

## **Econ 289: Topics in Game Theory**

Instructor: Fuhito Kojima

fuhitokojima1979 "at" gmail.com (replace "at" with @)

650-725-2620

<http://sites.google.com/site/fuhitokojimaeconomics/>

(This syllabus is evolving: Please check the latest version frequently. Last updated: 03/21/2011)

This is a topics course in game theory. We discuss mechanism/market design, especially theory and application of matching theory. This class builds on material covered in Econ 285.

I will put emphasis on recent advances in the topic and present open questions so that interested students can promptly come to the frontier and begin their own research.

About half of the classes are delivered in the lecture style. Then the latter half of the course is based on student presentations of recent research papers. Depending on availability of time (which depends on enrollment) and interest, I am planning to invite outside speakers for guest lectures.

### **Grading**

Grading will be based on class participation (discussion, student presentations) and a final paper.

### **Prerequisite**

Game theory at the 1st year PhD level. Also it is strongly recommended that you have taken Econ 285, because many of the topics are based on the material covered there.

If not, please familiarize yourself with the topic, by taking a look at slides at

<http://sites.google.com/site/economics285fall09/>

### **Textbooks**

The recommended textbook is

*Tow-Sided Matching by Roth and Sotomayor (1990)* from Oxford University Press.

I will also assign research papers.

**Lecture Topics** (the plan is tentative and may evolve depending on student interests and how the class proceeds). Papers with \* are the main readings for the class.

**03/28: Design of Labor Market Clearinghouses**

- \*Roth and Sotomayor (1990), Chapters 2-4.
- Gale, David and Lloyd Shapley (1962), "College Admissions and the Stability of Marriage" *American Mathematical Monthly*, 69, 9-15.
- \*Kojima, F. and Pathak, P. A. (2008), "Incentives and Stability in Large Two-Sided Matching Markets," *American Economic Review* 99, pp 608-627.
- \*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 (4) September, 748-780
- Immorlica, N. and Mahdian, M. (2005), "Marriage, Honesty, and Stability," *SODA* 2005, pp. 53–62.

**03/30: Design of Labor Market Clearinghouses (2)**

- \*Roth and Sotomayor (1990), Chapter 5.
- \*Roth, A.E., "The Evolution of the Labor Market for Medical Interns and Residents: A Case Study in Game Theory," *Journal of Political Economy*, 92, 1984, 991-1016.
- Klaus, Bettina and Flip Klijn [2005], "Stable Matchings and Preferences of Couples," *Journal of Economic Theory*, 121, 75-106.
- Fuhito Kojima, Parag Pathak, and Alvin E. Roth (2010), "Matching with Couples: Stability and Incentives in Large Markets", revise and resubmit, *Quarterly Journal of Economics*.

**04/04: Design of Labor Market Clearinghouses (3)**

- \*Roth and Sotomayor (1990), Chapters 2 and 5.
- Roth, A.E., "The Evolution of the Labor Market for Medical Interns and Residents: A Case Study in Game Theory," *Journal of Political Economy*, 92, 1984, 991-1016.
- \*Roth (1986), On the allocation of residents to rural hospitals: a general property of two-sided matching markets, *Econometrica*
- \*Yuichiro Kamada and Fuhito Kojima, Improving Efficiency in Matching Markets with Regional Caps: The Case of the Japan Residency Matching Program (2010)
- John William Hatfield and Fuhito Kojima, "Substitutes and Stability for Matching with Contracts" (2010), *Journal of Economic Theory*, 145, 1704-1723.

**04/06: Kidney Exchange**

- \*Alvin E. Roth, Tayfun Sönmez and M. Utku Ünver (2003) "Kidney Exchange" *Quarterly Journal of Economics*,

- \*Alvin E. Roth, Tayfun Sönmez, and M. Utku Ünver (2005) “Pairwise Kidney Exchange,” *Journal of Economic Theory*.
- Alvin E. Roth, Tayfun Sönmez, and M. Utku Ünver (2005) . A Kidney Exchange Clearinghouse in New England. *American Economic Review Papers and Proceedings*, 95(2): 376-380
- \*Alvin E. Roth, Tayfun Sonmez and Utku Unver (2007), “Efficient Kidney Exchange: Coincidence of Wants in Markets with Compatibility-Based Preferences,” *American Economic Review*, 97(3): 828-851.
- Hatfield, J. W. (2005), “Pairwise Kidney Exchange: Comment,” *Journal of Economic Theory*.
- M. Utku Unver (2010), “Dynamic Kidney Exchange”, *Review of Economic Studies*.

#### **04/11 and 04/13: Efficient Priority-Based Allocations**

- Abdulkadiroğlu, Atila, and Tayfun Sönmez (2003), "School Choice: A Mechanism Design Approach," *American Economic Review*, 93: 729-747.
- \*Haluk Ergin (2002) “Efficient Resource Allocation on the Basis of Priorities,” *Econometrica*, 70, 2489–2498.
- \*Guillaume Haeringer and Flip Klijn Constrained school choice, *Journal of Economic Theory*, 144, 1921-1947 (2009)
- \*Fuhito Kojima "Robust Stability in Matching Markets" forthcoming, *Theoretical Economics*.
- Kesten, Onur, On Two Kinds of Manipulation for School Choice Problems, forthcoming, *Economic Theory*
- Fuhito Kojima, Efficient Resource Allocation under Multi-unit Demand (2011), mimeo
- \*Kesten, Onur, “On Two Competing Mechanisms for Priority Based Allocation Problems,” *Journal of Economic Theory* 127, 2006; 155-171.
- Lars Ehlers and Aytok Erdil, Efficient Assignment Respecting Priorities, forthcoming, *Journal of Economic Theory*.

#### **04/18 and 4/20: Design of Random Assignment Mechanisms:**

- Abdulkadiroglu, A., and T. Sonmez (2003) “Ordinal Efficiency and Dominated Sets of Assignments,” *Journal of Economic Theory*, 112, 157—172.
- Abdulkadiroglu, A., and T. Sonmez (1998): “Random Serial Dictatorship and the Core from Random Endowments in House Allocation Problems,” *Econometrica*, 66, 689-698.
- \*Bogomolnaia, A., and H. Moulin (2001), “A New Solution to the Random Assignment Problem,” *Journal of Economic Theory*, 100, 295-328.
- Eric Budish, Yeon-Koo Che, Fuhito Kojima, and Paul Milgrom (2011), “Designing Random Allocation Mechanisms: Theory and Applications”, mimeo.
- \*Che, Yeon-Koo and Fuhito Kojima, “Asymptotic Equivalence of Random Priority and Probabilistic Serial Mechanisms,” forthcoming, *Econometrica*.
- Hylland and Zeckhauser (1979), “The efficient allocation of Individuals to Positions”, *Journal of Political Economy*.

- Katta, A.-K. and J. Sethuraman, “A solution to the random assignment problem on the full preference domain” (2006), *Journal of Economic Theory*.
- Kesten, O, “Why Do Popular Mechanisms Lack Efficiency in Random Environments?,” forthcoming, *Journal of Economic Theory*.
- \*Fuhito Kojima and Mihai Manea, “Incentives in the Probabilistic Serial Mechanism,” forthcoming, *Journal of Economic Theory*.
- Fuhito Kojima, “Random Assignment of Multiple Indivisible Objects” (2007), forthcoming, *Mathematical Social Sciences*.
- McLennan A., “Ordinal efficiency and the polyhedral separating hyperplane theorem,” *Journal of Economic Theory* 105 (2002), 435-449.
- Yilmaz, O., “House Allocation with Existing Tenants: A New Solution,” mimeo
- Manea, Mihai, “Asymptotic Ordinal Inefficiency of Random Serial Dictatorship,” forthcoming, *Theoretical Economics*.

**04/25: Theoretical Foundations (1): Characterizations of Assignment Mechanisms:**

- L. Ehlers and B. Klaus (2009): "Allocation via Deferred Acceptance," mimeo
- \*Fuhito Kojima and Mihai Manea: "Axioms for Deferred Acceptance," forthcoming, *Econometrica*.
- \*Papai, Szilvia, “Strategy-proof Assignments by Hierarchical Exchange,” *Econometrica* 68, 1403-1433
- Fuhito Kojima and Utku Unver, "The Boston School Choice Mechanism," mimeo.
- Lars-Gunnar Svensson (1999) “Strategyproof Allocation of Indivisible Goods,” *Social Choice and Welfare* 16, 557-567.
- Utku Unver and Marek Pycia, A Theory of House Allocation and Exchange Mechanisms , mimeo

**04/27: Theoretical Foundations (2): Monotone Methods and Matching**

- Donald Topkis, *Supermodularity and complementarity*, Princeton University Press
- P Milgrom, J Roberts, *Rationalizability, learning, and equilibrium in games with strategic complementarities* - *Econometrica*
- P Milgrom, C Shannon, *Monotone comparative statics* - *Econometrica*, 1994
- \*Adachi, Hiroyuki, “On a characterization of stable matchings,” *Economics Letters*, 2000, 68, 43–49.
- Echenique, Federico "A Characterization of Strategic Complementarities" *Games and Economic Behavior*. Volume 46, Issue 2, Pages 325-347 (February 2004). [PDF]
- Echenique, Federico and Jorge Oviedo, “Core Many-to-One Matchings by Fixed Point Methods,” *Journal of Economic Theory*, 2004, 115, 358– 376.
- Echenique, Federico and Jorge Oviedo, “A theory of stability in many-to-many matching,” *Theoretical Economics*, 2006, 1, 233–273.
- \*Hatfield, John William and Paul R.Milgrom, “Matching with Contracts,” *American Economic Review*, 2005, 95, 913–935.
- \*Ostrovsky, Michael, “Stability in Supply Chain Networks,” *American Economic Review*, 2007, forthcoming.

- Michihiro Kandori, Fuhito Kojima, and Yosuke Yasuda, Understanding Stable Matchings: A Noncooperative Approach, mimeo.

### **05/2 – 6/1: Student Presentations**

Below are the suggested papers for presentations. You can present other papers if they are related to matching and market design (in such a case, send me an email).

- Itai Ashlagi, Mark Braverman and Avinatan Hassidim , Matching with Couples Revisited
- Itai Ashlagi and Alvin E. Roth, Individual rationality and participation in large scale, multi-hospital kidney exchange.
- Atila Abdulkadiroglu and Yeon-Koo Che, The Role of Priorities in Assigning Indivisible Objects: A Characterization of Top Trading Cycles
- Bentley MacLeod and Miguel Urquiola, ANTI-LEMONS: SCHOOL REPUTATION AND EDUCATIONAL QUALITY, mimeo
- M. Utku Unver and Onur Kesten, A Theory of School-Choice Lotteries
- Onur Kesten, Morimitsu Kurino, and M. Utku Unver, Fair and Efficient Assignment via The Probabilistic Serial Mechanism
- Daisuke Hirata and Tadashi Hashimoto, "Characterizations of the Probabilistic Serial Mechanism,"
- David Card, Martin Dooley, and Abigail Payne, School Competition and Efficiency with Publicly Funded Catholic Schools, forthcoming, AEJ.
- Christopher Avery and Jonathan Levin, Early Admissions at Selective Colleges, American Economic Review, 100(6), December 2010.
- Parag Pathak and Tayfun Sonmez, School Admissions Reform in Chicago and England: Comparing Mechanisms by their Vulnerability to Manipulation
- Eduardo Azevedo, Imperfect competition in two-sided matching markets, 2010
- Eduardo Azevedo and Jacob Leshno, The college admissions problem with a continuum of students,
- Yan Chen and Onur Kesten. 2011. From Boston to Shanghai to Deferred Acceptance: Theory and Experiments on a Family of School Choice Mechanisms.
- Mustafa Oguz Afacan, Group Robust Stability in Matching Markets
- Ilya Segal, "The Communication Requirements of Social Choice Rules and Supporting Budget Sets," Ilya Segal, Journal of Economic Theory, 136, September 2007, pp. 341-378
- Stephen Chiu and Weiwei Weng, "Endogenous Preferential Treatment in Centralized Admissions", Rand Journal of Economics: 40(2), Summer 2009, 258-282.
- Muriel Niederle, Alvin E. Roth, and M. Utku Unver, "Unraveling Results from Comparable Demand and Supply: An Experimental Investigation", mimeo.
- John William Hatfield, Scott Duke Kominers, Alexandru Nichifor, Michael Ostrovsky, and Alexander Westkamp, "Stability and Competitive Equilibrium in Trading Networks", mimeo.