

22:544:653 Game theoretic methods for strategic decision-making

Fall 2023
1WP Room 228
Tuesdays 10am-12:50pm

Dr Thomas Lidbetter

1WP Room 1076
973-353-3578
tlidbetter@business.rutgers.edu

COURSE DESCRIPTION

Decision-making is crucial in many professions and decisions are not made in a bubble. The outcome of decisions depends not only on the choices made by the decision-maker, but also on decisions made by customers, business partners, competitors, etc. Game theory provides tools to analyze rational decision making in the context of complex environments in which several “players” have competing aims. This course will develop the core ideas of game theory along with several examples and applications, including bargaining, auctions, signaling and voting.

Course delivery mode: Hybrid. Some classes will be in person and some will be online (see course schedule below). You are expected to attend all in-person classes. Participation will be required. All classes will be recorded.

Learning Management System: Canvas

Hardware and software requirements: Students should have a desktop or laptop with webcam.

COURSE MATERIALS

- Required texts:

- S. Tadelis, *Game Theory: An Introduction*, Princeton University Press, 2013.

- Recommended texts:

- K. Binmore, *Playing for Real: Game Theory*, CUP, 2007.

- E. Mendelson, *Introducing Game Theory and Its Applications*, CRC, 2004.

- M. J. Osborne and A. Rubinstein, *A Course in Game Theory*, MIT press, 1994

LEARNING GOALS AND OBJECTIVES

- This course is designed to help students develop skills and knowledge in the following areas:

- *Modeling strategic decision making in a game theoretic framework*
- *Analyzing games*
- *Using different solution concepts to predict and understand behavior in games*

- *Applying game theoretic tools and models to decision making problems in business, management and entrepreneurship*

- Students who complete this course will demonstrate the following:

- *Ability to apply game theoretic techniques to model decision making problems*
- *Ability to solve games to predict and explain decision making behavior*

- Students develop these skills and knowledge through the following course activities and assignments:

- *Regular homework assignments*
- *A midterm exam*
- *A final exam*

PREREQUISITES

A basic knowledge of calculus and probability.

ACADEMIC INTEGRITY

I do NOT tolerate cheating. Students are responsible for understanding the RU Academic Integrity Policy (http://academicintegrity.rutgers.edu/files/documents/AI_Policy_2013.pdf). I will strongly enforce this Policy and pursue *all* violations. On all examinations, students must sign the RU Honor Pledge, which states, "On my honor, I have neither received nor given any unauthorized assistance on this examination or assignment." Don't let cheating destroy your hard-earned opportunity to learn. See business.rutgers.edu/ai for more details.

ATTENDANCE AND PREPARATION POLICY

- Expect me to attend all class sessions. I expect the same of you. If I am to be absent, my department chair or I will send you notice via email and Blackboard as far in advance as possible. If you are to be absent, report your absence in advance at <https://sims.rutgers.edu/ssra/>. If your absence is due to religious observance, a Rutgers-approved activity, illness, or family emergency/death and you seek makeup work, also send me an email with full details and supporting documentation within 3 days of your first absence.

- For weather emergencies, consult the campus home page. If the campus is open, class will be held.

- Expect me to arrive on time for each class session. I expect the same of you.

- Expect me to remain for the entirety of each class session. I expect the same of you.

- Expect me to prepare properly for each class session. I expect the same of you. Complete all background reading and assignments. You cannot learn if you are not prepared. The minimum expectation is that for each class, you have prepared by studying for at least twice as many hours.

- Expect me to participate fully in each class session. I expect the same of you. Stay focused and involved. You cannot learn if you are not paying attention.

CLASSROOM CONDUCT

- Do not call out in class. If you have a question, raise your hand.
- No food or drink in class.
- No side conversations or use of cell phones in class.
- Use the bathroom before class to avoid the necessity of bathroom breaks.

EXAM DATES AND POLICIES

There will be a midterm and exam and a final exam.

GRADING POLICY

Course grades are determined as follows:

2% participation
18% Homework assignments
40% Midterm exam
40% Final exam

Your final grade is not subject to negotiation. If you feel I have made an error, submit your written argument to me within one week of receiving your final grade. Clarify the precise error I made and provide all due supporting documentation. If I have made an error, I will gladly correct it. But I will adjust grades only if I have made an error. I cannot and will not adjust grades based on consequences, such as hurt pride, lost scholarships, lost tuition reimbursement, lost job opportunities, or dismissals. Do not ask me to do so. It is dishonest to attempt to influence faculty in an effort to obtain a grade that you did not earn, and it will not work.

COURSE SCHEDULE

<u>Date</u>	<u>Format</u>	<u>Topic</u>
Sep 5 th	In person	Introduction. Rational decision making (Tadelis, Part I).
Sep 12 th	In person	Normal form games. (Tadelis, Part 2): pure strategies, Nash equilibria, examples.
Sep 19 th	Online	Normal form games (continued): games with continuous strategy sets. Mixed strategies. Nash equilibria in mixed strategies.
Sep 26 th	In person	Dominance in mixed strategies. Nash's existence theorem. Zero-sum games: definition, max-min/min-max strategies, minimax theorem, examples.

Oct 3 rd	Online	Zero-sum games: [proving the minimax theorem], solving zero-sum games using linear programming, using the minimax theorem to find max-min strategies in non-zero sum games, solving games using symmetry, what can go wrong in infinite games.
Oct 10 th	In person	Dynamic games of complete information (Tadelis, Part III): games in extensive form, backward induction, subgame perfect Nash equilibria, commitment games (Stackelberg games), examples.
Oct 17 th	Online	Dynamic games of complete information: behavior strategies, imperfect information, information sets, Kuhn's theorem.
Oct 24 th	In person	Midterm exam.
Oct 31 st	In person	Search games: probabilistic search for a hidden target, search games with a hidden target, search on a network.
Nov 7 th	Online	Search games: Eulerian networks, tree networks, weakly Eulerian networks
Nov 14 th	In person	Repeated games (Tadelis, Chapter 10), poker
Nov 28 th	In person	Infinitely repeated games (Tadelis, Chapter 10), auctions (Tadelis, Chapter 13)
Dec 5 th	Online	Stable matching; review
Dec 12 th	In person	Final exam

SUPPORT SERVICES

If you need accommodation for a *disability*, obtain a Letter of Accommodation from the Office of Disability Services. The Office of Disability Services at Rutgers, The State University of New Jersey, provides student-centered and student-inclusive programming in compliance with the Americans with Disabilities Act of 1990, the Americans with Disabilities Act Amendments of 2008, Section 504 of the Rehabilitation Act of 1973, Section 508 of the Rehabilitation Act of 1998, and the New Jersey Law Against Discrimination. <https://ods.rutgers.edu>

If you are a military *veteran* or are on active military duty, you can obtain support through the Office of Veteran and Military Programs and Services. <http://veterans.rutgers.edu/>

If you are in need of *mental health* services, please use our readily available services. Rutgers University-Newark Counseling Center: <http://counseling.newark.rutgers.edu/>

If you are in need of *physical health* services, please use our readily available services. Rutgers Health Services – Newark: <http://health.newark.rutgers.edu/>

If you are in need of *legal* services, please use our readily available services: <http://rusls.rutgers.edu/>

If you are in need of additional *academic assistance*, please use our readily available services.

Rutgers University-Newark Learning Center: <http://www.ncas.rutgers.edu/rlc>

Rutgers University-Newark Writing Center: <http://www.ncas.rutgers.edu/writingcenter>