

ECON 673:
Information, Game Theory, and Market Design
Spring 2021 (DC Campus)
Course Syllabus

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Lectures: Tuesdays, 6:45-9:30PM

Office Hours: Tuesdays, 5:15-6:15PM, and by appointment

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TA Office Hours: Mondays, 5:30-6:30PM

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:

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

The learning outcomes that pertain to this course are: 5, 6, and 7.

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 aspect of a game would impact its other elements
 - Determine the stable outcomes of a game by applying solution concepts (such as Subgame Perfection) and the logic by which they are determined (i.e. backward induction)
 - Invoke Bayes's Rule to update beliefs based on new information
- Conceptual:
 - Differentiate between the standard 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 they observe 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 a different/supplemental presentation would help, I would recommend *Game Theory: An Introduction* by Steven Tadelis and/or *Game Theory for Applied Economists* by Robert Gibbons (in that order).

Course Structure

Lectures

Synchronous: The synchronous meetings will be a mix of traditional lecturing and interactive “lab” components. Sometimes I’ll give an introduction to the material, other times we’ll dive right into playing games or problem solving. The exact format will vary from lecture to lecture, but I will always break up the lecturing so that it is not just one long Zoom monologue. A typical meeting may go like this:

- 30-45 minute lecture block
- 5 minute break
- 30-45 minute “lab” block (games, interactive activities, discussions)
- 10 minute break
- 30-45 minute lecture block

Students will be expected to actively engage in the lecture by asking questions and participating in discussions. Class participation will be graded and factored into final grades.

Asynchronous: I will post pre-recorded lecture segments to the course website to supplement the material I cover in our synchronous meetings. Students will also be required to participate in asynchronous discussions of their projects.

Online Discussions

As part of the adjustment from in-person to fully virtual teaching, there WILL NOT BE any formally graded online discussion component. 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. These discussions will not be graded separately; they will be a component of the class participation grade.

Problem Sets

Problem sets will be posted on Tuesday nights, following the lecture, and they will be due two 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 four or fewer students. Only one write up needs to be turned in per group. A total of 4 problem sets will be assigned.

Project

For the term project, you will identify a situation in which it is critical for a player to take a best response approach to achieve an optimal outcome. Once you’ve identified a player in such a situation, you will play the role of advisor to that player and explain to them how to play optimally. I will provide more details in week 2, but, broadly speaking, the project will consist of the following components: a brief “elevator pitch” to be pre-recorded, a written paper, and both synchronous and asynchronous discussions of your papers.

Tests

There will be two take-home tests: a midterm examination and a final examination. Both tests will be take-home exams to be submitted electronically. The midterm will be posted on Thursday, 8 April and it will be due on Monday, 12 April. The final will be posted on Tuesday, 18 May and it will be due on Friday, 21 May.

Grading

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

- Class participation: 10%
- Problem sets: 15%
- Project: 25%
- Midterm exam: 20%
- Final exam: 30%

Class Participation

In order to ensure active participation in our synchronous meetings, I will be grading you on your level of participation. Specifically, you will be required to briefly submit feedback at the end of each lecture (what I refer to as “muddiest points” and “eureka moments”), and you must genuinely engage during our live meetings by taking part in discussions, asking questions, and participating in the “lab” portions. I will assume that all of you get the maximum score (10) for this part of the grade, and I will only deduct points if you clearly fail to participate.

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 4 problem sets throughout the quarter, a maximum of 12 raw points may be earned for the problem sets. Your problem set raw point total will then be multiplied by $15/12$, and this new amount will be the your cumulative problem set score (maximum score of 15).

Project

I will provide a detailed rubric and schedule for the project in week 2 (maximum score of 25).

Tests

Each exam will be worth a certain number of raw points. There will be no curve applied to the exams. 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.

Lecture 1 (2 March): Static games of complete information and equilibrium concepts

- Problem Set 1 posted
- Podcast lecture posted
- Probability Review podcast posted

Lecture 2 (9 March): Mixed strategies and Nash's Theorem

- Podcast lecture posted

Lecture 3 (23 March): Static Bayesian games and Auctions I (English/Vickrey)

- Problem Set 1 due
- Problem Set 2 posted

Lecture 4 (26 March): Auctions II (First-Price/Dutch)

Lecture 5 (30 March): Auctions III (revenue comparisons and generalizations)

- Practice midterm exam questions posted
- Podcast lecture posted
- Project: proposal due on 2 April

Lecture 6 (6 April): Auctions IV (additional topics)

- Problem Set 2 due

Midterm Examination (8-12 April)

Lecture 7 (13 April): Dynamic games of complete information and backward induction

- Problem Set 3 posted
- Podcast lecture posted
- Project: elevator pitch due on 16 April

Lecture 8 (20 April): Subgame perfection and repeated games

- Podcast lecture posted
- Project: pitch questions due on 21 April

Lecture 9 (27 April): Dynamic Bayesian games

- Problem Set 3 due
- Problem Set 4 posted
- Podcast lecture posted

Lecture 10 (4 May): Signaling games

- Podcast lecture posted
- Project: report due on 5 May

Lecture 11 (11 May): Screening games

- Problem Set 4 due
- Practice final exam questions posted
- Podcast lecture posted
- Project: in-class peer reviews

Lecture 12 (18 May): Social choice and matching

- Project: in-class peer reviews

Final Examination (18-21 May)

General Policies of the University of Maryland and the Department of Economics

Course Website: Copies of the course syllabus, your grades, and other relevant links and documents will be posted on the course's ELMS/Canvas website. You can access the site via www.elms.umd.edu. You will need to use your University of Maryland "directory ID" and password.

Email: The University has adopted email as the primary means of communication outside the classroom, and I will use it to inform you of important announcements. Students are responsible for updating their current email address via <http://www.registrar.umd.edu/current/> (Under the first major heading of "Online Transactions" there is a link to "Update Contact Information").

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. The courses in our DC program are 12-week courses that cover all the same material as a traditional semester-long 3-credit course (15 weeks). The compressed schedule makes it possible to complete our degree in just 15 months if you take 2 courses each term. But the compressed schedule also implies an accelerated pace with an average of 25% more work per week in a given course ($15/12 = 1.25$). The normal full-time load in a master's program is 3 courses per semester, or 6 courses per year. The weekly work load when taking 2 of our DC courses per term is equivalent to the load from 2.5 "normal" 15-week courses - so $2.5/3.0 = 83\%$ of a full-time load. Students who take 2 courses per quarter in our program complete 8 courses per year. So over the course of a year, taking 2 courses per quarter in our DC program is equivalent to 133% of a full-time load ($8/6 = 1.33$).

Academic Integrity: The University of Maryland has a nationally recognized Code of Academic Integrity. You should inform yourself about the UMD policies related to academic misconduct: <https://www.studentconduct.umd.edu/home/current-students>. Cases of academic misconduct, including plagiarism and giving or receiving unauthorized assistance on exams, will be referred to the UMD Office of Student Conduct. If found responsible for academic misconduct, students can be subject to sanctions. The standard sanction for graduate students found responsible for cheating on exams is expulsion from the university.

Student Conduct: Students are expected to treat each other with respect. Disruptive behavior of any kind will not be tolerated. Students who are unable to show civility to one another or myself will be referred to the Office of Student Conduct. You are expected to adhere to the Code of Student Conduct.

Excused Absences: The University of Maryland's policy on excused absences is posted here: <http://www.president.umd.edu/administration/policies/section-v-student-affairs/v-100g>. Please note: 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 – not the instructor's – to get yourself caught up in the course. 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). Since our program is an evening program in downtown Washington, DC, rather than a day program in College Park, we do not always cancel classes on the same days as the College Park campus. The program director will always 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.

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/>.

Students with Disabilities: The University of Maryland does not discriminate based on differences in age, race, ethnicity, sex, religion, disability, sexual orientation, class, political affiliation, or national origin. Reasonable accommodations will be arranged for students with documented disabilities. Students who have an accommodations letter from the Accessibility and Disability Service (ADS) should meet with me during the first week of the term to discuss and plan for the implementation of your accommodations. If you require reasonable accommodations but have not yet registered with ADS, please contact the Accessibility and Disability Service at 301-314-7682 or adsfrontdesk@umd.edu.

Academic Progress: The UMD 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 enrolled 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 have their enrollment in the program terminated 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.