Game Theory and Applications
Economics 682: Spring 2021

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 Thursdays 4PM to 6PM.

Teaching Assistant: Marcus Tomaino, tomaino@sas.upenn.edu, office hours Wednesdays noon to 1PM (Q&A session) and Fridays 11AM to noon (drop-in).

Class Structure: There will be weekly asynchronous and synchronous activities.

- Asynchronous: Recorded lectures, lecture notes, and lecture slides will be posted weekly by Monday. Problem sets will be assigned and due almost weekly, usually on Fridays at 5PM. Each week's lecture will include open-ended conceptual questions for students to discuss on Canvas. Finally, 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.

- Synchronous: I will hold live Zoom sessions on Tuesdays from 11AM to noon for solving problems and for playing games as classroom experiments. Marcus will hold questions-and-answers Zoom sessions on Wednesdays from noon to 1PM. (Please post your questions for these Q&A sessions in advance using the designated Canvas forum threads.) These synchronous sessions will be recorded to accommodate students who have different schedules or live in different time zones. In addition, Marcus and I will hold weekly drop-in office hours on Zoom.

- Links to all course material, including the lecture videos, Zoom meeting links, and Piazza website, can be found on Canvas.

Assignments and Assessments:

- Almost weekly problem sets (20%), except no problem sets will be due in the same weeks as the midterms. Problem sets will be graded coarsely ($\checkmark^+$, $\checkmark$, $\checkmark^-$, 0).

- Two midterms (20% each). Midterms will be 48-hour take-home exams. The first midterm will be released at noon on February 23, due at noon on February 25, and graded by March 1 (the drop deadline). The second midterm will be released at noon on April 6 and due at noon on April 8.

- Final exam (30%). The final exam will be a 48-hour take-home exam. It will be due during the final-exam block for this course (exact time and date to be determined by the Office of the Registrar, but it will be between May 4 and May 11).

- Class participation (10%). Participation in Canvas discussions, Piazza, live sessions, Q&A sessions, and office hours. You can earn full participation credit even if you take the course completely asynchronously.

Textbooks: Both textbooks are optional as the course will be based on the lecture notes and lecture videos. 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.