Game Theory and Applications

Economics 6110: Spring 2023

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 outcomes. 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 in Perelman Center for Political Science and Economics (PCPSE) 506.

Teaching Assistant: Alberto Ramírez de Aguilar Wille, arawille@sas.upenn.edu, Q&A sessions Wednesdays 1:30PM to 2:30PM in Williams Hall 1, drop-in office hours Thursdays 4:30PM to 5:30PM in PCPSE 500.

Class Logistics:

- We meet on Mondays and Wednesdays in PCPSE 101 from 10:15AM to 11:45AM.
- We will use Ed Discussion (Penn's Piazza replacement) as an asynchronous Q&A platform. Asking questions on Ed Discussion creates public goods, as the question and answer will be visible to other students. We will check Ed Discussion regularly, and we also encourage you to answer each other's questions.
- Both Alberto and I will hold weekly drop-in office hours. In addition, Alberto 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 Ed Discussion 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). The worst problem set score will be dropped.
- Midterms (20% each): There will be two midterm exams during normal class time on **February 15** and **March 29**.
- Final exam (40%). 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 1 and May 9. The final exam will be cumulative, but with a heavier emphasis on the part of the course not covered by the midterms.
- Class participation (including Canvas discussions, Ed Discussion, 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 6100) 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.