Auctions for Financial E-Commerce

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Possibilities for E-Commerce

- Improve supply chain
- Eliminate middlemen
- Introduce dynamic pricing
- Increase revenues
- Encourage efficiency
- Reduce transaction costs
Traditional Sealed-Bid Auctions

• Sealed-bid: bidders submit demand schedules
  – Pay-your-bid auction (traditional Treasury practice)
  – Uniform-price auction (Milton Friedman, 1959; now used for all Treasury auctions)
Traditional Sealed-Bid Auctions

- Procedure:
  - Bidders simultaneous and independently submit bids
  - Objects are awarded to the highest bids
  - Various possibilities for the payment rule

\[ Q_1 + Q_2 = Q \text{ (Aggregate Demand)} \]
Pay-Your-Bid Auction:
All bids above $P_0$ win and pay bid

\[ \text{Price} \]

\[ P_0 \]

(Stop-out)

\[ \text{Supply} \]

\[ \text{Demand} \]

(Bids)

\[ Q_s \]

Quantity
Uniform-Price Auction:
All bids above $P_0$ win and pay $P_0$
Critiques of Sealed-Bid Auctions

• Common-value auctions are subject to the well-known “Winner’s Curse”
  – Winners are the most “optimistic” bidders

• Ascending-bid auctions reduce the Winner’s Curse relative to sealed-bid auctions
  – Ascending-bid auctions give bidders continuous feedback about their opponents’ valuations
  – Sealed-bid auctions give bidders no feedback whatsoever

• Because of the diminished Winner’s Curse, bidders bid more aggressively in well-designed ascending-bid auctions than in sealed-bid auctions
  – This increases the seller’s expected revenues
Critiques of Sealed-Bid Auctions


- Current information technology makes ascending-bid auctions highly feasible

- Most recent introductions of successful auction formats have been of an ascending-bid nature
  - FCC auctions
  - European 3G auctions
  - eBay
Ascending-Bid Auction Formats for Financial E-Commerce

- Efficient dynamic auctions
  - Suitable when identical goods are available in large quantities (e.g., issuance of securities)

- Combinatorial auctions
  - Suitable when strong complementarities are present, so bidders want to purchase bundles
Efficient Dynamic Auctions

• Run as a “clock auction”
  – Auctioneer announces a price
  – Bidders respond by submitting quantities desired
  – Auctioneer raises the price
  – Bidders respond by submitting quantities desired
  – Process continues until the first price at which aggregate demand $\leq$ supply
  – Payment rule differs from simple, uniform price
Efficient Dynamic Auctions

- Example
  - 5 objects available
  - 4 bidders

<table>
<thead>
<tr>
<th>Price</th>
<th>Bidder A</th>
<th>Bidder B</th>
<th>Bidder C</th>
<th>Bidder D</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

- Aggregate Demand = 3 + 2 + 2 + 2 = 9
Efficient Dynamic Auctions

• Example
  – 5 objects available
  – 4 bidders

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<th>Bidder C</th>
<th>Bidder D</th>
</tr>
</thead>
<tbody>
<tr>
<td>25</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

• Aggregate Demand = 3 + 2 + 2 + 0 = 7
  – There is still excess demand, so auction continues
Efficient Dynamic Auctions

- Example
  - 5 objects available
  - 4 bidders

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<tr>
<th>Price</th>
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</thead>
<tbody>
<tr>
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<td>3</td>
<td>2</td>
<td>2</td>
<td>0</td>
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</tbody>
</table>

- Bidder A’s opponents demand = 2 + 2 + 0 = 4
  - Bidder A has “clinched” winning one unit, at price of 25
Efficient Dynamic Auctions

- Example
  - 5 objects available
  - 4 bidders

<table>
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<tr>
<th>Price</th>
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<th>Bidder B</th>
<th>Bidder C</th>
<th>Bidder D</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

- Aggregate Demand = 3 + 1 + 2 + 0 = 6
  - There is still excess demand, so auction continues
Efficient Dynamic Auctions

• Example
  – 5 objects available
  – 4 bidders

<table>
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<tr>
<th>Price</th>
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<th>Bidder C</th>
<th>Bidder D</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

• Bidder A’s opponents demand = 1 + 2 + 0 = 3
  – Bidder A has “clinched” winning a second unit, at price of 30
Efficient Dynamic Auctions

• Example
  – 5 objects available
  – 4 bidders

<table>
<thead>
<tr>
<th></th>
<th>Bidder A</th>
<th>Bidder B</th>
<th>Bidder C</th>
<th>Bidder D</th>
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</thead>
<tbody>
<tr>
<td>Price</td>
<td>30</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
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• Bidder C’s opponents demand = $3 + 1 + 0 = 4$
  – Bidder C has “clinched” winning one unit, at price of 30
Efficient Dynamic Auctions

• Example
  – 5 objects available
  – 4 bidders

<table>
<thead>
<tr>
<th>Price</th>
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<th>Bidder B</th>
<th>Bidder C</th>
<th>Bidder D</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>0</td>
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• Aggregate Demand = 3 + 0 + 2 + 0 = 5
  – There is no longer excess demand, so auction ends
  – Bidders A and C each win one more unit at 35
Summary of Example of Efficient Dynamic Auction

• Bidder A
  – Wins 3 objects, at prices 25, 30 and 35

• Bidder C
  – Wins 2 objects, at prices 30 and 35

• Auction puts objects in hands who value them the most

• No incentive for resale
References on Efficient Dynamic Auctions

- U.S. Patent Nos. 5,905,975 and 6,026,383
- All downloadable from www.ausubel.com; click on “Auctions”
Combinatorial Auctions
(a.k.a. “Package Bidding”)

• Run iteratively, with bidders submitting package bids consisting of a set of objects and an associated price
• Say the set of objects being auctioned is \{A,B,C,D,E,F,G,H,I,J,K,L\}
• A bidder might submit bids of (\{A,B,F\},100) and (\{C,D,H,I,J\},125)
• At any given time, the “provisionally-winning bids” are the collection of compatible bids that maximize revenues
• Bidders may continue to submit package bids until the auction closes
Combinatorial Auctions
(a.k.a. “Package Bidding”)

- Bids are treated as all-or-nothing bids
- Useful in spectrum auctions where there are synergies between spectrum licenses
- First use for spectrum will be in the FCC’s 700 MHz Auction scheduled for September 2001
- Also useful for financial applications where a bidder would want the entire package or nothing (hedges?) or the ability to place mutually-exclusive bids
Conclusion: Auctions for Financial E-Commerce

• Improve supply chain
• Eliminate middlemen
• Introduce dynamic pricing
• Increase revenues
• Encourage efficiency
• Reduce transaction costs