

Economics 109: Game Theory (combined A00 and B00 classes)

Spring 2021, Professor Denis Shishkin This course examines strategic situations, in which each agent's behavior generally affects the well-being of the other agents. Game theory is a technical framework for rigorously analyzing decision-making in such settings. Almost every type of interaction between living things is strategic. As social scientists, we focus on human interaction, and we shall assume that people behave in a rational, deliberate manner. In addition to exploring theory in the abstract, we will consider a variety of applications from economics, political science, and law.

(Tentative) Course Outline A. Representing Games

1. [Ch. 1-3] Intro, extensive form representation, strategies
2. [4-5] Normal form representation, beliefs, mixed strategies

B. Analysis of Static Settings

1. [6-8] Best response, rationalizability, applications
2. [9-10] Nash equilibrium, applications
3. [11] Mixed strategy equilibrium

C. Analysis of Dynamic Settings

1. [14] Extensive form, backward induction
2. [15-16] Subgame perfect equilibrium, applications
3. [18-19] Bargaining
4. [22-23] Repeated games, applications

D. Information

1. [24] Random events and incomplete information
2. [26-27] Bayesian equilibrium, applications
3. [28-29] Perfect Bayesian equilibrium, applications

Schedule: All class meetings will take place remotely using Zoom according to the schedule below (all times Pacific).

Grading Weights: The raw total is 100 points: 5 points for reflection surveys, 5 bonus points, 60 points for exams, 30 points for problem sets. The worst exam and worst problem set will **not** be counted towards the grade. The course will be graded on the curve according to Econ Department standards for Econ 109, which is roughly a 2.9 average GPA for the class and about 25-30 percent A grades. Prof. Shishkin will also track the performance of students who earn bonus points by being on multiple class panels and/or attend office hours. At the end of the quarter, Prof. Shishkin may adjust the grading cutoffs downward to ensure that grades are set appropriately for this sample of students, which can only increase grades for other students in the class.

Examinations: There will be 5 short (50 min) examinations: 4 midterms on each even week and final on Saturday of the last week. The exams will be self-proctored on Zoom, with students locally recording themselves taking the exams and then uploading the recordings in Canvas (see protocol in Logistics).

- The *midterm exams* will take place on Tuesday evenings **April 6, April 20, May 4, May 18 at 8:00 – 8:50 p.m.** Students will be required to download/view the exam questions and submit their answers using both Gradescope (linked within Canvas) and Canvas, be present on Zoom with screen sharing and video on, record their Zoom sessions, and upload their Zoom recordings to Canvas.
- The *final exam* will comprise a midterm-like part and an interview part. The first part will take place on **Saturday June 5 8:00-8:50 a.m.** in the same format as the midterms. The interview part will take place on Zoom **Saturday June 5 9:00am-11:00am.** Not all students will be interviewed. Selections for interviews will be at the discretion of the instructor and TAs, based on (i) random draw, and (ii) in case of any individual problems with midterms and assignments. Each interview will be conducted privately by the instructor and TAs; the student will explain how to solve exam problems.

Problem Sets: There will be (at least) 4 graded assignments. They will be posted on Canvas and will be due on Mondays at 11:59 pm.

Surveys: Please, fill out a very short intro survey on time zones, etc in the first week. At the end of each week, please, fill out a short survey that asks you to name 2-3 things (in 1-2 sentences) you (i) enjoyed learning, (ii) struggled with, and (iii) would like to learn more about. Each survey counts as 0.5 points.

Bonus Points: Bonus points can be earned in two ways: (i) by signing up for and participating in the class panels (each panel is 0.5 points) or (ii) by solving bonus exercises in problem sets. Note that if you do wish to participate in the class panels, you can earn the maximal 5 bonus points only through bonus exercises and vice versa.

Required Textbook: Watson, J., *Strategy: An Introduction to Game Theory* (W.W. Norton), 3rd edition.

Class Website and Prof. Shishkin's Office Hours: Materials will be posted on Canvas. Students should log in regularly to follow the schedule, access video lectures, and check for announcements. Prof. Shishkin's office hours will be on **Wednesdays from 8 am to 9:45 am** Pacific time at the discussion sessions zoom link. Please, note that the office hour schedule may eventually change.

Teaching Assistants: Malte Lammert (mlammert@ucsd.edu), Sasha Levkun (alevkun@ucsd.edu), Alex Garland (jgarland@ucsd.edu), Giampaolo Bonomi (gbonomi@ucsd.edu).

Procedure for Questions: It is best to ask questions during class meetings, discussion sessions, and in office hours. In all other cases, questions about the material or logistics are welcome on **Piazza**. Do not send emails to Prof. Shishkin except to inform him of urgent matters relating to the course (such as letting him know of an illness that necessitates missing an examination).

Additional Policies:

1. Incidents in which students are suspected of cheating on exams will be reported to the administration.
2. Students have one week from the day in which the midterm examinations and quizzes are graded to report errors in grading and/or to request that problems be re-graded. If a student submits his/her exam for re-grading, then the student's entire exam will be re-graded by the professor (with no guarantee of a higher total score).
3. Tests (examinations and quizzes) will take place during scheduled class times (lectures and discussion sessions) that appear on the official University course schedule. Students are required to attend lectures and discussion sessions on the days in which tests are held. Students missing a test will be given a zero score for the test. No one will be excused from this rule, except in cases of urgent and serious health issues as well as for exceptions required by university policy. If a student cannot attend an examination or quiz due to an urgent health problem, then the student must report this to the professor as soon as possible. Following the health incident, the student must present documentation to provide evidence that the health incident precluded taking the test (a physician's note is typically sufficient). The student will then be excused from the test and his or her course grade will be determined by appropriately scaling up the grades earned on the other tests. If the missed test is the final examination, then the student will be given an incomplete grade and will have to take the final examination set for the next offering of Econ 109 (in the following quarter) to complete the course.

Understanding the Course Prerequisites:

Students are required to enter Econ 109 with a full understanding of the material covered in Econ 100abc, which include the following game-theory topics presented in Econ 100c:

- Normal-form (matrix) and extensive-form representations [familiarity with]
- Strategies and mixed strategies [operational understanding]
- Best response and dominance [definitions and operational understanding]
- Iterated dominance [definition and operational understanding]
- Nash equilibrium [definition and calculations, also for games requiring calculus]
- Cournot and Bertrand models of oligopoly [ability to calculate the Nash equilibria]
- Mixed-strategy Nash equilibrium [definition and ability to compute for 2x2 games]
- Backward induction and subgame perfection [rudimentary knowledge]
- Stackelberg oligopoly model [ability to calculate the subgame-perfect equilibrium]
- Adverse selection [rudimentary understanding, in particular of lemons markets]
- Moral hazard [rudimentary understanding]

These topics will be presented in Econ 109 at a deeper level than they are covered in Econ 100c. In some cases, Econ 109 will offer a review of what the students learned in Econ 100c, but it will be a rapid review. In other cases, the coverage in Econ 109 will begin where the Econ 100c coverage ended, and so the students must understand these topics at the Econ 100c level before the relevant Econ 109 lectures. Econ 109 also covers more advanced topics and applications that are not covered in Econ 100c.