Professor Colin Stewart   Office Hours: Mondays 3–4pm
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ECO426H1F: Market Design
Fall 2023

Classes: 2:10–5:00pm Thursdays in KP113

The third hour of class will be used for tutorials on Sept. 14, Sept. 28, Oct. 12, and Oct. 26. In other weeks, lectures may run later than 5:00pm.

Topics: The first four lectures will be devoted to the theory and practice of centralized matching markets without money. We will begin with assignment problems in which a collection of indivisible and distinct goods (such as dorm rooms or kidneys for transplant) are to be allocated to a group of individuals. We will then move on to two-sided matching problems including matching students to schools and medical residents to hospitals.

The next three lectures will examine the allocation of goods using auctions. We will begin with the basic theory of auctions of a single object, exploring theoretical models of bidding in various auction formats and questions of how to design auctions to maximize revenue or efficiency. We will then move on to auctions of multiple objects, with an emphasis on keyword search auctions and/or radio spectrum auctions, exploring how these auctions operate in practice and how insights from the basic theory inform their design.

The final two lectures will cover additional topics, possibly including the design of voting rules, prediction markets, or additional material on auctions.

Assessment:
Term Test 1 (Matching), October 5 - 35%
Term Test 2 (Auctions), November 2 - 25%
Quiz (Additional Topics), November 30 - 10%
Final Paper, due December 15 - 30%

Term tests. The two tests will take place from 2:10–4pm in **EX 310**. The quiz will take place during class time in the usual classroom. Tests will focus primarily on problem-solving, but there may also be some verbal short-answer questions.

Students who miss a test or quiz due to a medical issue must notify me by email before the exam begins. You must provide documentation in support of your specific medical circumstances. This documentation can consist of an Absence Declaration (via ACORN) or the University's Verification of Student Illness or Injury (VOI) form. If you are declaring an absence on ACORN, please be sure to include my email address (colin.stewart@utoronto.ca) so that the system will notify me. The VOI form indicates the impact and severity of the illness, while protecting your privacy about the details of the nature of the illness. You can submit a different form (like a letter from a doctor), as long as it is an original document, and it contains the same information as the VOI. For more information on the VOI, please see http://www.illnessverification.utoronto.ca. For information on Absence Declaration Tool for A&S students, please see https://www.artsci.utoronto.ca/absence. If you get a concussion, break your hand, or suffer some other acute injury, you should register with Accessibility Services as soon as possible.

I will normally schedule a make-up test for students who could not take the original test. Participating students will be notified of the date and time of the exam by email, possibly as late as the night before the make-up will take place. Any student who misses the make-up exam will get zero; there will

be no make-up make-up. Note that providing false or misleading information in support of a request for a make-up is a serious academic offense.

Final paper. For the final paper, you will choose a centralized market (broadly defined) to analyze. I will provide some suggestions of specific markets to study but you are also free to choose a different market subject to my approval.

After briefly describing the current market design, your paper should address its strengths and weaknesses. Can the design be improved? If so, how? Your paper will be evaluated on the clarity and depth of reasoning you provide. The ideal paper will combine insights from theory we discuss in class with careful consideration of practical issues. Papers should be 1500–2000 words long.

You may write the paper either individually or together with one other student. If you choose to work as a pair, you must let me know by email at least one month before the paper is due (i.e., by November 15th). Pairs should submit a single essay with both names on it.

Papers are due at midnight at the end of the day on December 15th. Late papers will be penalized at a rate of 10 percentage points each day (incurred at midnight). This penalty will not be waived, nor will individual extensions be granted, even with a medical note. We will use the University's plagiarism detection tool. Please note the following (taken from the official University policy):

> Normally, students will be required to submit their course essays to the University's plagiarism detection tool for a review of textual similarity and detection of possible plagiarism. In doing so, students will allow their essays to be included as source documents in the tool's reference database, where they will be used solely for the purpose of detecting plagiarism. The terms that apply to the University's use of this tool are described on the Centre for Teaching Support & Innovation web site (https://uoft.me/pdt-faq).

Students who choose to opt out of this service must inform me by the end of September, and are to submit pdf versions of their papers by email to colin.stewart@utoronto.ca.

ACADEMIC INTEGRITY: Suspected cases of academic dishonesty will be taken very seriously. Please familiarize yourself with the Code of Behaviour on Academic Matters. Additional information is available at http://www.artsci.utoronto.ca/osai and http://life.utoronto.ca/get-smarter/academic-honesty/. Note that being unaware of rules or policies is not a valid defense in cases of academic dishonesty.

TA: The TA for this course is En Hua Hu. He will hold office hours at times and locations to be announced later. His email address is enhua.hu@mail.utoronto.ca.

EMAIL: Email should be used only for logistical questions about the course. Questions about course content should be asked in person, either at office hours or after class. If you do not receive a response to an email within two business days, please resend it.

QUERCUS: Course materials and announcements will be posted on Quercus. You are responsible for checking Quercus regularly.

IMPORTANT DATES:
Oct 5: Term Test 1 (in EX 310)
Nov 2: Term Test 2 (in EX 310)
Nov 9: Reading Week, no class or office hours
Nov 30: Quiz (in class)
Dec 15: Final paper due

RECOMMENDED READING:

Market Design, by Guillaume Haeringer, MIT Press.

Matching markets

Two-Sided Matching: A Study in Game-Theoretic Modeling and Analysis, by A.E. Roth and M.A.O. Sotomayor, Cambridge University Press.

Who Gets What—and Why: The New Economics of Matchmaking and Market Design, by A.E. Roth, Houghton Mifflin Harcourt.

"What have we learned from market design," by A.E. Roth, *The Economic Journal* 118, 2008, pp. 285–310. Available at `http://www.jstor.org/stable/20108798`

School choice

"The Boston public school match," by A. Abdulkadiroglu, P.A. Pathak, A.E. Roth, and T. Sönmez, *American Economic Review* 95(2), pp. 368–371. Available at `http://economics.mit.edu/files/3021`

"The New York City high school match," by A. Abdulkadiroglu, P.A. Pathak, and A.E. Roth, *American Economic Review* 95(2), pp. 364–367. Available at `http://economics.mit.edu/files/3024`

"What really matters in designing school choice mechanisms," by P.A. Pathak, in *Advances in Economics and Econometrics, 11th World Congress of the Econometric Society*. Available at `https://economics.mit.edu/files/12799`

Kidney exchange

Section 2 of "Matching, allocation, and exchange of discrete resources," by T. Sönmez and M.U. Ünver, in *Handbook of Social Economics* Vol. 1A, 2011. Available at `https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1311517`

"Kidney exchange and the Alliance for Paired Donation: Operations research changes the way kidneys are transplanted," by R. Anderson et al., *Interfaces* 45(1), pp. 26–42. Available at `http://pubsonline.informs.org/doi/pdf/10.1287/inte.2014.0766`

Auction theory

Chapter 9 of *Networks, Crowds, and Markets: Reasoning about a Highly Connected World*, by D. Easley and J. Kleinberg, Cambridge University Press, 2010. Available at `http://www.cs.cornell.edu/home/kleinber/networks-book/networks-book-ch09.pdf`

Auction Theory, by V. Krishna, Academic Press, 2010. Available online through the U of T library.

Spectrum auctions

"The biggest auction ever: The sale of the British 3G telecom licences," by K. Binmore and P. Klemperer, *The Economic Journal* 112, 2002, pp. C74–C96. Available at `http://www.jstor.org/stable/798361`

"Selling spectrum rights," by J. McMillan, *Journal of Economic Perspectives* 8(3), 1994, pp. 145–162. Available at `http://www.jstor.org/stable/2138224`

Keyword search auctions

"Internet advertising and the generalized second-price auction: Selling billions of dollars worth of keywords," by B. Edelman, M. Ostrovsky, and M. Schwarz, *American Economic Review* 97(1), 2007, pp. 242–259. Available at `http://www.jstor.org/stable/30034393`

"Strategic bidder behavior in sponsored search auctions," by B. Edelman and M. Ostrovsky, *Decision Support Systems* 43, 2007, pp. 192–198. Available at `http://web.stanford.edu/~ost/papers/cycling.pdf`