



**ECON 564**

**Introduction to Market Design**

**Units: 4**

**Fall 2024 – Mon/Wed 12:00-1:20pm**

**Location: GFS 207**

**Instructor:** Prof. Nicolas Lambert

**Office:** KAP 318B

**Office Hour:** Wed 4:00-5:00pm or by appointment

**Contact Info:** [lambertn@usc.edu](mailto:lambertn@usc.edu)

**TA:** TBD

**Office:** KAP 363

**Office Hour:** TBD

**Contact Info:**

## Course description

This course introduces students to the theory and practice of the design of markets and economic mechanisms. Market design is a field of microeconomics that seeks to understand what makes markets work well or badly, identify marketplace opportunities, fix markets when they are broken, or create them when they are missing. It combines formal analysis of economic models with empirical analysis of real-life markets to understand how and when can markets create value, how to engineer market rules so as to achieve a particular goal, such as overcoming a market failure or maximizing profits, and understand the challenges of implementing markets in practice.

The course is divided into 3 parts: (1) market design with prices, with a focus on auctions and with a variety of applications including spectrum auctions, online advertising, peer-to-peer lending, online marketplaces such as eBay and Amazon; (2) market design without prices, with a focus on matching markets and applications to organ transplants, dating platforms, allocation of public housing, school choice, labor market clearing houses; (3) class projects where teams of students design a market of their choice and present their findings to the class.

Sessions will combine formal lectures with class discussions and examples/problems solved in class. Attendance is mandatory.

There is no formal course prerequisite, but familiarity with basic mathematical concepts is required, in particular, linear algebra, calculus, and probability. Knowledge of computer programming (e.g., Python) can be useful for the class project.

# Grading

Grades will be based on the following components:

- Class participation (10%) in discussion and problems solved in class.
- One in-class exam (40%), scheduled on **October 28**. The exam will test your knowledge and understanding of the key concepts you will have learned over the semester. It is closed books and closed laptops.
- One project proposal (10%), due **November 6**.
- One in-class presentation (15%), in the last 3 sessions of the course. Evaluation will be based on your presentation style, the content, and the effectiveness of your communication.
- One final paper (25%) due **December 15**.

## Class project

You will work in small groups to develop a project of market design. The goal is to put in practice the concepts learned during the semester.

You will be asked to:

1. Choose an environment of interest (e.g., online marketplaces, dating platforms, etc.).
2. Identify some desirable objectives (e.g., profit or welfare maximization, fairness, etc.).
3. Propose a market design to satisfy these objectives. Typically your market will be based on one of the designs studied in class, which you will adapt to suit your needs.
4. Demonstrate the use of your market. For example, you can show a prototype of your market and empirical results obtained from computer simulations, or conduct experiments with your friends and classmates.
5. Provide an informal analysis to help understand your choices and your findings. Your analysis should help answer some basic questions. What does the theory predict regarding the outcome of your market? Why do you think your market satisfies your objectives? What worked as expected, what did not, and why? Moving forward, are there modifications you want to bring to your design, and if so, why and what are they?

The class project proceeds in three phases:

1. A one-page project proposal, which describes the context and environment of interest, the objectives you want to achieve, and an agenda with the key steps of the development of your project along with the role of each group member. You are encouraged to include a timeline.
2. A class presentation, expected to be 20-25 mins long, using slides. This presentation should include the context and your objectives, provide a description of the design of your market, present your initial empirical findings, discuss your findings and/or a preliminary analysis, and conclude with your next steps. The presentation should make your ideas accessible to a general audience not necessarily familiar with the market you have focused on.
3. A final paper, expected to be 15-20 pages long. The final paper complements the class presentation. It should describe in full details the implementation of your market, the challenges anticipated, and include some preliminary analysis which can be theoretical with a simple model, or empirical with experimental data or computer simulations. It can include a review of the related literature, if you find it relevant, but it is not necessary.

## Reading material

Reading material includes presentation slides and academic articles, which will be available on Blackboard. You will only be tested on the material covered in class.

I do not require a textbook for this course. However, if you would like to use a textbook, I highly recommend:

- Guillaume Haeringer (2018): *Market Design: Auctions and Matching*. The MIT Press.

This book is very accessible and covers the majority of the topics of this course. When applicable, I will refer you to the relevant book chapters associated to class lectures.

For a broad, non-technical introduction to market design, you can read:

- Alvin Roth (2015): *Who gets What and Why: the New Economics of Matchmaking and Market Design*. Eamon Dolan/Mariner Books.

For advanced (PhD level) market design theory, you can read:

- Alvin Roth and Marilda Sotomayor (1990): *Two-Sided Matching: A Study in Game-Theoretic Modelling and Analysis*. Econometric Society Monograph Series, Cambridge University Press.
- Vijay Krishna (2009): *Auction Theory*. Academic Press, 2nd edition.
- Paul Milgrom (2004): *Putting Auction Theory to Work*. Cambridge University Press.

## Lecture Schedule

Week	Monday	Wednesday
1	<i>August 26</i> Why Design Markets?	<i>August 28</i> The Essentials of Game Theory
2	<i>September 2</i> <i>University Holiday</i>	<i>September 4</i> The Four Main Auctions
3	<i>September 9</i> The Private Value Model	<i>September 11</i> Equilibrium and Outcome Evaluation
4	<i>September 16</i> Optimal Auctions	<i>September 18</i> Revenue Equivalence
5	<i>September 23</i> The Common Value Model	<i>September 25</i> Auctions in the Real World
6	<i>September 30</i> Mechanism Design	<i>October 2</i> The VCG Mechanism
7	<i>October 7</i> One-to-One Matching I	<i>October 9</i> One-to-One Matching II
8	<i>October 14</i> The Medical Match	<i>October 16</i> Assignment Problems
9	<i>October 21</i> Student Housing	<i>October 23</i> School Choice

## Schedule

Weeks 1 to 9 are reserved for lectures. The table above shows a tentative schedule, subject to change depending on lecture pace and class size. I will provide handouts and readings via class announcements prior to each lecture.

Weeks 10 and beyond are reserved for the exam, project development with one-on-one meetings with the instructing team, and project presentations.

## Reading list

Readings will be communicated via class announcements, and sampled from the list below.

- Why design markets?
  - A. Roth (2002): “The Economist as Engineer: Game Theory, Experimentation, and Computation as Tools for Design Economics.” *Econometrica*, 70(4), pp. 1341–1378.
  - A. Roth (2008): “What Have We Learned from Market Design?,” *Economic Journal*, 118, pp. 285–310.
  - C. Prendergast (2017): “How Foodbanks Use Markets to Feed the Poor.” *Journal of Economic Perspectives*, 31(4), pp. 145–162.
- Auction theory:
  - W. Vickrey (1961): “Counterspeculation, Auctions, and Competitive Sealed Tenders,” *Journal of Finance*, 16: 8–37.
  - R. Myerson (1981): “Optimal Auction Design,” *Mathematics of Operations Research*, 6(1): 58–73.
  - J. Bulow and P. Klemperer (1996): “Auctions Versus Negotiations,” *American Economic Review*, 86, pp. 180–194.
- Auctions in practice:
  - B. Edelman, M. Ostrovsky and M. Schwarz (2007): “Selling Billions of Dollars of Keywords: The Generalized Second Price Auction,” *American Economic Review*, 97(1), pp. 242–259.
  - K. Leyton-Brown, P. Milgrom and I. Segal (2017): “Economics and computer science of a radio spectrum reallocation,” *Proceedings of the National Academy of Sciences*, 114, pp. 7202–7209.
  - A. Roth and A. Ockenfels (2002): “Last-Minute Bidding and the Rules for Ending Second-Price Auctions: Evidence from eBay and Amazon Auctions on the Internet,” *American Economic Review P&P*, 92, pp. 1093–1103.
  - M. Cramton (2006): “Simultaneous Ascending Auctions,” in P. Cramton, Y. Shoham, and R. Steinberg (eds.), *Combinatorial Auctions*, Chapter 4, pp. 99–114, MIT Press.
- Mechanism design:
  - L. Ausubel and P. Milgrom (2006): “The Lovely but Lonely Vickrey Auction,” in P. Cramton, Y. Shoham, and R. Steinberg (eds.), *Combinatorial Auctions*, Chapter 1, MIT Press.
- One-to-one matching:
  - D. Gale and L. Shapley (1962): “College Admissions and the Stability of Marriage,” *American Mathematical Monthly*, 69, pp. 9–15.
- The medical match:

- A. Roth (1984): “The Evolution of the Labor Market for Medical Interns and Residents: A Case Study in Game Theory,” *Journal of Political Economy*, 92, pp. 991–1016.
  - A. Roth and E. Peranson (1999): “The Re-design of the Matching Market for American Physicians: Some Engineering Aspects of Economic Design,” *American Economic Review*, 89, pp. 748–780.
  - J. Kagel and A. Roth (2000): “The Dynamics of Reorganization in Matching Markets: A Laboratory Experiment Motivated by a Natural Experiment,” *Quarterly Journal of Economics*, 115, pp. 201–235.
- School choice:
    - P. Pathak and T. Sönmez (2008): “Leveling the Playing Field: Sincere and Sophisticated Players in the Boston Mechanism,” *American Economic Review*, 98(4), pp. 1636–1652.
    - P. Pathak and T. Sönmez (2013): “School Admissions Reform in Chicago and England: Comparing Mechanisms by their Vulnerability to Manipulation,” *American Economic Review*, 103(1), pp. 80–106.
    - P. Pathak (2018): “What Really Matters in Designing School Choice Mechanisms,” *Advances in Economics and Econometrics, 11th World Congress of the Econometric Society*, eds. Bo Honore, Ariel Pakes, Monika Piazzesi, Larry Samuelson. Cambridge University Press.
    - A. Abdulkadiroğlu and T. Sönmez (2003): “School Choice: A Mechanism Design Approach,” *American Economic Review*, 93(3), pp. 729–747.
    - A. Abdulkadiroğlu, P. Pathak and A. Roth (2005): “The New York City High School Match,” *American Economic Review P&P*, 95, pp. 364–367.
    - A. Abdulkadiroğlu, P. Pathak, A. Roth and T. Sönmez (2005): “The Boston Public School Match,” *American Economic Review P&P*, 95, pp. 368–371.
    - O. Kesten (2010): “School Choice with Consent,” *Quarterly Journal of Economics*, 125, pp. 297–1348.
  - One-sided matching:
    - A. Abdulkadiroğlu and T. Sönmez (1999): “House Allocation with Existing Tenants,” *Journal of Economic Theory*, 88, pp. 233–260.
  - Kidney exchanges:
    - A. Roth, T. Sönmez and U. Ünver (2003): “Kidney Exchange.” *Quarterly Journal of Economics*, 119, pp. 457–488.

## Acknowledgements

I am very grateful to Afshin Nikzad, Parag Pathak, and especially Guillaume Haeringer for sharing their class material.

## Support Systems

**Student Health Counseling Services** - (213) 740-7711 – 24/7 on call [engemannshc.usc.edu/counseling](http://engemannshc.usc.edu/counseling) Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

**National Suicide Prevention Lifeline** - 1 (800) 273-8255 – 24/7 on call [suicidepreventionlifeline.org](http://suicidepreventionlifeline.org) Free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week.

**Relationship and Sexual Violence Prevention Services (RSVP)** - (213) 740-4900 – 24/7 on call [engemannshc.usc.edu/rsvp](http://engemannshc.usc.edu/rsvp) Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

**Office of Equity and Diversity (OED) | Title IX** - (213) 740-5086 [equity.usc.edu](http://equity.usc.edu), [titleix.usc.edu](http://titleix.usc.edu) Information about how to get help or help a survivor of harassment or discrimination, rights of protected classes, reporting options, and additional resources for students, faculty, staff, visitors, and applicants. The university prohibits discrimination or harassment based on the following protected characteristics: race, color, national origin, ancestry, religion, sex, gender, gender identity, gender expression, sexual orientation, age, physical disability, medical condition, mental disability, marital status, pregnancy, veteran status, genetic information, and any other characteristic which may be specified in applicable laws and governmental regulations.

**Bias Assessment Response and Support** - (213) 740-2421 [studentaffairs.usc.edu/bias-assessment-response-support](http://studentaffairs.usc.edu/bias-assessment-response-support) A venue to report incidents of bias, hate crimes, and microaggressions for appropriate investigation and response.

**The Office of Student Accessibility Services** - (213) 740-0776 <https://osas.usc.edu/> Support and accommodations for students with disabilities. Services include assistance in providing readers/notetakers/interpreters, special accommodations for test taking needs, assistance with architectural barriers, assistive technology, and support for individual needs.

**USC Support and Advocacy** - (213) 821-4710 [studentaffairs.usc.edu/ssa](http://studentaffairs.usc.edu/ssa) Assists students and families in resolving complex personal, financial, and academic issues adversely affecting their success as a student. **Diversity at USC** - (213) 740-2101 [diversity.usc.edu](http://diversity.usc.edu) Information on events, programs and training, the Provost's Diversity and Inclusion Council, Diversity Liaisons for each academic school, chronology, participation, and various resources for students.

**USC Emergency** - UPC: (213) 740-4321, HSC: (323) 442-1000 – 24/7 on call [dps.usc.edu](http://dps.usc.edu), [emergency.usc.edu](http://emergency.usc.edu) Emergency assistance and avenue to report a crime. Latest updates regarding safety, including ways in which instruction will be continued if an officially

declared emergency makes travel to campus infeasible.

**USC Department of Public Safety** - UPC: (213) 740-6000, HSC: (323) 442-120 – 24/7 on call [dps.usc.edu](http://dps.usc.edu) Non-emergency assistance or information.