ECON3308 Game Theory in Economics

MW 4:30 - 5.45, O'Neill 257.

Boston College, Fall 2023.

Instructor: Pietro Dall'Ara, dallarap@bc.edu.

TA: Anirudh Pisharam, pisharam@bc.edu.

Instructor's office hours: M 5.45 - 6.45, Maloney Hall 385B.

TA's office hours: TBA.

Last update: 8/14.

Description The course is an undergraduate-level introduction to game theory. Game theory is a set of analytical tools that provides a structured way to think about strategic interactions, which are situations where the consequences of one person's choices depend on others' behavior. The course covers applications of game theory to economics, although the game-theoretic approach is used in political science, computer science, biology, and law.

Prerequisites Single-Variable calculus and probability. In game theory, we deal with maximization problems, probability distributions and Bayesian updating. This course is quantitatively more demanding than other economics courses, and it is important to be comfortable with mathematical reasoning in the form of "carrying out an argument with sufficient precision." (Gale and Shapley, 1962.) Background knowledge of calculus and probability, combined with an interest in strategic thinking and a taste for formalism, will (hopefully) make you enjoy this course.

Required Textbook

Watson, Joel. *Strategy: An Introduction to Game Theory*, 3rd edition, 2013, W. W. Norton.

Extra Readings (Not Required) A concise yet enjoyable textbook that is not required is Robert Gibbons' *Game Theory for Applied Economists*, which is my suggestion as a complement to Watson's introduction to game theory. For additional exercises and alternative exposures at approximately the same level of mathematical formalism as the course, see: Martin Osborne's *An Introduction to Game Theory* and Steven Tadelis' *Game Theory*. For more advanced treatments, see, in ascending order of difficulty: *Game Theory* by Maschler, Solan and Zamir, and *Game Theory* by Fudenberg and Tirole. For philosophical discussions and exercises about the topics of the course, see Ken Binmore's *Playing for Real*.

Grading

- Problem sets: 10% (6-8 bi-weekly individual problem sets, PS1 is not graded and one of your lowest scores is dropped.)
- Midterm: 40%.
- Final: 50%. The final is not cumulative. However, the topics that we cover after the midterm build on all previously covered topics.

Outline and Readings

Topics, order and dates may change.

Part 1 Chapters 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11. Gibbons: ch. 1.

- Representation of a strategic interaction as a game. (Week 1-2, ch. 1-2)

  [No class on 9/4, Labor day.]

  PS1 Due WED 9/6.
- Games in normal form, strategies, and beliefs. (Week 3, ch. 3-4)
- Dominance, best response. (Week 4, ch. 6)

  PS2 due TUE 9/26
- Iterated dominance and rationalizability (Week 5, ch. 7)

- Nash equilibrium. (Week 6, ch. 8, 9 and 5)

  PS3 due FRI 10/6

  [No class on 10/9, fall break, we meet on Tue, 10/10 (administrative Monday)]

- Mixed strategies and applications (Week 7, ch. 10, 11)

Midterm: Mon 10/16, 4:30-5.45, O'Neill 257.

Part 2 (Dynamics, incomplete information and network games) Chapters: 14, 15, 16, 22, 23, 24, 25, 26, 27, 28, 29. Gibbons: ch. 2, 3, 4.

- Games in extensive form and sequential rationality. (Week 8, ch. 14)
- Backward induction and subgame perfection. (Week 9, ch. 15, 16)
- Repeated games, reputation, and collusion. (Week 10, ch. 22 and 23)

  PS 4 due MON 11/6.

- Random events and incomplete information (Week 11, ch. 24, 25)
- Principal-Agent games and Bayes-Nash equilibrium. (Week 12, ch. 25, 26)

  PS 5 due TUE 11/21

  [No class on WED 11/22, Thanksgiving recess.]

- Markets with asymmetric information, auctions, information aggregation. (Week 13, ch. 27)
- Perfect Bayesian equilibrium and reputation (Week 14, ch. 28-29)
- Network games (time permitting, Benjamin Golub's notes at https://arxiv.org/abs/1806.00566)

  PS6 due 12/6.

Final: Wed, 12/6, 4.30-5.45, O'Neill 257 (Last class).

Objectives

- Represent a game in normal and extensive form.
- Find dominant strategies, rationalizable strategies, Nash equilibria, subgame-perfect equilibria, Bayesian Nash equilibria and Perfect Bayesian equilibria of extensive-form and normal-form games.
- Apply iterated dominance, backward induction and the folk theorem.

Miscellanea

Accessibility If you are a student with a disability seeking accommodations in this course, please contact the Connors Family Learning Center regarding learning disabilities and ADHD, or the Disability Services Office regarding all other types of disabilities, including temporary disabilities. You can contact Kathy Duggan (617-552-8093, dugganka@bc.edu) at The Connors Family Learning Center. Also, see https://www.bc.edu/content/bc-web/offices/student-affairs/sites/dean-of-students/disability-services/services.html. Please let me know if a requirement for this course conflicts with your religious observance so that we can figure out a way for you to observe your religious practice and complete the requirements for this course.

Academic Integrity Please familiarize yourself with Boston College's academic integrity policy, which applies to this course. If you have any questions as to what that means, please go to https://www.bc.edu/content/bc-web/academics/sites/university-catalog/policies-procedures.html.

References D. Gale & L. S. Shapley, College Admissions and the Stability of Marriage, *The American Mathematical Monthly*, 1962.