

# 15.098: Online Auctions - Theory and Applications

Special Seminar in Applied Probability  
Tuesdays: 11:30-1:30pm, ORC Morse Reading Room

Spring 2002

## 1 Description

Auctions have been a phenomenon of fundamental economic importance for a very long time, but with the surge of Internet and E-Commerce technologies they have recently gained unprecedented popularity and reach. From eBay to FreeMarkets, Yahoo, Amazon, Sotheby's and the Federal Communications Commission, auctions are used to sell or buy almost anything today, including collectibles, antiques, complex industrial contracts, energy, consumer products, treasury bonds, cars, insurance policies, multi-billion dollar airwaves license rights, and others.

From an academic standpoint, auction theory has undoubtedly emerged over the last couple of years as one of the most active field of applied research; The study of auctions is an exciting and truly multi-disciplinary endeavor, involving most notably Game Theory, Computer Science, Optimization and Applied Probability. Understandably, it has attracted many present and past researchers, so that the existing literature on auctions is to date extremely varied and voluminous, comprising literally thousands of papers ranging from rigorous, high-quality (sometimes even beautiful!) work to lame and un-insightful discussions.

The purpose of this seminar is to introduce doctoral students to this literature through in-depth presentations of what we feel are the best and

most important papers in the field. Organized by faculty members currently conducting research in this area, it should be a valuable opportunity to both learn about the classical results of auction theory and find out about the current research directions and (many) research opportunities. We will maintain in this seminar an informal setting, with the goal of stimulating an active learning environment through open discussions. Participating students will be responsible for presenting papers in a conference-quality format, so it will also be an opportunity for them to get some detailed feedback on and improve their presentation skills. Moreover, there will be a student facilitator (who will not be the student presenting). The facilitator will work with the person presenting beforehand to help and ensure that the presentation is clear, accessible and self-contained. He or she will also interrupt the presentation to initiate class discussion, repeat and emphasize important insights and to summarize as appropriate.

## 2 List of Topics and Papers

*Note:* Most of the following papers are available to students taking the course from SloanSpace at <http://sloanspace.mit.edu>, in the class locker for 15.098-Special Seminar in Applied Probability (go to "File Storage"). In addition, special announcements will be posted on the bulletin board of the sloanspace locker at the same location.

### **Organizational Session, Optimal Bidding in Online Auctions - February 5**

- We will discuss logistical issues, in particular the assignment of papers to Students
- Also there will be a detailed presentation of:  
Bertsimas, D., J. Hawkins and G. Perakis, "Optimal Bidding in Online Auctions," MIT Operations Research Center, December 2001. [sloanspace]

### **Session 1 - February 12**

#### **Classical Auction Theory I: History and Classical Results**

- Present the insights from:  
Vickrey, W., "Counterspeculation, Auctions, and Competitive Sealed Tenders," *Journal of Finance*, 16 (1961), 8-37. [sloanspace]
- Detailed presentation of (skip Chapter 4):  
Wolfstetter, Elmer, "Auctions: An Introduction," *Journal of Economic Surveys*, 10/4, (1995): 367-420. [sloanspace]

## **Session 2 - February 26**

### **Classical Auction Theory II: Mechanism Design**

- Detailed presentation of (you may also use some material from Chapter 4 in the Wolfstetter survey):  
Myerson, Roger B., "Optimal Auction Design," *Mathematics of Operations Research*, 6 (1981), 58-73. [paper copy]
- Present additional insights from:  
Harris, M. and A. Raviv, "A Theory of Monopoly Pricing Schemes with Demand Uncertainty," *The American Economic Review*, Vol. 71, No. 3. (Jun., 1981), pp. 347-365. [sloanspace]

## **Session 3 - March 5**

### **Combinatorial Auctions I (Underlying Optimization Theory)**

- Detailed presentation of:  
de Vries, S. and R. Vohra, "Combinatorial Auctions: A Survey," Northwestern University, Center for Mathematical Studies in Economics and Management Science, August 2000. [sloanspace]
- Present the insights from:  
Rothkopf, M. H., A. Pekec and R. M. Harstad, "Computationally Manageable Combinational Auctions," *Management Science*, 44 (1998), 1131-1147. [sloanspace]

#### **Session 4 - March 12**

##### **Combinatorial Auctions II (Iterative Mechanisms)**

- Detailed presentation of:

Milgrom, P. and L. Ausubel, "Ascending Auctions with Package Bidding," University of Maryland and Stanford University, June 2001. [sloanspace]

- Compare with and present additional insights from:

Parkes, D. C. and L. H. Ungar, "Iterative Combinatorial Auctions: Theory and Practice," Proc. 17th National Conference on Artificial Intelligence (AAAI-00), 74-81, 2000. [sloanspace]

#### **Session 5 - March 19**

##### **Combinatorial Auctions III (Practical Implementations)**

- Detailed presentation of:

Milgrom, P., "Putting Auction Theory to Work: The Simultaneous Ascending Auction," *Journal of Political Economy*, 108 (2000), 245-272. [sloanspace]

#### **Session 6 - April 2**

##### **Assignment and Scheduling Auctions**

- Detailed presentation of:

Wellman, M. P., W. E. Walsh, P. R. Wurman and J. K. MacKie-Mason, "Auction Protocols for Decentralized Scheduling," EECS Dept., University of Michigan, Ann Arbor, MI, June 1999. Forthcoming in *Games and Economic Behavior*. [sloanspace]

- Present insights from:

Demange, G., D. Gale and M. Sotomayor, "Multi-Item Auctions," *Journal of Political Economy*, 94 (1986), 863-872. [sloanspace]

Bertsekas, D. P., "The Auction Algorithm for Assignment and Other Network Flow Problems: A Tutorial," *Interfaces*, 20-4 (1990), 133-149. [sloanspace]

**Session 7 - April 9**  
**Revenue Management Auctions**

- Detailed presentation of:  
Vulcano, G., G. van Ryzin and C. Maglaras, "Optimal Dynamic Auctions for Revenue Management," Graduate School of Business, Columbia University, October 2001. [sloanspace]

**Session 8 - April 23**  
**Procurement Auctions I (Capacity Constraints)**

- Detailed presentation of:  
Gallien, J. and L. Wein, "A Smart Market for Industrial Procurement with Capacity Constraints," submitted to *Management Science*, November 2001. [sloanspace]
- Present the insights from:  
W. J. Elmaghraby, "The Importance of Ordering in Sequential Auctions", Georgia Institute of Technology, January 2001. [paper copy]

**Session 9 - April 30**  
**Procurement Auctions II (Multi-Parameter Bidding)**

- Detailed presentation of:  
Wein, L. M. and D. R. Beil, "An Inverse Optimization-Based Auction Mechanism to Support a Multi-Attribute RFQ Process," MIT Operations Research Center, October 2001. [sloanspace]
- Present the insights from:  
Schummer, J. and R. Vohra, "Auctions for Procuring Options," Northwestern University MEDS, March 2001.

**Session 10 - May 7**  
**Online Auctions I (Bidding Processes)**

- Detailed presentation of:

Roth, A. E. and A. Ockenfels, "Last Minute Bidding and the Rules for Ending Second-Price Auctions: Theory and Evidence from a Natural Experiment on the Internet," Harvard University, Economics Dept., June 2000. [sloanspace]

- Present the insights from:

Vakrat, Y. and A. Seidmann, "Implications of the Bidders' Arrival Process on the Design of Online Auctions," *33rd Hawaii International Conference on System Sciences* (2000). [sloanspace]

**Session 11 - May 14**  
**Online Auctions II**

- To be announced