Analysis and Modeling of
Lowest Unique Bid Auctions

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Outline

• Introduction
  o What is Lowest Unique Bid Auctions (LUBA)?
  o Problem Definition

• Dataset

• Analysis
  o Network Analysis
  o Winners under the Lens
  o Profit Analysis

• Synthesis
  o Modeling user behavior in LUBA

• Conclusion
Outline

• Introduction
  ○ What is **Lowest Unique Bid Auctions (LUBA)?**
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Lowest Unique Bid Auction (LUBA)

Quite popular in many European countries

Winner is the bidder whose bid is **lowest** and **unique**

**General Auction**

- (A) $3
- (B) $5
- (C) $3
- (D) $6

**LUBA**

- (A) $3
- (B) $5
- (C) $3
- (D) $6
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Problem Definition

• **Analysis:**
  - Whether bidders learn from their experiences or participations?
  - Whether this mechanism is a game/lottery/scam?
  - On what parameters do winners rely on?
  - Can winning be correlated with activity, co-activity, value of item, competition etc.?

• **Synthesis:**
  - Modeling LUBA which explains user behavior
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Dataset

- We collected data from uniquebidhomes.com [Radicchi et al., PloS ONE, 2012]

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Auctions</td>
<td>189</td>
</tr>
<tr>
<td>Number of Bidders</td>
<td>3740</td>
</tr>
<tr>
<td>Number of Bids</td>
<td>55041</td>
</tr>
</tbody>
</table>

- Detailed information of all parameters of auction (value etc.) and bid (amount, timestamp etc.) are collected
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Bidder–Auction Bipartite Network

Bidders

Auctions

Bipartite Network

One mode projection on bidder node
Bidder–Auction Bipartite Network

Cumulative degree distributions of bidder nodes

(a) Unweighted one mode projection.

(b) Weighted one mode projection.
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Top winners

- Out of 3740, only 52 bidders won at least one auction.
  - Seems to be an addiction

- Top 5 winners
  - Participated 70% auctions
  - Won 57% of auctions
  - Seem to be very efficient
  - Are they so ???
### Top winners: Other Properties

**“Mean Item Value” per bidder => Bid Selection**

<table>
<thead>
<tr>
<th>Rank 1</th>
<th>Rank 2</th>
<th>Rank 3</th>
<th>Rank 4</th>
<th>Rank 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>-52%</td>
<td>+154%</td>
<td>+211%</td>
<td>+284%</td>
<td>+190%</td>
</tr>
</tbody>
</table>

Avg: 76421.61

**“Mean Number of Bids” per bidder => Aggressiveness**

<table>
<thead>
<tr>
<th>Rank 1</th>
<th>Rank 2</th>
<th>Rank 3</th>
<th>Rank 4</th>
<th>Rank 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>59</td>
<td>58</td>
<td>24</td>
<td>94</td>
<td>34</td>
</tr>
</tbody>
</table>

Avg: 5.81

**“Mean Number of other Bidders” per bidder => Competition**

<table>
<thead>
<tr>
<th>Rank 1</th>
<th>Rank 2</th>
<th>Rank 3</th>
<th>Rank 4</th>
<th>Rank 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>87</td>
<td>101</td>
<td>124</td>
<td>91</td>
</tr>
</tbody>
</table>

Avg: 50
Top winners: Other Properties

(Contd…)

# of wins might not be an efficient measure

ρ = Number of wins per participation for each user

<table>
<thead>
<tr>
<th>Rank</th>
<th>ρ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rank 1</td>
<td>3</td>
</tr>
<tr>
<td>Rank 2</td>
<td>4</td>
</tr>
<tr>
<td>Rank 3</td>
<td>5</td>
</tr>
<tr>
<td>Rank 4</td>
<td>13</td>
</tr>
<tr>
<td>Rank 5</td>
<td>35</td>
</tr>
</tbody>
</table>

Auctions sorted by the time
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Profit per bidder: Formulation

Item

Actual price: $1000

Bidder A (Winner)

A’s Bids

<table>
<thead>
<tr>
<th>Bid fee</th>
<th>Bid value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$2</td>
<td>$0.02</td>
</tr>
<tr>
<td>$2</td>
<td>$0.04</td>
</tr>
<tr>
<td>$2</td>
<td>$0.05</td>
</tr>
<tr>
<td>$2</td>
<td>$0.06</td>
</tr>
</tbody>
</table>

A’s Profit = $1000 – ($2 × 4) - $0.04 = $991.96
Actual price: $1000

Profit per bidder: Formulation

Bid fee Bid value
$2 $0.02
$2 $0.04
$2 $0.05
$2 $0.06

A’s Bids

A’s Profit = – ($2 \times 4)
= - $8
Winners are not Gainers!!

- 99% of the bidders are in loss => Chance of addiction ???

- Among top 5 winners => only 2 are in top 5 high profit bidders

- Winners are in loss, even top most winner who won 37/40 has Net Profit -1127

- High loss in an auction generally followed after a win

- Top two winners win with losses => Crazy / Scam ??
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Memory–driven Agent Based Model

Auction $i$
Memory-driven Agent Based Model

Auction $i$

Preferentially selected with high participation

Bidders

$B_1, B_2, B_3, \ldots, B_u$
Memory-driven Agent Based Model

Auction $i$

Preferentially selected with high participation

Bidders

$B_1$, $B_2$, $B_3$, ..., $B_u$

Calculate Optimizing value

$OV_1$, $OV_2$, $OV_3$, ..., $OV_u$

$f$ (past win, participation, profit, randomness)
Memory-driven Agent Based Model

Auction $i$

Bidders

$B_1$, $B_2$, $B_3$, ..., $B_u$

Preferentially selected with high participation

Calculate Optimizing value

$OV_1$, $OV_2$, $OV_3$, $OV_u$

Start Bidding:
Memory-driven Agent Based Model

Auction $i$

 Preferentially selected with high participation

Bidders

$B_1$  $B_2$  $B_3$  ...  $B_u$

Calculate Optimizing value

$O\!V_1$  $O\!V_2$  $O\!V_3$  $O\!V_u$

Start Bidding:

○ Preferentially select bidders based on OV
Memory-driven Agent Based Model

Auction $i$

Bidders

Calculate Optimizing value

Start Bidding:
- Preferentially select bidders based on OV
- Place random bid
Memory-driven Agent Based Model

Auction $i$

Preferentially selected with high participation

Bidders

$B_1$ $B_2$ $B_3$ $\cdots$ $B_u$

Calculate Optimizing value

$OV_1$ $OV_2$ $OV_3$ $OV_u$

Start Bidding:

- Preferentially select bidders based on $OV$
- Place random bid

Stop when Stopping Condition encountered

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(a) Unweighted and (b) Weighted degree distributions of the bidders obtained from the model (circles) and from the real data (line).
The cumulative winning distribution of the bidders obtained from the model (circles) and from the real data (line).
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Conclusions

- 57% of the auctions are won by the top five winners (probably they learn from the previous wins)
- The bidder who participated in maximum number of auctions did not win a single one
- Top winners except the topmost winner participate in auctions with high item values
- Most surprisingly, about 99% of the bidders are in loss in terms of the net profit
- The stochastic agent-based model efficiently captures two fundamental characteristics of LUBAs
Acknowledgements

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http://cse.iitkgp.ac.in/~tanmoyc/
http://cnerg.org/

Thank You