III: Emerging Intermediaries
Chapter 10: Auctions, Bidding and Exchanges Design

Jayant Kalagnanam
IBM T.J. Watson Research Center
Yorktown Hts, NY 10598
jayant@us.ibm.com

David Parkes
Engineering & Applied Science
Harvard University
parkes@eecs.harvard.edu

1. Introduction
   - Auction as a (price) negotiation mechanism,
   - Basic types, (English, Dutch, open-cry, sealed-bid, single-sided vs double auctions)
   - Advanced auctions required for negotiation at Business-to-Business level (Combinatorial, Volume Discount auctions, Multi-attribute auction, Exchanges and Double Auctions)

2. Basic Ideas
   - Fundamental results from auction/game theory, linear programming
     - Private vs Common values, Revenue equivalence
     - Allocative efficiency, revenue maximization
     - Pareto optimality
     - Bayesian /Nash equilibrium and its analysis, dominant strategies
     - Price equilibria and Duality
   - Mechanism Design
     - Direct Revelation Principle and Impossibility results
     - Incentive compatibility and/or strategy proofness,
     - Vickrey pricing
     - Models of agent rationality
     - Budget balance
     - Linear Programming and its importance for mechanism design

3. Characterization and Computational Considerations for Auction Design
   - Open-cry (iterative) vs Sealed-bid (one-shot)
   - Bidding Rules, Bid types (bundled all-or-nothing, volume discount curves, multi-attribute bids etc)
   - Compact Bid Representation (Bidding languages, XOR, OR, XAND etc)
   - Winner Determination (computational complexity of different auction types)
   - Bid Formulation/Reformulation (myopic best response, strategic bidder etc)
   - Price Signalling

4. Design and Analysis of Some Interesting Auction Mechanisms
   - Simple auctions (English, Dutch etc)
   - Combinatorial auctions (example of more difficult cases)
   - Multi-unit homogeneous auctions (Ausubel, Gale, Demange, Sotomeyer etc, Vohra et al)
   - Multi-unit heterogeneous auctions with additive utility functions (Volume discount)
   - Heterogenous auction with sub/super additive utility functions – combinatorial (Parkes & Unger, Bikchandani et al)
   - Procurement Reverse Auctions
     - Capacity constrained allocation mechanisms (Gallien & Wein)
     - Business rules as side constraints for combinatorial and volume discount auctions (Davenport & Kalagnanam)
   - Multi-attribute auctions (Che, Branco, Wein & Beil)
   - Double Auctions/Exchanges
     - Call markets (continuous vs periodic clearing)
- McAfee, k-DA, Nisan, Sandholm, Davenport & Kalagnanam
- Combinatorial exchanges
- Parkes et al, Kalagnanam et al.

5. Simulation and Experimental Economics
   - simulation as a tool for mechanism design and equilibrium analysis
     - Kephart, Greenwald,
   - experimental economics and its use for mechanism design (tentative)
     - Ledyard, Plott, Gjerstad