



ECON 564

Introduction to Market Design

Units: 4

Fall 2023 – Mon/Wed 12:00-1:20pm

Location: KAP 158

Instructor: Prof. Nicolas Lambert

Office: KAP 318B

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

Contact Info: lambertn@usc.edu

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 (20%) in discussion and problems solved in class.

- One in-class exam (25%), tentatively scheduled on **October 23**. 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 (15%), tentatively due **October 27**.
- One in-class presentation (20%), in Weeks 13–15. Evaluation will be based on your presentation style, the content, and the effectiveness of your communication.
- One final paper (20%), due the last day of the exam period, **December 13**.

Class project

You will work in small teams 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/environment of interest, the objectives you seek to achieve, and an agenda that describes the key steps of the development of your project along with the role of each member of your team. 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 roughly 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 relevant.

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 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.

For a general, non-mathematical text about 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 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.

Schedule

Weeks 1 to 9 are reserved for lectures. The table below 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.

Tentative Lecture Schedule

Week	Monday	Wednesday
1	<i>August 21</i> Why Design Markets?	<i>August 23</i> The Essentials of Game Theory
2	<i>August 28</i> Private Value Auctions	<i>August 30</i> Private Value Auctions
3	<i>September 4</i> <i>University Holiday</i>	<i>September 6</i> Private Value Auctions
4	<i>September 11</i> Common Value Auctions	<i>September 13</i> Auctions in Practice
5	<i>September 18</i> Auctions in Practice	<i>September 20</i> Mechanism Design
6	<i>September 25</i> The VCG Mechanism	<i>September 27</i> One-to-One Matching
7	<i>October 2</i> One-to-One Matching	<i>October 4</i> The Medical Match
8	<i>October 9</i> School Choice	<i>October 11</i> One-Sided Matching
9	<i>October 16</i> One-Sided Matching	<i>October 18</i> Kidney Exchange

Weeks 10 to 13 are reserved for the exam and project development with one-on-one meetings with the instructing team. Weeks 13 to 15 are reserved for in-class project presentations.

Reading list

Below is the tentative reading list.

- 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. 297–348.
- 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.

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Support Systems

Student Health Counseling Services - (213) 740-7711 – 24/7 on call 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 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 Free and confidential therapy services, workshops, and training for situations related to gender-based harm.

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