BEEM147: Topics in Microeconomic Theory II
Matching and Market Design

Spring Term 2021
University of Exeter

INSTRUCTOR	Alejandro Robinson-Cortés
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OFFICE HOURS	online by appointment
MATERIAL	distributed through ELE on Mondays
TUTORIALS	Fridays 10am–noon in Zoom

EVALUATION[1]

Final take-home exam:	55%
Presentations:	25%
Problem sets:	20%

COURSE DESCRIPTION

- The course will be mostly self-guided through lecture notes. Weekly prerecorded lectures will focus on certain aspects of the notes and provide background information.

- Students are expected to cover the material, notes and videos, on their own before attending weekly tutorials.

- Tutorials will be dedicated to Q&A, discussion, and solving problems. Students are encouraged to prepare questions before coming to tutorials. Questions may range from the very specific (e.g., about a step in a proof) to the very general (e.g., about real-life applications).

- Each student will do two presentations on topics or papers of their interest. At least one of the presentations has to be related to matching or market design (see recommended topics below). The other presentation may be of any topic broadly related to microeconomics. Students must coordinate with the instructor regarding the topics and papers of presentations.

- There will be two problem sets.

SYLLABUS

1. **House allocation:** preferences, mechanism design and matching; Pareto efficiency; strategy-proofness; serial dictatorship.

2. **Housing market:** object-allocation with property rights; individual rationality and the core; top-trading cycle (TTC) algorithm; housing allocation with existing tenants.

3. **Kidney exchange:** TTC with waiting list: chains and cycles; matroids and priority mechanisms.

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1. Next year, in Spring Term 2022, the Evaluation will be Research Proposal (30%), Presentations (40%), Problem Sets (30%).

4. **Random allocations:** stochastic dominance; random serial dictatorship; probabilistic serial mechanism.

5. **Marriage market:** stability; transferable and non-transferable utility; Gale-Shapley and the Deferred Acceptance (DA) algorithm; Shapley-Shubik and the Assignment Game; the roommate assignment problem.

6. **The medical match:** many-to-one matching; history of the NRMP; the rural hospitals theorem.

7. **School choice:** justified envy and non-wastefulness; the Boston mechanism; priority-based matching.

8. **Course allocation:** many-to-many matching; DA with bids, the Harvard Draft, the Wharton model and combinatorial assignment problems.

OTHER TOPICS (time permitting and for presentations)

9. **Fair division:** cake cutting and bankruptcy problems.

10. **Voting rules and social choice:** Condorcet winner criterion; the Gibbard-Satterthwaite theorem; Arrow impossibility theorem.

11. **Dynamic matching:** dynamic one-sided allocations and two-sided matching; centralized vs. decentralized mechanisms; dynamic stability.

12. **Empirical matching models:** the econometrics of the marriage market: Choo and Siow model, matching with costly concessions: imperfectly transferable utility; empirical NTU models: the medical match and school choice.

13. **Matching with network externalities:** assigning faculty offices.

14. **Global kidney exchange:** designing (and financing) kidney exchanges across borders; ethics concerns and controversy.

15. **Antitrust lawsuit against the medical match (NRMP):** the effect of Gale-Shapley's DA on medical residents' salaries.

TIMELINE

4 Jan	Start of Spring Term	
15 Jan	Week 1	House allocation
22 Jan	Week 2	Housing market
29 Jan	Week 3	Kidney exchange
5 Feb	Week 4	Random allocations (Pset 1 due)
12 Feb	Week 5	Marriage market I
19 Feb	Week 6	Marriage market II
26 Feb	Week 7	The medical match
5 Mar	Week 8	School choice (Pset 2 due)
12 Mar	Week 9	Student presentations 1
19 Mar	Week 10	Course allocation
25 Mar	Week 11	Student presentations 2
26 Mar	End of Spring Term	
26 Apr	Final Exam	

Reading List: Syllabus

Note: this list includes supporting material and additional readings for the topics covered in class.

0. **Textbooks on matching and market design**

   - Alvin E. Roth and Marilda A. Oliveira Sotomayor. 1990. *Two-Sided Matching: A Study in Game-Theoretic Modeling and Analysis.* Econometric Society Monographs. Cambridge University Press
   - Guillaume Haeringer. 2017. *Market Design: Auctions and Matching.* The MIT Press

00. **General readings on market design**

   - Muriel Niederle, Alvin E. Roth, and Tayfun Sönmez. 2008. "matching and market design." In *The New Palgrave Dictionary of Economics,* edited by Steven N. Durlauf and Lawrence E. Blume. Basingstoke: Palgrave Macmillan
   - Alvin E. Roth. 2008. "What Have We Learned from Market Design?" *The Economic Journal* 118 (527): 285–310
   - Alvin E. Roth. 2016. *Who Gets What — and Why.* New York: First Mariner Books

1. **House allocation**

   - Chapter 11 of Haeringer (2017)

2. **Housing market**

   - Lloyd Shapley and Herbert Scarf. 1974. "On cores and indivisibility." *Journal of Mathematical Economics* 1 (1): 23–37
   - Alvin E. Roth and Andrew Postlewaite. 1977. "Weak versus strong domination in a market with indivisible goods." *Journal of Mathematical Economics* 4 (2): 131–137
   - Alvin E. Roth. 1982. "Incentive compatibility in a market with indivisible goods." *Economics Letters* 9 (2): 127–132
   - Jinpeng Ma. 1994. "Strategy-proofness and the strict core in a market with indivisibilities." *International Journal of Game Theory* 23:75–83
   - Atila Abdulkadiroğlu and Tayfun Sönmez. 1999. "House Allocation with Existing Tenants." *Journal of Economic Theory* 88 (2): 233–260
   - Section 2 of Tayfun Sönmez and M. Utku Ünver. 2009. *Matching, Allocation, and Exchange of Discrete Resources.* Boston College Working Papers in Economics 717. Boston College Department of Economics

3. **Kidney exchange**

   - Alvin E. Roth, Tayfun Sönmez, and M. Utku Ünver. 2004. "Kidney Exchange." *The Quarterly Journal of Economics* 119 (2): 457–488
   - Alvin E. Roth, Tayfun Sönmez, and M. Utku Ünver. 2005. "Pairwise kidney exchange." *Journal of Economic Theory* 125 (2): 151–188
   - Section 3 of Sönmez and Ünver (2009)
   - Chapter 16 of Haeringer (2017)

4. **Random allocations**

   - Atila Abdulkadiroğlu and Tayfun Sönmez. 1998. "Random Serial Dictatorship and the Core from Random Endowments in House Allocation Problems." *Econometrica* 66 (3): 689–701

- Anna Bogomolnaia and Hervé Moulin. 2001. "A New Solution to the Random Assignment Problem." *Journal of Economic Theory* 100 (2): 295–328
- Yeon-Koo Che and Fuhito Kojima. 2010. "Asymptotic Equivalence of Probabilistic Serial and Random Priority Mechanisms." *Econometrica* 78 (5): 1625–1672
- Chapter 12 of Haeringer (2017)

5. **Marriage market**

- David Gale and Lloyd S. Shapley. 1962. "College Admissions and the Stability of Marriage." *The American Mathematical Monthly* 69 (1): 9–15
- Lloyd S. Shapley and Martin Shubik. 1971. "The assignment game I: The core." *International Journal of Game Theory* 1 (1): 111–130
- Gary S. Becker. 1973. "A Theory of Marriage: Part I." *Journal of Political Economy* 81 (4): 813–846
- Chapters 2–5 and 8 of Roth and Sotomayor (1990)
- Chapter 9 of Haeringer (2017)

6. **The medical match**

- Alvin E. Roth. 1984. "The Evolution of the Labor Market for Medical Interns and Residents: A Case Study in Game Theory." *Journal of Political Economy* 92, no. 6 (December): 991–1016
- Chapter 5 of Roth and Sotomayor (1990)
- Alvin E. Roth and Elliott Peranson. 1999. "The Redesign of the Matching Market for American Physicians: Some Engineering Aspects of Economic Design." *American Economic Review* 89, no. 4 (September): 748–780
- Alvin E. Roth. 2003. "The Origins, History, and Design of the Resident Match." *JAMA* 289, no. 7 (February): 909–912
- Fuhito Kojima, Parag A. Pathak, and Alvin E. Roth. 2013. "Matching with Couples: Stability and Incentives in Large Markets." *The Quarterly Journal of Economics* 128, no. 4 (August): 1585–1632
- Chapter 10 of Haeringer (2017)

7. **School choice**

- Atila Abdulkadiroğlu and Tayfun Sönmez. 2003. "School Choice: A Mechanism Design Approach." *American Economic Review* 93, no. 3 (June): 729–747
- Atila Abdulkadiroğlu, Parag A. Pathak, Alvin E. Roth, and Tayfun Sönmez. 2005. "The Boston Public School Match." *American Economic Review* 95 (2): 368–371
- Section 4 of Sönmez and Ünver (2009)
- Parag A. Pathak. 2016. "What Really Matters in Designing School Choice Mechanisms." Unpublished paper
- Chapter 13 and 14 of Haeringer (2017)

8. **Course allocation**

- Tayfun Sönmez and M. Utku Ünver. 2010. "Course Bidding at Business Schools." *International Economic Review* 51 (1): 99–123
- Eric Budish. 2011. "The Combinatorial Assignment Problem: Approximate Competitive Equilibrium from Equal Incomes." *Journal of Political Economy* 119 (6): 1061–1103

- Eric Budish and Estelle Cantillon. 2012. "The Multi-unit Assignment Problem: Theory and Evidence from Course Allocation at Harvard." *American Economic Review* 102, no. 5 (May): 2237–71
- Chapter 15 of Haeringer (2017)

Reading List: Other Topics

Note: this list includes suggested papers for presentations. Depending on the topic, the presentation may be of a single or multiple papers.

9. **Fair division**

   - Robert J Aumann and Michael Maschler. 1985. "Game theoretic analysis of a bankruptcy problem from the Talmud." *Journal of Economic Theory* 36 (2): 195–213
   - Ulle Endriss. 2010. "Lecture Notes on Fair Division"

10. **Voting rules, social choice, and mechanism design**

    - Kenneth J. Arrow. 1951. *Social Choice and Individual Values.* Yale University Press
    - Allan Gibbard. 1973. "Manipulation of Voting Schemes: A General Result." *Econometrica* 41 (4): 587–601
    - Mark Allen Satterthwaite. 1975. "Strategy-proofness and Arrow's conditions: Existence and correspondence theorems for voting procedures and social welfare functions." *Journal of Economic Theory* 10 (2): 187–217
    - Philip J. Reny. 2001. "Arrow's theorem and the Gibbard-Satterthwaite theorem: a unified approach." *Economics Letters* 70 (1): 99–105
    - Roger B. Myerson. 2013. "Fundamentals of Social Choice Theory." *Quarterly Journal of Political Science* 8 (3): 305–337
    - Shengwu Li. 2017. "Obviously Strategy-Proof Mechanisms." *American Economic Review* 107, no. 11 (November): 3257–87

11. **Dynamic matching**

    - M. Utku Ünver. 2010. "Dynamic Kidney Exchange." *The Review of Economic Studies* 77 (1): 372–414
    - Laura Doval. 2018. "A Theory of Stability in Dynamic Matching Markets." Unpublished paper
    - Mohammad Akbarpour, Shengwu Li, and Shayan Oveis Gharan. Forthcoming. "Thickness and Information in Dynamic Matching Markets." *Journal of Political Economy*
    - Mariagiovanna Baccara, SangMok Lee, and Leeat Yariv. Forthcoming. "Optimal Dynamic Matching." *Theoretical Economics*

12. **Empirical matching models**

    - Eugene Choo and Aloysius Siow. 2006. "Who Marries Whom and Why." *Journal of Political Economy* 114 (1): 175–201
    - Jeremy T. Fox. 2010. "Identification in matching games." *Quantitative Economics* 1 (2): 203–254
    - Alfred Galichon and Bernard Salanié. 2015. "Cupid's Invisible Hand: Social Surplus and Identification in Matching Models." Unpublished paper

13. **Matching with network externalities**

- Mariagiovanna Baccara, Ayşe İmrohoroğlu, Alistair J. Wilson, and Leeat Yariv. 2012. "A Field Study on Matching with Network Externalities." *American Economic Review* 102, no. 5 (May): 1773–1804

14. **Global kidney exchange**

   - Francesca Minerva, Julian Savulescu, and Peter Singer. 2019. "The ethics of the Global Kidney Exchange programme." *The Lancet* 394 (10210): 1775–1778

   - Afshin Nikzad, Mohammad Akbarpour, Michael A. Rees, and Alvin E. Roth. 2020b. "Global Kidney Chains." Unpublished paper

   - Afshin Nikzad, Mohammad Akbarpour, Michael A. Rees, and Alvin E. Roth. 2020a. "Financing Transplant Costs of the Poor: A Dynamic Model of Global Kidney Exchange." Unpublished paper

15. **Antitrust lawsuit against the medical match (NRMP)**

   - Muriel Niederle and Alvin E. Roth. 2012. "Antitrust Lawsuit Against the Resident Match." Lecture slides

Background Readings

Note: this reading list includes background readings in general topics of microeconomic theory. The course is designed to be self-contained. These should be useful only if you feel there are some topics you need to brush up.

- David M. Kreps. 1988. *Notes On The Theory Of Choice.* Underground classics in economics. Avalon Publishing

- Andreu Mas-Colell, Michael D. Whinston, and Jerry R. Green. 1995. *Microeconomic Theory.* Oxford University Press

- D. Diamantaras, E. Cardamone, K.A.C. Campbell, S. Deacle, and L.A.A. Delgado. 2009. *A Toolbox for Eoreonomic Design.* Palgrave Macmillan

- David M. Kreps. 2012. *Microeconomic Foundations I: Choice and Competitive Markets.* Economics Books 9890. Princeton University Press, October