

ECON 4020: Game Theory I

MW 14:45 - 16:00, G64 Goldwin Smith Hall

Cornell University, Spring 2022

Instructor: Tommaso Denti, tjd237@cornell.edu

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Office hours: WF 13:00-14:30, 447 Uris Hall/Online

Syllabus version: May 5, 2022

Description. The course is an undergraduate-level introduction to game theory and its economic applications. A “game” is any situation where people make choices whose consequences also depend on others’ behavior. Game theory studies how people anticipate others’ intentions and act accordingly. The course focuses on economic applications, but the approach reaches disciplines as diverse as computer science, biology, political science, law, and musicology. Examples of games are chess, tennis, jam sessions, stock markets, elections, kidney exchange programs, wars, . . .

Prerequisite. The language of game theory is math. The math for this course is pretty basic: some probability theory and single variable calculus. However, it is essential to be comfortable with mathematical reasoning or “carrying out an argument with sufficient precision,” as game theorists D. Gale and L. Shapley put it.¹ The formal prerequisites for this course are ECON 3010 and ECON 3030, but if you think ECON 4020 is for you anyway, you should contact me.

¹See the last page of their Nobel prize-winning “College Admissions and the Stability of Marriage.”

Textbooks. The official reference is Steve Tadelis' *Game Theory: An Introduction*. We will not closely follow any textbook, but Tadelis' book covers most of the material and is as formal as the course aims. Tadelis' book could be paired with a less rigorous but more concise read, such as Robert Gibbons' *Game Theory for Applied Economists*. For more exercises (solving many problems is necessary to learn game theory), useful references are Martin Osborne's *An Introduction to Game Theory*, Joel Watson's *Strategy*, and Prajit Dutta's *Strategies and Games*. For more conceptual discussions, see Pierpaolo Battigalli's lecture notes on Canvas.

Requirements. The course grade will be based on two midterms (40%), five problem sets (the best four count for 20%), and a cumulative final exam (40%). For problems sets you are encouraged to work in groups, but every student has to write their own solution and submit it individually. There will be two problem sets on static games, two problem sets on dynamic games, and one problem set on incomplete information, all more or less evenly spaced.

Outline. References to Tadelis' chapters in parentheses.

- Jan 24 (online): Decision problems (1)
- Jan 26 (online): Static games (3)
- Jan 31 and Feb 2 (both online): Iterated strict dominance (4.1-2)
- Feb 7 and 9: Nash equilibrium (5)
- Feb 14, 16, and 21: Mixed actions (2.1-3, 6.1-2)
- Feb 23: First prelim
- Mar 2: Dynamic games (2.4, 7.1)
- Mar 7: Nash equilibrium in dynamic games (7.2-3)
- Mar 9: No class
- Mar 10 (online) and 14: Subgame perfection (8)
- Mar 16, 21, 24, and 28: Repeated games (10)

- Mar 30: Second prelim
- Apr 11: No class
- Apr 13 and 18: Incomplete information (12.1)
- Apr 20, 25, and 27: Bayesian Nash equilibrium (12.2-5)
- May 2 and 4: Correlated equilibrium (lecture notes)
- May 9: Higher-order beliefs (lecture notes)
- May 16: Final exam

Please note that there are no classes on March 9 and April 11. We will make up for the class on March 9 with an online lecture on March 10, which will be recorded. There will be no substitution for the class on April 11.

Rules of the game.

- All emails should be addressed to Valeria.
- The textbook is complementary and optional. Exams will be based solely on the material covered in class.
- Taking all exams (two midterms and a final) is a requirement of the course. Missing an exam without a valid excuse will result in a failing grade for the entire course.
- To be considered valid, an excuse must be proffered prior to the exam that is to be missed; if at all possible, the excuse must be in writing, and it must be verifiable. These criteria are necessary, not sufficient, however. We reserve the right to deem an excuse meeting the above criteria invalid.
- No makeup test will be offered for a midterm. If a midterm is missed with a valid excuse, the other midterm and the final exam will count for 30% and 50%. If both midterms are missed with valid excuses, the final exam will count for 80%.
- All requests for regrades must be submitted in writing within one week of the exam being handed back. Regrades may raise or lower your score.

- Late submissions for problem sets are not permitted.
- Together with all the members of the department of economics, we respect and uphold university policies and regulations pertaining to racial or ethnic discrimination, sexual harassment, assistance available to handicapped, visually and/or hearing impaired students, the observation of religious holidays, and plagiarism. All students are advised to become familiar with the respective university regulations and are encouraged to bring any questions or concerns to our attention.