

Mechanism Design & Information

Course Syllabus

Théo Durandard

Spring 2024

Basic Information

Credits: 3 undergraduate hours, or 4 graduate hours

Meeting Times: TTh 12:30 pm - 01:50 pm in 131 Animal Sciences Laboratory

Instructor: Théo Durandard

Email: theod@illinois.edu

Office Hours: TBA in DKH 216

Course Description

A homework assignment has four questions. Two students want to split the homework but do not know which questions the other prefers. Can they reach a fair division? In this course, we will learn how economists think about this question (and many others). Traditionally, economics has focused on the study of existing markets, but recently, economic theorists have been involved in designing markets for new products and redesigning poorly performing existing markets. Mechanism design is used to determine pricing policies, write labor contracts, design auctions, tax schemes, matching mechanisms, etc... We will approach these issues from a theoretical perspective and examine real-world applications. Examples will include how Google sells advertising space, how medical students are matched to residencies, and how governments auction natural resources.

Topics covered

We will cover a subset of the following topics.

1. Markets.

- Walrasian Markets
- First Welfare Theorem
- Coase Theorem
- Market failures: Information Asymmetries, Externalities, Price-taking, Transaction costs . . .

2. Mechanism design.

- Revelation principle.
- Bilateral trade.
- Public goods provision.
- VCG mechanisms.
- Allocation problems.

3. Profit maximizing mechanisms.

- Moral hazard and the principal-agent problem.
- Adverse selection and screening.
- Optimal auctions.

4. Matching.

- Two-sided markets: Deferred-acceptance.
- One-sided markets: Top Trading Cycles.

Evaluation

I will assign four problem sets during the quarter. Each will consist of 3 questions and be worth 9 points (3 points per question). Any attempted question will give you one point automatically. There will be a midterm exam on March, 7th. The midterm will be closed-book, and calculators are not allowed. The midterm will consist of two problems, similar to the one we will solve in class, and be worth 40 points. You will also have to prepare one in-class 30-minute presentation on a topic related to the class by group of 2. The presentation will be worth 35 points.

Your semester grade will be the maximum of the sum of your grades and 100. This means that there are 11 bonus points for the class.

Neither the grading scale (how numerical scores translate to letter grades) nor the distribution of final grades is fixed ahead of time. Letter grades depend on a mix of absolute and relative performance. Therefore, I cannot show a fixed grading scale or a target grade distribution ahead of time.

However, I expect a semester grade of over 90 to translate to an A, over 75 to translate to a B, and over 60 to translate to a C.

(Again remember that this is my expectation prior to the class. The final cutoffs between grades may vary significantly from these expected cutoffs depending on the difficulty of the midterm and problem sets I come up with, and on the class performance.)

Prerequisites

The formal prerequisites are ECON 302, ECON 437, and MATH 220/221. Technically speaking, only a basic knowledge of elementary calculus and probability theory is required. However, this class can be abstract. You should feel comfortable with standard mathematical reasoning.

Readings

Lecture notes and/or slides will be posted at the beginning of every topic (more or less every week). Along with the problem sets, they will contain all the material you are responsible for. Some of these notes will follow, more or less closely:

- “An Introduction to the Theory of Mechanism Design” by Tillman Börgers.
- “Who gets what and why” by Alvin Roth.

As the class progresses, I will also suggest additional blog posts, research articles, and podcasts.

Class schedule (subject to changes)

Week	Date	Topic	Important info
Building blocks			
1	1/16	Introduction: Economics as Engineering <i>Readings: “The Economist as Engineer” by Alvin Roth</i>	
	1/18	Game Theory review: models, Strategies, Nash Equilibrium	
2	1/23	Game Theory review (continued): Uncertainty, Bayesian Nash equilibrium, Dominant strategies	HW1 posted
	1/25	Optimization review: KKT, Envelope Theorem, Integration by part	Form groups for presentation
Allocation through markets			
3	1/30	Efficiency, Walrasian markets	
	2/1	First Welfare Theorem	
4	2/6	Coase Theorem	HW1 due
	2/8	Market failures: externalities, asymmetric information, ...	HW2 posted

Week	Date	Topic	Important info
Introduction to mechanism design			
5	2/13 2/15	Examples and setting Revelation principle	Submit topics for presentations (no need to be very specific yet)
Screening: allocation through mechanisms			
6	2/20 2/22	VCG mechanisms VCG mechanisms (continued)	
7	2/27 2/29	Optimal selling mechanism: single buyer Optimal selling mechanism: auctions	HW2 due
8	3/5	Review session	No class: office hour
	3/7	In class midterm	Midterm
8	3/12 3/14	Spring break Spring break	No class No class
Organizations: Labor contracts			
10	3/19 3/21	Examples and Moral hazard: setting Optimal contract with limited liability: bonus contracts	
11	3/26	Contests and promotions	Submit preliminary slides for presentation, HW3 posted
	3/28	Contests (continued): other examples	
Matching markets			
12	4/2	National Resident Matching Program, and the Deferred Acceptance Algorithm (DAA)	
	4/4	Stable matchings and the DAA	
13	4/9	School choice, kidney exchange, ...	HW3 due
	4/11	Roommate problem	HW4 posted
14	4/16	Student presentations	Submit final slides
	4/18	Student presentations	
15	4/23	Student presentations	
	4/25	Student presentations	
16	4/30	Student presentations	HW4 due

This is not an easy course, so do not despair if you struggle; so do I. But:

If you need help understanding expectations, assignments, or instruction, please speak up or come and see me. I care a lot about not leaving anybody behind.

Academic Assistance

Students are encouraged to utilize the many resources we have throughout campus to assist with academics. We recommend that you seek them out starting early in the semester, not just in times of academic need, in order to develop good study habits and submit work which represents your full academic potential. Many resources are found on the Economics Website including details about the Economics Tutoring Center, Academic Advising, and other academic support options: <https://economics.illinois.edu/academics/undergraduate-program/academic-student-support>.

Academic Integrity

According to the Student Code, “It is the responsibility of each student to refrain from infractions of academic integrity, from conduct that may lead to suspicion of such infractions, and from conduct that aids others in such infractions.” Please know that it is my responsibility as an instructor to uphold the academic integrity policy of the University, which can be found here: <https://studentcode.illinois.edu/article1/part4/1-401/>.

Academic dishonesty may result in a failing grade. Every student is expected to review and abide by the Academic Integrity Policies. It is your responsibility to read this policy to avoid any misunderstanding. Do not hesitate to ask the instructor(s) if you are ever in doubt about what constitutes plagiarism, cheating, or any other breach of academic integrity. Read the full Student Code at <https://studentcode.illinois.edu/>.

Students with Disabilities

To obtain disability-related academic adjustments and/or auxiliary aids, students with disabilities must contact the course instructor and the Disability Resources and Educational Services (DRES) as soon as possible. To contact DRES you may visit 1207 S. Oak St., Champaign, call 333-4603 (V/TTY), or e-mail a message to disability@illinois.edu. DRES Website: www.disability.illinois.edu/.

Community of Care

As members of the Illinois community, we each have a responsibility to express care and concern for one another. If you come across a classmate whose behavior concerns you, whether in regards to their well-being or yours, we encourage you to refer this behavior to the Student Assistance Center (217-333-0050 or <http://odos.illinois.edu/community-of-care/referral/>). Based on your report, the staff in the Student Assistance Center reaches out to students to make sure they have the support they need to be healthy and safe. Further,

we understand the impact that struggles with mental health can have on your experience at Illinois. Significant stress, strained relationships, anxiety, excessive worry, alcohol/drug problems, a loss of motivation, or problems with eating and/or sleeping can all interfere with optimal academic performance. We encourage all students to reach out to talk with someone, and we want to make sure you are aware that you can access mental health support at the Counseling Center (<https://counselingcenter.illinois.edu/>) or McKinley Health Center (<https://mckinley.illinois.edu/>).

For mental health emergencies, you can call 911 or walk into the Counseling Center, no appointment needed.

Disruptive Behavior

Behavior that persistently or grossly interferes with classroom activities is considered disruptive behavior and may be subject to disciplinary action. Such behavior inhibits other students' ability to learn and an instructor's ability to teach. A student responsible for disruptive behavior may be required to leave class pending discussion and resolution of the problem and may be reported to the Office for Student Conflict Resolution for disciplinary action.

Emergency Response Recommendations

Emergency response recommendations can be found at the following website: <http://police.illinois.edu/emergency-preparedness/>. I encourage you to review this website and the campus building floor plans website within the first 10 days of class. <http://police.illinois.edu/emergency-preparedness/building-emergency-actionplans/>.

Religious Observances

The Religious Observance Accommodation Request form is available at <https://odos.illinois.edu/community-of-care/resources/students/religious-observances/>. Submit the form to the instructor and to the Office of the Dean of Students (helpdean@illinois.edu) by the end of the second week of the course; in the case of exams or assignments scheduled after this period, students should submit the form to the instructor and to the Office of the Dean of Students as soon as possible. Family Educational Rights and Privacy Act (FERPA) Any student who has suppressed their directory information pursuant to Family Educational Rights and Privacy Act (FERPA) should self- identify to the instructor to ensure protection of the privacy of their attendance in this course. See <http://registrar.illinois.edu/ferpa> for more information on FERPA. Student information and records will not be released to anyone other than the student unless the student has provided written approval or as required by law.

Sexual Misconduct Reporting Obligation

The University of Illinois is committed to combating sexual misconduct. Faculty and staff members are required to report any instances of sexual misconduct to the University's Title IX and Disability Office. In turn, an individual with the Title IX and Disability Office will provide information about rights and options, including accommodations, support services, the campus disciplinary process, and law enforcement options. A list of the designated University employees who, as counselors, confidential advisors, and medical professionals, do not have this reporting responsibility and can maintain confidentiality, can be found here: <http://www.wecare.illinois.edu/resources/students/#confidential>. Other information about resources and reporting is available here: <http://wecare.illinois.edu/>.

Student Support

The Counseling Center is committed to providing a range of services intended to help students develop improved coping skills in order to address emotional, interpersonal, and academic concerns. Please visit their website to find valuable resources and services: <https://counselingcenter.illinois.edu/>.

Counseling Center Information: 217-333-3704

Location: Room 206, Student Services Building (610 East John Street, Champaign IL)

McKinley Mental Health Information: 217-333-2705

Location: 3rd Floor McKinley Health Center 1109 South Lincoln, Urbana, IL

Emergency Dean: The Emergency Dean may be reached at (217) 333-0050 and supports students who are experiencing an emergency situation after 5 pm, in which an immediate University response is needed and which cannot wait until the next business day. The Emergency Dean is not a substitute for trained emergency personnel such as 911, Police or Fire. If you are experiencing a life threatening emergency, call 911. Please review the Emergency Dean procedures: <http://odos.illinois.edu/emergency/>.

Academic Dates and Deadlines

Students should make note of important academic deadlines for making changes to their courses (add, drop, credit/no-credit, grade replacement, etc.). <https://registrar.illinois.edu/academic-calendars>

Please check with your academic department regarding specific procedures and policies.