University of Pittsburgh
Department of Economics
Econ. 2760: Advanced Topics in Microeconomic Theory
Matching Markets, Exchange and Allocation of Discrete Resources: A Course on Market Design

Semester: Spring 2006

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Class Hours and Room: Monday-Wednesday11:45 am - 1:00 pm Room: WWPH 04940

Office Hours: Tuesday 3:00–5:00 pm or by appointment

Course Objectives: This is a PhD level course on advanced microeconomics. The aim of the course is to give PhD students a background in market design literature in conjunction with the theory of matching, exchange and allocation of discrete resources. The course will survey a vast amount of economics literature on matching theory that has started with Gale and Shapley (1962) and Shapley and Scarf (1974). The course will cover two-sided matching model (Gale and Shapley, 1962) (hospital-intern market), two-sided matching with contracts (Kelso and Crawford, 1982), house allocation model (Hylland and Zeckhauser, 1981), housing market (Shapley and Scarf, 1974), fair allocation problems with priorities (Balinski and Sönmez, 1998) (school choice, course bidding), house allocation with existing tenants (Abdulkadiroğlu and Sönmez, 1999) (college dorm allocation, kidney exchange). I will also refer to experimental and computational literature on the subject matter when I talk about the real-life markets.

Course Materials:

1. *Main Textbook:* *Alvin E. Roth and Marilda Sotomayor (1990) Two-Sided Matching: A Study on Game-Theoretic Modelling. Cambridge University Press.

2. Articles and working papers (will be obtained from the reserve at WWPH Economics library)

3. Lecture notes in class

Course Prerequisites: A "basic" understanding of micro theory and game theory

Grading Requirements: Students who take this course for grade should (1) write a critical review of one of the papers that is in the course syllabus or present the paper they reviewed in the lecture format (depending on the availability of time in the semester), and (2) (i) take a final exam or (ii) *make adequate progress on an original paper* related to the subject matter and present the paper in class (depending on the availability of time in the semester). The students who will take the latter option should come and *talk to me as soon as possible.*

Tentative Course Outline and Tentative Reading List

1. Market Design vs Mechanism Design, Economics Engineering

   Alvin E. Roth (2002) The Economist as Engineer: Game Theory, Experimentation, and Computation as Tools for Design Economics. *Econometrica* 70, 1341-1378.

2. Two-sided matching model and stable matching theory (Hospital-intern market, entry-level labor markets for young professionals, school choice)

   *Alvin E. Roth and Marilda Sotomayor (1990) Two-Sided Matching: A Study in Game-Theoretic Modeling and Analysis, Econometric Society Monograph Series, Cambridge University Press. Chapters 1-6 [NOT ON RESERVE, needs to be bought]

   (a) *One-to-one model and many-to-one model*

   David Gale and Lloyd Shapley (1962), "College Admissions and the Stability of Marriage," *American Mathematical Monthly*, 69, 9-15.

   (b) *Matching with more complicated preferences and auctions*

   i. Alexander S. Kelso,Jr. and Vincent P. Crawford (1982), "Job Matching, Coalition Formation, and Gross Substitutes", *Econometrica*, 50, pp 1483-1504.

   ii. *Donald M. Topkis (1998) Supermodularity and Complementarity. Princeton University Press. Chapter 2: Lattices, Supermodular Functions and Related Topics, Pages 7-92.

   iii. John William Hatfield and Paul Milgrom, (2005) "Matching with Contracts" *American Economic Review* 95 (4), September.

   (c) *Towards a larger class of algorithms and design of the NRMP algorithm*

   i. Alvin E. Roth, and John H. Vande Vate (1990) "Random Paths to Stability in Two-Sided Matching", *Econometrica*, 58 No. 6, pp. 1475-1480, 1990.

   ii. Couples (from *Roth and Sotomayor, Chapter 5)

   iii. 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

   (d) *How outcomes depend on market rules and organization, unraveling (Entry-level labor markets for professional specialty professions, college football bowl selections)*

   i. Alvin E. Roth and Xiaolin Xing (1994) "Jumping the Gun: Imperfections and Institutions Related to the Timing of Market Transactions," *American Economic Review*, 84, September, 992-1044.

   ii. John Kagel and Alvin E. Roth (2000) "The Dynamics of Reorganization in Matching. Markets: A Laboratory Experiment Motivated by a Natural Experiment." *Quarterly Journal of Economics*

iii. C. Nicholas McKinney, Muriel Niederle, and Alvin E. Roth (2005) "The collapse of a medical labor clearinghouse (and why such failures are rare)" *American Economic Review* 95(3), June.

iv. Ernan Haruvy, Alvin E. Roth and M. Utku Ünver (2006) "The Dynamics of Law Clerk Matching: An Experimental and Computational Investigation of Proposals for Reform of the Market" *Journal of Economic Dynamics and Control*, (2006), 30: 457-486

v. Muriel Niederle, Alvin E. Roth and M. Utku Ünver (2005) "Unraveling is Caused by Comparable Supply and Demand" working paper

vi. Muriel Niederle and Alvin E. Roth (2003) "Unraveling reduces mobility in a labor market: Gastroenterology with and without a centralized match" *Journal of Political Economy*, 111: 1342 – 1352.

vii. Guillaume Fréchette, Alvin E. Roth, and M. Utku Ünver (2003) "Unraveling Yields Inefficient Matchings: Evidence from Post-Season College Football Bowls" working paper (see www.pitt.edu/~uunver to download this working paper)

3. "Housing market" and "House allocation problem" (Dormitory room allocation, school choice, and kidney exchange)

   (a) *Housing market (School choice)*

      i. Lloyd Shapley and Herbert Scarf (1974) "On cores and indivisibility." *Journal of Mathematical Economics* 1, 23-28.

      ii. *Herve Moulin (1995) Cooperative Microeconomics: A Game-Theoretic Introduction. Princeton University Press, Chapter 3

      iii. Alvin E. Roth and Andrew Postlewaite (1977) "Weak versus strong domination in a market with indivisible goods." *Journal of Mathematical Economics* 4, 131-137.

      iv. Alvin E. Roth (1982) "Incentive compatibility in a market with indivisibilities." *Economics Letters* 9, 127-132.

      v. Atila Abdulkadiroğlu and Tayfun Sönmez (2003) "School Choice: A Mechanism Design Approach." *American Economic Review*, 93, 729-747.

   (b) *House allocation problem*

      i. Annund Hylland and Richard Zeckhauser (1977) "The efficient allocation of individuals to positions." *Journal of Political Economy* 87, 293-314.

      ii. Lars-Gunnar Svensson (1994) "Queue allocation of indivisible goods." *Social Choice and Welfare* 11, 323-330.

      iii. Lars-Gunnar Svensson (1999) "Strategyproof Allocation of Indivisible Goods" *Social Choice and Welfare* 16, 557-567.

   (c) *When house allocation meets housing markets (Dormitory room allocation, kidney exchange)*

i. Atila Abdulkadiroğlu and Tayfun Sönmez (1999) "House Allocation with Existing Tenants." *Journal of Economic Theory*, 88, 233-260.

ii. Alvin E. Roth, Tayfun Sönmez and M. Utku Ünver (2003) "Kidney Exchange" *Quarterly Journal of Economics,* 119, 457-488

(d) *When two-sided matching meets one-sided matching (Kidney exchange revisited)*

i. Anna Bogomolnaia and Herve Moulin (2004) "Random matching under dichotomous preferences." *Econometrica* 72: 257-279.

ii. Alvin E. Roth, Tayfun Sönmez, and M. Utku Ünver (2005) "Pairwise Kidney Exchange" *Journal of Economic Theory*

iii. 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

(e) *Random allocation, efficiency vs incentives*

i. Atila Abdulkadiroğlu and Tayfun Sönmez (1998) "Random serial dictatorship and the core from random endowments in house allocation problems." *Econometrica* 66, 689-701.

ii. Anna Bogomolnaia and Herve Moulin (2001) "A new solution to the random assignment problem." *Journal of Economic Theory* 100, 295-328.

iii. Tayfun Sönmez and M. Utku Ünver (2005) "House Allocation with Existing Tenants: An Equivalence" *Games and Economic Behavior* 52, 153-185

(f) *Discrete resource allocation based on priorities and two-sided matching theory: (School choice revisited, school admissions and course allocation)*

i. Michel Balinski and Tayfun Sönmez (1999) "A Tale of Two Mechanisms: Student Placement" *Journal of Economic Theory* 84: 73-94, January 1999.

ii. Atila Abdulkadiroğlu and Tayfun Sönmez (2003), "School Choice: A Mechanism Design Approach." *American Economic Review*, 93: 729-747. [REPEAT FROM ABOVE]

iii. Szilvia Papai, "Strategyproof Assignment by Hierarchical Exchange" (2000), *Econometrica* , 68: 1403-1433.

iv. Haluk Ergin, "Efficient Resource Allocation on the Basis of Priorities" (2002) *Econometrica*, 70: 2489-2497.

v. Atila Abdulkadiroğlu, Parak A. Pathak and Alvin E. Roth (2005) "The New York City High School Match." *American Economic Review, Papers and Proceedings* 95(2), May.

vi. Atila Abdulkadiroğlu, Parak A. Pathak, Alvin E. Roth and Tayfun Sönmez (2005) "The Boston Public School Match." *American Economic Review, Papers and Proceedings* 95(2), May.

vii. Yan Chen and Tayfun Sönmez (2004) "School Choice: An Experimental Study." *Journal of Economic Theory*, forthcoming (available on JET web site and www2.bc.edu/~sonmezt)

viii. Yan Chen and Tayfun Sönmez (2002) "Improving Efficiency of On-Campus Housing: An Experimental Study." *American Economic Review*, 92, 1669-1686.

ix. Tayfun Sönmez and M. Utku Ünver (2003) "Course Bidding at Business Schools" working paper (available at www.pitt.edu/~uunver)

x. Aradhna Krishna and M. Utku Ünver (2004) "An Experiment on Course Bidding at Business Schools" working paper (available at www.pitt.edu/~uunver)