of additional examples and illustrative games (chapter numbers here are for the 4th ed.). Roughly speaking, the first half of the course focuses on theory, and the second, on applications.

1) Introduction and General Principles:
    a) DS 1 & 2: Basic ideas and examples. How to think about strategic games.
2) Theory (may reverse order of chapters)
    a) Simultaneous-Move Games
        i) Basics:
            (1) DS 4: Simultaneous-move games: Discrete strategies.
        ii) Mixed strategies:
            (1) DS 7: Simultaneous-move games: Mixed strategies.
        iii) More advanced:
            (1) DS 5: Simultaneous-move games: Continuous strategies.
    b) Sequential Move Games
        i) Basics:
            (1) DS 3: Games with sequential moves.
        ii) More advanced:
            (1) DS 6: Combining sequential and simultaneous moves.
        iii) Games Against Nature
    c) Risk Aversion (we may skip this topic)
        i) DS Appendix to Chapter 8: Risk attitudes and Bayes' Theorem.
3) Applications (topics and order subject to change)
    a) DS 10: The *Prisoners' Dilemma* and repeated play games.
    b) DS 17: Bargaining.
    c) DS 8: Asymmetric information, signaling and screening.
    d) DS 12: Evolutionary games.

We will, in all likelihood, end here. … but if time permits:

- DS 16: Auction design and bidding strategy.
- DS 13 & 15: Voting and mechanism design.
- DS 14: Brinkmanship.
- DS 9: Threats, commitments and strategic moves.