

ECON 673: Information, Game Theory, & Market Design
University of Maryland – College Park
Master of Sciences in Applied Economics Program

Spring 2023

Course Syllabus

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Lectures: Tuesdays, 6:30-9:15PM, Tydings 2109

Office Hours: Mondays, 5-6PM, via Zoom

(By request: In person on Tuesdays before lecture or via Zoom for other times)

TA: Tereza Varejkova

TA Email: tvarejko@umd.edu

TA Office Hours: Sundays, 5-6PM, via Zoom

General Information

Course Description

At its core, this course is about the interplay between information and incentives among multiple agents across a wide variety of settings. Just like in an introductory Microeconomics course such as ECON 641, we are focused on decision-making, but now we move away from a single decision maker like a utility-maximizing individual or a profit-maximizing monopolist to a set of decision makers whose choices impact each other. Such situations are best understood using the tools of noncooperative game theory. We begin this course with relatively simple games such as the Prisoners' Dilemma, and we progress by adding realism and complexity to these games throughout the term. The examples in this course will draw heavily from market practices: duopolies, auctions, contracts, negotiations, signaling/screening, etc. By the end of the course, students will have developed a broadly applicable methodology for analyzing, critiquing, and optimizing decision-making processes.

Learning Objectives

Our program has 7 general learning outcomes for students (those in bold pertain to this course):

1. Ability to understand, evaluate and analyze economic data
2. Ability to understand and interpret statistical evidence from economic data
3. Ability to apply empirical evidence to assessing economic arguments
4. Ability to apply macroeconomic theories to policy discussions
5. **Ability to apply microeconomic theories to policy discussions**
6. **Ability to communicate economic ideas to a broader audience**
7. **Ability to evaluate the effectiveness of policy programs using sound economic techniques**

Additionally, upon completing this course, students should also be able to:

- Technical:
 - Comprehend the fundamental language, principles, and solution concepts of game theory
 - Explain the connections between the various components of a game and how a change to one component of a game would impact its other components
 - Determine the stable outcomes of a game by applying solution concepts (e.g. Subgame Perfection) and the logic by which they are determined (e.g. backward induction)
 - Apply Bayes's Rule to update beliefs based on new information
- Conceptual:
 - Contrast the ECON 641 utility maximization approach and the best response approach
 - Recognize the inherent tension between cooperation and competition and the impact of this tension on contracts and collusion
 - Employ mixed strategies in the face of uncertainty
 - Identify the gap between first-best and second-best outcomes caused by informational asymmetries
 - Draw the link between incentives and the competing goals of efficiency and optimality
 - Identify non-credible threats in dynamic settings
 - Discern the strategic power of information in signaling and screening games
 - Critique voting mechanisms according to the principles of welfare economics
 - Appreciate the efficacy and limitations of matching mechanisms
- Applied:
 - Analyze a non-technical description of a multi-party decision process and formally diagram it as a game
 - Frame the outcomes observed in current events and critically interpret non-academic writing, such as that found in *The Economist*, through the lens of game theory
 - Communicate the usefulness and applicability of game theory to other areas of economics and related fields such as social psychology and political science

Prerequisites

ECON 641 and ECON 644 (may be taken concurrently with ECON 644)

Recommended Texts

I structure my lectures and lecture slides so that you should not need additional sources to be successful in the course. I have tried out some textbooks in the past, but none have been widely embraced by students. As such, I will not require a textbook (but I might assign some chapters/sections of books as independent reading). All of that being said, if you would like a different/supplemental presentation of the course content, I would strongly recommend *Game Theory: An Introduction* by Steven Tadelis and I would secondarily recommend *Game Theory for Applied Economists* by Robert Gibbons.

Course Structure

In-Person Lectures

Lectures will be held on Tuesday nights from 6:30PM to 9:15PM. There will be a 15-minute break sometime between 7:30PM and 8:15PM. Due to my travel schedule, some lectures will have to either be virtual or rescheduled at a time that works for us. Students will be expected to actively engage in the lecture by asking questions and participating in discussions. I will pose discussion questions and/or readings at the end of lectures and ask you to come up with responses to be discussed in subsequent lectures.

Pre-Recorded Lectures: I will post pre-recorded lecture segments to the course website to supplement the material I cover in our in-person lectures. You will be required to view these as part of your class participation grade, and you will be assessed on this material.

Problem Sets

Problem sets will be posted on Tuesday nights, following the lecture, and they will be due two to three weeks later, prior to the start of that week's lecture. Problem set submissions must be either typed or scanned, and they must be submitted electronically on the course website. You are welcome and encouraged to work in groups on the problem sets, but please keep the group size at three or fewer students. Only one submission needs to be turned in per group (but please make sure to include everyone's names to ensure credit is awarded to all members of the group). A total of 5 problem sets will be assigned.

Project

There will be a term project focusing on behavioral/experimental economics as applied to game theory. I will provide more details early in the course.

Tests

There will be two tests: a midterm and a final. All tests will be administered during regular lecture hours and will last two hours and forty-five minutes.

Grading

The overall course grade will be based on the following components:

- Class Participation: 10%
- Problem sets: 20%
- Project: 20%
- Midterm exam: 20%
- Final exam: 30%

Class Participation

In order to ensure active participation in lectures, I will be grading you on your level of participation. Specifically, you must genuinely engage during lectures by taking part in discussions, asking questions, and participating in the interactive portions such as mock auctions, and you will be required to briefly submit feedback at the end of each lecture (what I refer to as “muddiest points” and “eureka moments”). You are also required to watch asynchronous materials (“podcasts”) posted online and prepare questions about the podcasts to be discussed at the start of the following lecture.

Problem Sets

The problem sets will be graded on a four point scale as follows:

- 3 – Complete answers with few if any errors
- 2 – Complete or nearly complete answers with some minor errors
- 1 – Incomplete answers that show basic understanding but suffer from substantial errors
- 0 – A submission that shows little understanding or little effort, or no submission at all

Since there will be a total of 5 problem sets throughout the term, a maximum cumulative raw score of 15 may be earned for the problem sets. This raw score will be multiplied by 20/15 to yield problem set component of the overall course score.

Project

I will separately provide a detailed rubric and schedule for the project (maximum score of 20).

Tests

Each test will be worth a certain number of raw points. There will be no curve applied to the tests. Each student's raw point total will be scaled so that the maximum possible cumulative score is 20 for the midterm and 30 for the final.

Final Grade

At the end of the term, every student will have a numerical course grade equal to the sum of the student's cumulative scores on the various components described above. The numerical course grade will be between 0 and 100. I will decide upon the numerical cutoffs between various letter grades based on my professional judgment. I will consider students' performance relative to the class. I will also consider absolute standards of professional competence. Highly competent students will get A's. Barely competent students will get B's. Incompetent students will get B-'s or worse. The cutoffs that I use will respect the ordinal ranking of numerical course grades. No student with a given numerical course grade will receive a lower letter grade than someone else with the same or a lower numerical course grade. The cutoffs that I use will never be higher than the standard cutoffs used in the program.

Schedule

What follows is a schedule of lecture topics and assignments. While the dates of the assignments are fixed, I may adjust the lecture topics as needed. Please note the lectures that will happen virtually.

Lecture 1 (31 January): Static games of complete information and equilibrium concepts

- Problem Set 1 posted

Lecture 2 (7 February): Mixed strategies and Nash's Theorem

Lecture 3 (14 February): Auctions I (English/Vickrey)

Lecture 4 (21 February): Static Bayesian games

- Problem Set 1 due
- Problem Set 2 posted

Lecture 5 (28 February): Auctions II (First-Price/Dutch)

Lecture 6 (7 March): Auctions III (revenue comparisons and generalizations)

- Problem Set 2 due
- Problem Set 3 posted
- Practice midterm exam questions posted

Lecture 7 (14 March): **Midterm Examination**

NO MEETING Spring Break (21 March)

Lecture 8 (28 March): Auctions IV (additional topics) and dynamic games of complete information

- Problem Set 4 posted

VIRTUAL Lecture 9 (4 April): Social choice and matching

- Problem Set 3 due
- Problem Set 4 posted

Lecture 10 (11 April): Backwards induction and subgame perfection

Lecture 11 (18 April): Repeated games

Lecture 12 (25 April): Dynamic Bayesian games

- Problem Set 4 due
- Problem Set 5 posted

Lecture 13 (2 May): Signaling and screening games

Lecture 14 (9 May): Contracts and principle-agent problems

- Problem Set 5 due
- Practice final exam questions posted

Lecture 15 (16 May): **Final Examination**

Standard Policies

Policies related to all graduate courses at the University of Maryland are posted on this page of the Graduate School's website: <https://gradschool.umd.edu/faculty-and-staff/course-related-policies>

Please familiarize yourself with these policies related to academic integrity, non-discrimination policy, accessibility, absences and accommodations, grading, academic standing, grievance procedures, and other important policies.

Work Load: Mastering the material covered in this course requires a significant amount of work outside of class. Students should expect to spend more time outside of class than in class – typically at least twice as much time.

Academic Progress: The graduate school requires that students maintain a GPA of at least 3.0. Students whose cumulative GPA falls below 3.0 will be placed on academic probation by the graduate school. Students on academic probation must ask the program's director to petition the graduate school if they want to remain in the program. The petition must include a plan for getting the student's GPA up to at least 3.0. Students who do not live up to their plan can be forced to leave the program without having earned the degree. Note: a grade of "B" corresponds to a GPA of 3.0. A grade of "B-" corresponds to a GPA of 2.7.

Excused Absences: If you miss any class meetings for any reason, you are still responsible for all material covered during the meeting you missed. It is your responsibility to work with the instructor to make sure you catch up on the missed material. Instructors routinely facilitate things by posting lecture notes, etc.

If you need to miss an exam or other graded course requirement because of illness, injury, or some other emergency: Follow doctor's orders and get documentation. Get in touch with the instructor as soon as you're able – preferably prior to missing the exam or deadline. Communicate with the instructor to make up the course requirement as soon as possible. You are entitled to recover before you make up the course requirement, but you are not entitled to extra days to study beyond the time the doctor's note says you're incapacitated. If you are incapacitated for more than a week or so beyond the end of the term, your grade in the course will be an "Incomplete." In such cases you must negotiate a plan with your instructor for completing the course requirements. Once you make up the course requirement the instructor will change your "I" to the appropriate letter grade.

School Closings and Delays: Information regarding official University closing and delays can be found on the campus website and the snow phone line: (301) 405-SNOW (405-7669). The program director will also announce cancellation information to the program as an announcement on the program's ELMS/Canvas site. This will generally be done by 1:00 p.m. on days when weather or other factors are an issue. When classes need to be canceled during the semester, we make every effort to schedule makeup classes.

UMD Counseling Center: Sometimes students experience academic, personal and/or emotional distress. The UMD Counseling Center in Shoemaker Hall provides comprehensive support services that promote personal, social, and academic success. The cost of these services is covered by the fees you already paid when you registered for classes, and there is no additional charge if you use the services. Proactively explore the range of services available, including the Counseling Service, Accessibility and Disability Service, Learning Assistance Service, and the Testing Office, all described at <http://www.counseling.umd.edu/>.

Graduate Academic Counselor: The UMD Graduate School also has an academic counselor available to support students who are having difficulty navigating mental health resources on campus, are considering a leave of absence, and/or need assistance finding mental health care off campus. The Graduate Academic Counselor also facilitates bi-weekly Graduate Student Circle Sessions which provide an opportunity to learn about resources and connect with other graduate students. Students can learn more about the Graduate Academic Counselor by going to: <https://gradschool.umd.edu/gradcounselor>

Course Evaluations: Near the end of the term, you will receive an email inviting you to submit a voluntary and anonymous course evaluation. Your feedback on courses will be very helpful in improving the quality of instruction in our program.

Access to Morrill Hall and Morrill 1102: Morrill Hall is locked every day from 7:00 p.m. – 7:00 a.m. Your university ID gives you swipe access to the back door of the building. There is keypad access to the door of Morrill 1102. The code will be shared with students by the program coordinator.