Game Theory and Applications

Economics 682: Spring 2022

Game theory is the study of *interdependent* decision-making. Firms in an oligopolistic industry, diplomats at a negotiation table, bidders at an art auction, applicants and employers in a job market — these are some of the environments where people must consider the behavior of other *players* when deciding on their own actions. Unlike single-agent decision problems, these multi-agent *games* represent economic situations where decentralized choices made by several individuals jointly determine everyone's outcome. This course will equip you with the tools of game theory to model and analyze these and other strategic interactions.

Your Host: Kevin He, hekevin@econ.upenn.edu, office hours Fridays 10AM to noon.

Teaching Assistant: Marcus Tomaino, tomaino@sas.upenn.edu, Q&A sessions Mondays 5PM to 6PM and drop-in office hours Thursdays 5PM to 6PM.

Class Structure:

- The first two weeks of this class (January 12 to January 21) will be online. During this period, I will post recorded lectures, lecture notes, and lecture slides on Canvas by the Monday of each week. I will also hold live Zoom sessions on Tuesdays from 10:45AM to 11:45AM.
- When the university transitions back to in-person classes, we will meet on Tuesdays and Thursdays from 10:15AM to 11:45AM in Perelman Center for Political Science and Economics (PCPSE), room 101.
- Problem sets will be assigned and due almost weekly.
- Each week's lecture will include open-ended conceptual questions for students to discuss on Canvas.
- We will use Piazza as an asynchronous Q&A platform. Asking questions on Piazza creates public goods, as the question and answer will be visible to other students. We will check Piazza regularly, and we also encourage you to answer each other's questions.
- Both the Marcus and I will hold weekly drop-in office hours. In addition, Marcus will hold a weekly questions-and-answers session to review some of the more difficult course material. The contents of these Q&A sessions are guided by your inputs, so please use the designated Canvas forum threads to post questions and topics that you would like to see covered.
- Links to all course material, including the Piazza website, can be found on Canvas.

Assignments and Assessments:

- Almost weekly problem sets (20%), except no problem set will be due in the same week as the midterm. Problem sets will be graded coarsely ($\checkmark^+$, $\checkmark$, $\checkmark^-$, 0).
- Midterm (35%): There will be an in-person midterm exam during normal class time on Thursday, March 3.
- Final exam (45%). There will be a two-hour, in-person final exam. The exact time and date will be determined by the Office of the Registrar, but it will be between May 2 and May 10. The final exam will be cumulative, but with a heavier emphasis on the second half of the course.

- Class participation (including Canvas discussions, Piazza, office hours, etc.) will be taken into account to improve your final grade if you are just below a grade boundary.

Textbooks: Both textbooks are optional as the course will be based on the lecture notes. I will point out chapters in the textbooks that relate to each lecture as supplementary reading. The course roughly follows the order of topics in the Gibbons textbook, but with a level of emphasis on theory that is closer to the Jehle and Reny textbook.

- Robert Gibbons, Game Theory for Applied Economists, ISBN: 978-0691003955
- Geoffrey Jehle and Philip Reny, Advanced Microeconomic Theory (3rd Edition), ISBN: 978-0273731917

Prerequisites: Mathematical maturity at the level of the Mathematical Appendix in the Jehle and Reny textbook. You should be comfortable with optimization, probability, and basic real analysis. Prior coursework in economics (e.g., Economics 681) is helpful but not required.

Course Policies: Courses taught in the Department of Economics are bound by a standardized set of department course policies that govern grading appeals, academic integrity, etc. Please see https://economics.sas.upenn.edu/undergraduate/course-information/course-policies.

Topics: The course will cover four families of games, including both theory and applications.

(1) Static games with complete information. Applications include Cournot and Bertrand oligopolies.

(2) Dynamic games with complete information. Applications include bargaining, repeated games, and folk theorems.

(3) Static games with incomplete information. Applications include auctions and the revenue-equivalence theorem.

(4) Dynamic games with incomplete information. Applications include job-market signaling.