CS395T
Agent-Based Electronic Commerce
Fall 2006

Peter Stone

Department of Computer Sciences
The University of Texas at Austin
A Bidding Game

- Bid for my pen
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- The highest bid wins
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- Only the winning bid pays the amount of the bid
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- I’ll hand you a price that I will “pay” if you win the auction.
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Example:
  - You have a value of $3.
  - You bid $2.
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• Example:
  – You have a value of $3.
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  – If everyone bids lower than you, you earn $1.
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**Example:**
- You have a value of $3.
- You bid $2.
- If everyone bids lower than you, you earn $1.
- Otherwise, you earn $0.
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Example:
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First-price sealed bid auction
Let’s Try Again

- Same thing
- New values
Now Change the Rules

- The highest bidder still wins
Now Change the Rules

- The highest bidder still wins
- But only pay as much as the 2nd highest bidder
Now Change the Rules

- The highest bidder still wins
- But only pay as much as the 2nd highest bidder

Second-price sealed bid auction
This Course

- Auctions, including some auction theory
- Game theory and mechanism design
- Autonomous bidding agents
This Course

• Auctions, including some auction theory

• Game theory and mechanism design

• Autonomous bidding agents

• Other topics according to your interests
  - What do you want to learn?
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Syllabus on-line
Market Mechanisms

Diagram showing a central node labeled "Market" connected to multiple nodes labeled "Agent."
Market Mechanisms

- eBay
Market Mechanisms

- eBay
- Telecommunications spectrum
Market Mechanisms

- eBay
- Telecommunications spectrum
- Electricity
Market Mechanisms

- eBay
- Telecommunications spectrum
- Electricity
- Takeoff/landing slots at airports
Market Mechanisms

- eBay
- Telecommunications spectrum
- Electricity
- Takeoff/landing slots at airports
- Building temperature
Some Bidding Agent Domains

- Simulated travel agent
- Supply chain management
- Automated market design
- FCC spectrum auctions
- Stock market trading
Simulated Travel Agent

Trading Agent Competition

Department of Computer Sciences
The University of Texas at Austin

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Simulated Travel Agent

Trading Agent Competition

- Bid for flights, hotel rooms, entertainment tix
Simulated Travel Agent

Trading Agent Competition

- Bid for flights, hotel rooms, entertainment tix
- Simultaneous auctions of different types
Simulated Travel Agent

Trading Agent Competition

- Bid for flights, hotel rooms, entertainment tix
- Simultaneous auctions of different types
- Values of goods interact
Simulated Travel Agent

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- Bid for flights, hotel rooms, entertainment tix
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- Values of goods interact
- Represent customers with different preferences
Simulated Travel Agent

Trading Agent Competition

- Bid for flights, hotel rooms, entertainment tix
- Simultaneous auctions of different types
- Values of goods interact
- Represent customers with different preferences
- Bid against other travel agents, created by others
Supply Chain Management

Trading Agent Competition (TAC)

TAC/SCM Scenario

Agent
- automated
- optimizing

RFQs & orders

Production schedule

Delivery schedule

Offers

Suppliers
- strict MTO
- variable supply and prices

Manufacturers
- limited capacity
- competition for uncertain supplies and orders

Customers
- different levels and variability of demand
- "hard" due dates

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Automated Market Design

- A new TAC game

- First competition next summer

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• May get a preview this semester
FCC Spectrum Auctions

• Model of auction #35
FCC Spectrum Auctions

- Model of auction #35
- 422 licenses; 80+ bidders; \( \approx \$8 \) billion spent
- Ran Dec 12 – Jan 26, 2001
FCC Spectrum Auctions

- Model of auction #35

- 422 licenses; 80+ bidders; ≈$8 billion spent

- Ran Dec 12 – Jan 26, 2001

- FauCS — a realistic simulator based on information from AT&T’s real bidders
Stock Market Trading

Penn-Lehman Automated Trading Project
Stock Market Trading

Penn-Lehman Automated Trading Project

- Real market data
Stock Market Trading

Penn-Lehman Automated Trading Project

- Real market data
- Based on Electronic Crossing Network (ECN) data
- Not just stock price, but complete order books
Stock Market Trading

Penn-Lehman Automated Trading Project

- Real market data
- Based on Electronic Crossing Network (ECN) data
- Not just stock price, but complete order books
- Agent bids can be matched with real-world orders
Bidding for Multiple Items

<table>
<thead>
<tr>
<th></th>
<th>utility</th>
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<tbody>
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<td>camera alone</td>
<td>$50</td>
</tr>
<tr>
<td>flash alone</td>
<td>10</td>
</tr>
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<td>both</td>
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  - Auctions are independent (no combinatorial bids)
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  - Auctions are simultaneous
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- $\in [10, 50]$ — **Depends on the price of the camera**
Research Challenges

- Autonomous bidding — no human input (agents)
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- Predict future market characteristics (machine learning)
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- Interact with other, unknown agents  
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- Predict future market characteristics (machine learning)
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Indifferent to other agents’ goals
Beauty Contest

- Everyone submit a number $\in [0, 100]$
Beauty Contest

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- I’ll compute the mean
Beauty Contest

- Everyone submit a number \( \in [0, 100] \)
- I’ll compute the mean
- Whoever’s number is closest to \( \frac{2}{3} \) of the mean wins $?
Beauty Contest

- Everyone submit a number $\in [0, 100]$
- I’ll compute the mean
- Whoever’s number is closest to $2/3$ of the mean wins $\$?

- [http://www.cs.rutgers.edu/~mlittman/topics/nips.html](http://www.cs.rutgers.edu/~mlittman/topics/nips.html)
  - Camerer

Assignments for Tuesday

- Join the mailing list!
Assignments for Tuesday

- Join the mailing list!
- Read Klemperer
Assignments for Tuesday

- Join the mailing list!
- Read Klemperer
- Send a question or comment by midnight Monday