

# ECON 8819-01: Mechanism Design

Spring 2017

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**Office Hours:** By Appointment

**Course Objectives:** This course covers introductory and advanced materials on the theory of mechanism design. The aim of the course is to build a solid background for economics PhD students in mechanism design as well as introduce selected material on the frontiers. Even though it is targeted to graduate students who would like to do theoretical work, other students may benefit as well.

**Teaching Method:** Lectures and Presentations. The lectures will cover the theoretical material, supplemented with examples. Participation is very much encouraged. Problem solving is essential for improving one's understanding of mechanism design. Regular homework exercises will be assigned. Students will be required to present papers from the reading list.

## Course Materials:

1. Course notes and slides at Canvas
2. *An Introduction to the Theory of Mechanism Design*, Tilman Börgers (Recommended)
3. *Mechanism Design, A Linear Programming Approach* Rakesh V. Vohra
4. *Auction Theory* Vijay Krishna
5. *Putting Auction Theory to Work* Paul Milgrom
6. *Mechanism Theory*, Matthew O. Jackson<sup>1</sup>

### Other Recommended Materials:

7. *Nonlinear Pricing*, Robert B. Wilson

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<sup>1</sup>An abridged version of this appears in *Optimization and Operations Research*, edited by Ulrich Derigs, in the *Encyclopedia of Life Support Systems*, EOLSS Publishers: Oxford UK,[<http://www.eolss.net>], 2003.

**Grades and Requirements:** Students are expected to come to each class, read the assigned material, and solve the homework questions as scheduled. Class participation through questions to the instructor and answers to the questions of the instructor are expected. There will be non-graded homework assignment sets and a final exam at the end of the semester. In addition, you will present some recent work from the reading list. The final will make up 60% and the presentations will count 40% toward your grade. However, solving homework assignments before they are due and turning in “your own” solutions to us is a requisite of this course. That is to say, if the professors deem that not turning in solved assignments became habitual, then they have the right to discount the student’s final course grade on their discretion.

### **Tentative Course Outline:**

#### **First Part:**

- Screening (Manelli and Vincent, 2007; Mussa and Rosen, 1978)
- Bayesian Mechanism Design Examples
  - Optimal Auction Design (Myerson, 1981)
  - The Simple Economics of Optimal Auctions (Bulow and Roberts, 1989)
  - Efficient Mechanisms for Bilateral Trading (Myerson and Satterthwaite, 1983)
  - Dissolving a Partnership Efficiently (Cramton, Gibbons, and Klemperer, 1987)
  - Public Goods (d’Aspremont and Gérard-Varet, 1979)
- Implementable Allocation Rules (Rochet, 1987; Saks and Yu, 2005)
- Incentive Compatibility and Revenue Equivalence (Krishna and Maenner, 2001; Milgrom and Segal, 2002)
- Bayesian Mechanism Design: A General Approach
  - Efficient Bayesian Incentive Compatible Mechanisms (Williams, 1999; Krishna and Perry, 1998)
  - Interdependent Values (Jehiel and Moldovanu, 2001)
  - Correlated Types (Crémer and McLean, 1988)

#### **Second Part:** Dominant Strategy Design and Topics

- Strategy-proof Mechanism Design, Non-transferable Utility (NTU) (Chapter 8, Borgers)
  - Gibbard-Satterthwaite
  - Single-Peaked Social Choice Domain (Moulin)
  - Monotonicity

- NTU Continued: House Allocation and Exchange (Sonmez & Unver 2011, notes)
  - House allocation (Svensson),
  - House exchange (Ma)
  - Trading Cycles (Pycia and Unver)
- NTU Mechanisms at the Large
  - House allocation at the Large (Manea and Kojima, Che and Kojima, Liu and Pycia, Pycia)
  - Two-sided matching at the Large (Immorlica and Maahdian, Kojima and Pathak, Azevedo and Leshno)
  - Strategy-proofness at the Large (Azevedo and Budish)
- Strategy-proof Mechanism Design, Transferable Utility (TU) (Chapter 4, 7 Borgers)
- Robust Mechanism Design (Borgers and other text)

### Reading List:

#### First Part:

- “On the equivalence of Bayesian and dominant strategy implementation”— Gershkov, Goeree, Kushnir, Moldovanu, and Shi (Econometrica, 2013)
- “A geometric approach to mechanism design”— Goeree and Kushnir (Working Paper)
- “Torture and the Commitment Problem”— Baliga and Ely (Restud, Forthcoming)
- “Robustly Coalition-Proof Incentive Mechanisms for Public Good Provision are Voting Mechanisms and Vice Versa”— Bierbrauer and Hellwig (Forthcoming, Restud)
- “Genericity and Robustness of Full Surplus Extraction” — Chen and Xiong (Econometrica, 2013)
- “On the generic (im)possibility of full surplus extraction” — Heifetz and Neeman (Econometrica, 2006)
- “Dominant strategy implementation of Bayesian incentive compatible allocation rules” — Mookherjee and Reichelstein (Journal of Economic Theory, 1992)
- “Robustly Collusion-Proof Implementation” — Che and Kim (Econometrica, 2006)
- “Optimal Design of Research Contests” — Che and Gale (AER, 2003)
- “Generalized Reduced-Form Auctions: A Network-Flow Approach” — Che, Kim, and Mierendorff (ECMA, 2013)

- “Robustness and Linear Contracts” — Carroll (AER, 2015)
- “Robustness and Separation in Multidimensional Screening” — Carroll (ECMA, Forthcoming)
- “Robustly Optimal Auctions with Unknown Resale Opportunities” — Carroll and Segal (Working Paper)
- “Existence of Optimal Mechanisms in Principal-Agent Problems” — Ohad, Reny, and Swinkels (ECMA, Forthcoming)
- “A Theory of Crowdfunding - A Mechanism Design Approach with Demand Uncertainty and Moral Hazard” — Strausz (AER, Forthcoming)
- “The Design of Ambiguous Mechanisms” — Tillio, Kos, and Messner (Restud, Forthcoming)
- “Optimal Voting Rules” — Gershkov, Moldovanu, and Shi (Restud, Forthcoming)
- “Incentive Compatibility of Large Centralized Matching” — Lee (Restud, Forthcoming)
- “Incentive Compatible Market Design with Applications” — Yenmez (International Journal of Game Theory, 2015)
- “Incentive Compatible Matching Mechanisms: Consistency with Various Stability Notions” — Yenmez (American Economic Journal: Microeconomics, 2013)

Second Part:

- Herve Moulin “On strategy-proofness and single peakedness” *Public Choice* January 1980, Volume 35, Issue 4, pp 437-455
- Yves Sprumont “The Division Problem with Single-Peaked Preferences: A Characterization of the Uniform Allocation Rule” *Econometrica* Vol. 59, No. 2 (Mar., 1991), pp. 509-519
- Tayfun Sonmez and M. Utku Unver (2011), “Matching, Allocation, and Exchange of Discrete Resources,” J. Benhabib, A. Bisin, and M. Jackson (eds.) *Handbook of Social Economics*, Elsevier, 2011.
- Jin Peng Ma “Strategy-proofness and the strict core in a market with indivisibilities,” *International Journal of Game Theory*, March 1994, Volume 23, Issue 1, pp 75-83
- Lars-Gunnar Svensson “Strategy-proof allocation of indivisible goods” *Social Choice and Welfare* September 1999, Volume 16, Issue 4, pp 557-567

- Tayfun Sonmez and M. Utku Unver “House allocation with existing tenants: A characterization,” *Games and Economic Behavior*, Volume 69, Issue 2, July 2010, Pages 425-445
- Szilvia Papai “Strategyproof Assignment by Hierarchical Exchange,” *Econometrica* November 2000 Volume 68, Issue 6 Pages 1403-1433
- Marek Pycia and M. Utku Unver “Incentive compatible allocation and exchange of discrete resources,” *Theoretical Economics* 12 (2017), 287-329
- Anna Bogomolnaia and Herve Moulin “A New Solution to the Random Assignment Problem,” *Journal of Economic Theory* 100, 295-328 (2001)
- Samson Alva and Vikram Manjunath “Strategy-proof Pareto-improvement,” 2017 Working paper
- Nicole Immorlica and Mohammad Mahdian “Marriage, honesty, and stability,” Conference Proceedings of the Sixteenth Annual ACM-SIAM Symposium on Discrete Algorithms, 2005, Pages 53-62
- Yeonkoo Che and Fuhito Kojima “Asymptotic Equivalence of Probabilistic Serial and Random Priority Mechanisms,” *Econometrica* Vol. 78, No. 5 (September, 2010), 1625-1672
- Qingmin Liu and Marek Pycia “Ordinal Efficiency, Fairness, and Incentives in Large Markets,” 2016, Working paper
- Eduardo Azevedo and Jacob Leshno “A Supply and Demand Framework for Two-Sided Matching Markets,” *Journal of Political Economy*, 2016, vol. 124, no. 5
- Eduardo Azevedo and Eric Budish “Strategy-proofness in the Large” 2015 Working paper

**Statement on Academic Integrity from the College of Arts and Sciences:** The College [of Arts and Sciences] expects all students to adhere to the accepted norms of intellectual honesty in their academic work. Any forms of cheating, plagiarism, or dishonesty or collusion in another's dishonesty is a fundamental violation of these norms.

CHEATING is the use or attempted use of unauthorized aids in any exam or other academic exercise submitted for evaluation. This includes data falsification; the fabrication of data; deceitful alteration of collected data included in a report; copying from another student's work; unauthorized cooperation in doing assignments or during an examination; the use of purchased essays, term papers, or preparatory research for such papers; submission of the same written work in more than one course without prior written approval from the instructor(s) involved; and dishonesty in requests for either extensions or papers or make-up examinations.

PLAGIARISM is the deliberate act of taking the words, ideas, data, illustrative material, or statements of someone else, without full and proper acknowledgment, and presenting them as one's own.

COLLUSION is assisting or attempting to assist another student in an act of academic dishonesty.

As part of your scholarly development, you must learn how to work cooperatively in a community of scholars and fruitfully utilize the work of others without violating the norms of intellectual honesty. You have a responsibility to learn the parameters of collaboration and the proper forms for quoting, summarizing and paraphrasing.

Faculty members who detect any form of academic dishonesty have the responsibility to take appropriate action. The faculty member also has the responsibility to report the incident and penalty to the Department Chairperson and the appropriate Class Dean. The report will remain in your student file until you graduate.

If the gravity of the offense seems to warrant it or if the faculty member prefers that another academic authority decide the matter, he or she may refer the case to a Dean. In addition, if the student is unwilling to accept the faculty member's decision, he or she may choose to have the matter adjudicated either by an Associate Dean or by an Administrative Board. The section of the College of Arts and Sciences in the Boston College Undergraduate Catalogue has further details about this process. Academic integrity is a very important matter. If you have any questions in any of your courses about what is allowed or not allowed, please discuss the matter immediately with the instructor.

### **Disability Statement:**

If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and the Office of Disability Resources and Services through Suzy Conway, Ph.D., LICSW, Assistant Dean for Students with Disabilities, Office of the Dean for Student Development, Boston College, 21 Campanella Way, Suite 212, Phone: 617-552-3470, TTY: 617-552-2548, Fax: 617-552-3473, Email: [suzy.conway@bc.edu](mailto:suzy.conway@bc.edu). Also see <http://www.bc.edu/offices/odsd/disabilityservices.html>.