



Analyzing Unique-Bid Auctions for Fun and Profit

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Unique Bid Auctions

- Each bidder can make as many bids as he wants
- Each bid costs a fix amount
- Bids are expressed in cents granularity
- Bids remain private
- The winning bid is the highest bid made by a *single*(unique) participant
- If some bid is bid more than once, then all of its instances are disqualified and the next highest unique bid is the winning candidate
- The winner pays the winning bid and the fix amount for each bid he made
- The losers also pay for their bids and suffer negative gain

The screenshot shows the BidWiz website interface. At the top, there is a navigation bar with 'www.bidwiz.co.uk', 'My Account | Customer Service', and a 'Bid Now' button. Below this is a login section with fields for 'Use name:' and 'Password:', and buttons for 'Sign in', 'See Registrations', and 'Forgot Password'. The main content area is a grid of 16 auction items, each with a product image, title, maximum price, bid quota, a countdown timer, and a 'Bid Now' button. The items include:

- Sony Vaio (Max Price £15, Bids Quota 571, Auction No. 3322)
- Apple iPad 2 32GB (Max Price £19, Bids Quota 1241, Auction No. 3370)
- Amazon's Kindles (Max Price £12, Bids Quota 1741, Auction No. 3365)
- Xbox or PS3 (Max Price £9, Bids Quota 1218, Auction No. 3139)
- Panasonic Lumix TZ10 (Max Price £8, Bids Quota 1241, Auction No. 3377)
- iPod Touch 4G 32GB (Max Price £9, Bids Quota 1241, Auction No. 3392)
- iPhone 4s 32GB (Max Price £19, Bids Quota 1848, Auction No. 3370)
- Samsung 3D 40 inch LED TV (Max Price £39, Bids Quota 1551, Auction No. 3306)
- The New iPad 64GB (Max Price £29, Bids Quota 2333, Auction No. 3332)
- Samsung SyncMaster (Max Price £9, Bids Quota 578, Auction No. 3330)
- Samsung Galaxy S2 (Max Price £12, Bids Quota 1746, Auction No. 3334)
- £50 BidWiz Voucher (Max Price £5, Bids Quota 334, Auction No. 3332)
- Canon EOS 600D (Max Price £29, Bids Quota 678, Auction No. 3359)
- Samsung Smart 3D LED TV (Max Price £12, Bids Quota 2001, Auction No. 3302)
- iPad 2 *Beginners Only* (Max Price £15, Bids Quota 1043, Auction No. 3302)
- iRobot Roomba (Max Price £9, Bids Quota 1070, Auction No. 3394)

On the right side of the page, there is a 'Register Now' section with a 'and get 100% Free Extra Bids!' offer. Below this is a 'Login' section with fields for 'Use name:', 'Password:', and 'Forgot Password:'. Further down is a 'Personal Details' section with fields for 'First name:', 'Surname:', 'Add e-mail:', 'Town/City:', 'Post Code:', and 'E-mail:'. At the bottom right, there is a 'Sold Auctions &' section with a list of winners and their winning bids.

Unique-Bid Auctions

- Auction signals
 - Private:
 - Notifying the bidder after each bid whether his bid is unique together with the position
 - If not unique, the bidder is notified of the unique bid position closest to his disqualified one
 - Public:
 - Sorted positional tables of the current qualified bids (Q) and disqualified bids (DQ) without the actual values.
- Profitability (auctioneer)
- Legality
 - Randomness/Chance vs. Strategy/Skill
 - No external randomizing device

Free Training

Time Left 23 : 05 : 07
Hrs. Min. Sec.

Max Price £19

Bids Quota 11

My Bid . **BID NOW**

Recent Bidders

S.o. from City6	18.96
W.T. from City4	18.94
B.T. from City5	18.92
B.M. from City1	18.90
L.P. from City3	18.89
t.t. from City7	18.87
v.v. from City10	18.86
T.K. from City2	18.84

Auction Details

BIDDERS: 8
AVG. BIDS PER BIDDER: 1.8
UNIQUE BIDS: 9
TOTAL BIDS: 14

Register Now
Get 100% Extra Free Bids!

Position	User	City	Bid
First Place	T.K.	City2	..,.,.
2 Unique	S.o.	City6	..,.,.
3 Unique	B.M.	City1	..,.,.
4 Unique	v.v.	City10	..,.,.
5 Unique	B.M.	City1	..,.,.
6 Unique	S.o.	City6	..,.,.
7 Unique	B.T.	City5	..,.,.
8 Unique	B.M.	City1	..,.,.
9 Unique	W.T.	City4	..,.,.
Non-Unique	v.v.	City10	..,.,.
Non-Unique	B.M.	City1	..,.,.
Non-Unique	L.P.	City3	..,.,.
Non-Unique	t.t.	City7	..,.,.
Non-Unique	S.o.	City6	..,.,.

Cash it value: £0

New Free Training

Related Work

- Equilibrium analysis (single-bid case)
 - No symmetric pure-strategy equilibria in HUBA
 - In any asymmetric pure-strategy equilibria:
 - A single bidder choosing the **maximum bid**
 - The **remaining bidders stay out**
 - Nash(1950): There is a symmetric equilibrium for every finite game.
- Symmetric mixed-strategies equilibria exists
 - Involves a randomization over a consecutive set of bids, containing the highest possible one

Data Extraction

- Current available data for research
 - Only the final snapshot of qualified bids (**Q**) and disqualified bids (**DQ**) after the last transaction are published
- Dynamic temporal data
 - Individual level bids and timings information can offer many insights into bidding behavior
 - Allows for building a tractable models
- Back-propagation algorithm
 - Sample the partial information of Q, DQ rapidly and saving their instances during the entire auction
 - Starting from the fully exposed information of the last transaction going back through the saved instances, recover the bids of Q and DQ at each transaction
 - Utilize Levenshtein(Edit)-Distances for the propagation

Q

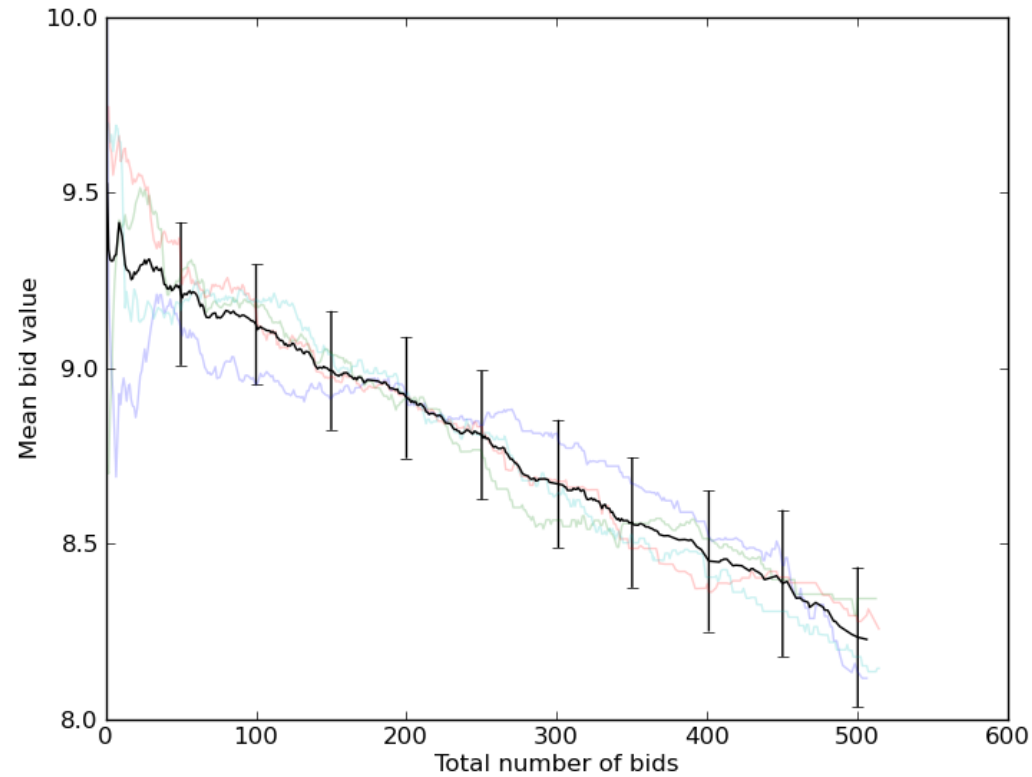
1-Unique		v.v.	City10	18.96
2-Unique		v.v.	City10	18.95
3-Unique		t.t.	City7	18.91
4-Unique		B.T.	City5	18.88
5-Unique		B.M.	City1	18.82
6-Unique		B.T.	City5	18.76
7-Unique		T.K.	City2	18.73
8-Unique		v.v.	City8	18.68
9-Unique		S.o.	City6	18.67
10-Unique		T.K.	City2	18.65
11-Unique		T.K.	City2	18.63
12-Unique		T.K.	City2	18.61
13-Unique		B.T.	City5	18.58
14-Unique		t.t.	City7	18.54

DQ

Non-Unique		W.T.	City4	19
Non-Unique		S.o.	City6	19
Non-Unique		W.T.	City4	18.99
Non-Unique		v.v.	City10	18.99
Non-Unique		B.T.	City5	18.98
Non-Unique		v.v.	City8	18.98
Non-Unique		B.M.	City1	18.98
Non-Unique		v.v.	City10	18.98
Non-Unique		T.K.	City2	18.97
Non-Unique		t.t.	City7	18.97
Non-Unique		v.v.	City10	18.97
Non-Unique		v.v.	City8	18.97
Non-Unique		B.M.	City1	18.97
Non-Unique		L.P.	City3	18.94
Non-Unique		t.t.	City7	18.94
Non-Unique		L.P.	City3	18.93
Non-Unique		W.T.	City4	18.93
Non-Unique		T.K.	City2	18.93
Non-Unique		L.P.	City3	18.92
Non-Unique		v.v.	City8	18.92
Non-Unique		M.G.	Colmenarj	18.92
Non-Unique		W.T.	City4	18.92
Non-Unique		W.T.	City4	18.9
Non-Unique		B.M.	City1	18.9
Non-Unique		T.K.	City2	18.9

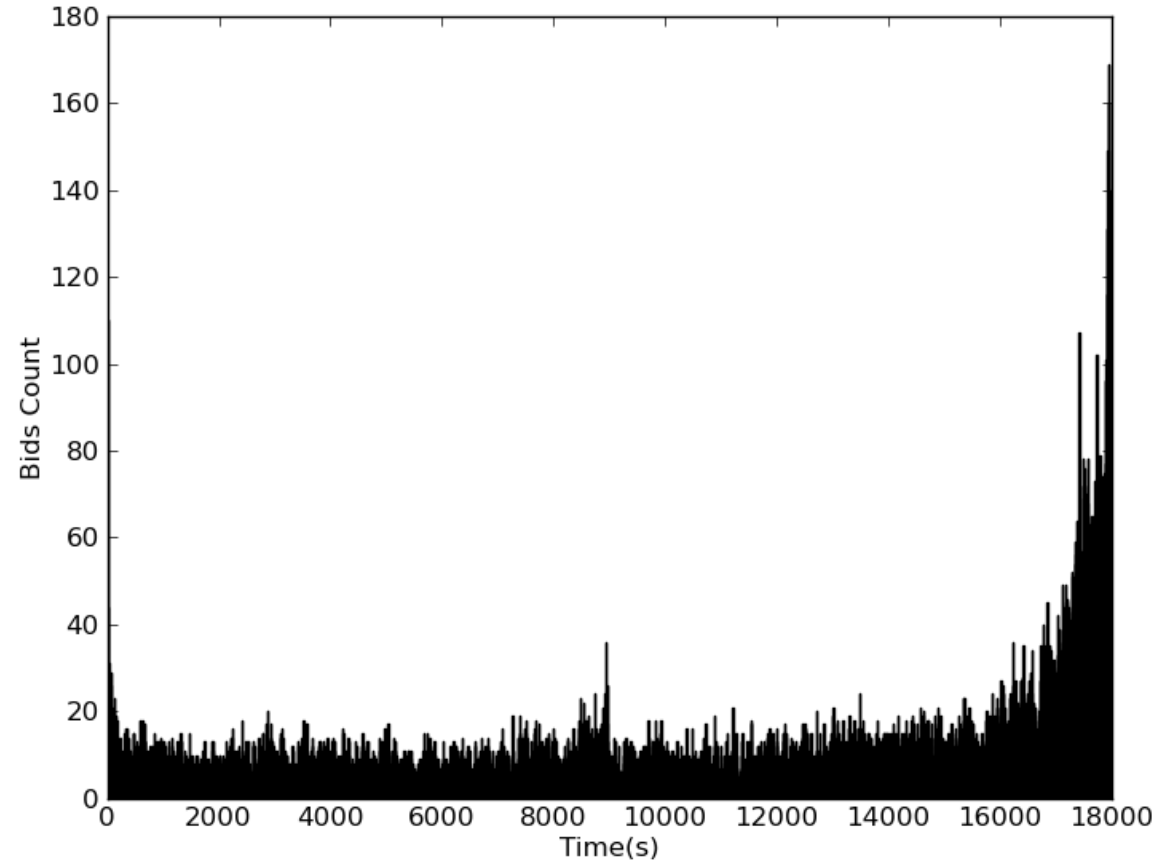
Macro Behavior

- Average bid price drops linearly with number of bids



Macro Behavior

- Last minute bidding (“Sniping”)



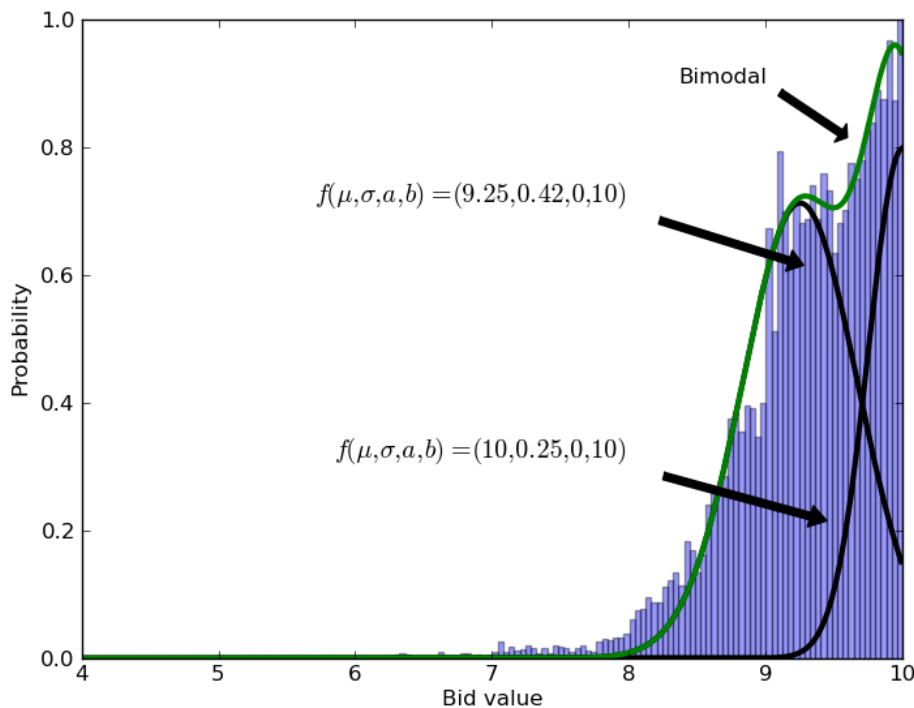
Individual Bidders Behaviors

- 7% of the bidders generated 43% of the bids (*heavy bidders*)
- 93% of the bidders place only 2 bids (*2-offers bidders*)
 - The auctions we sampled provided each bidder with 2 free bids

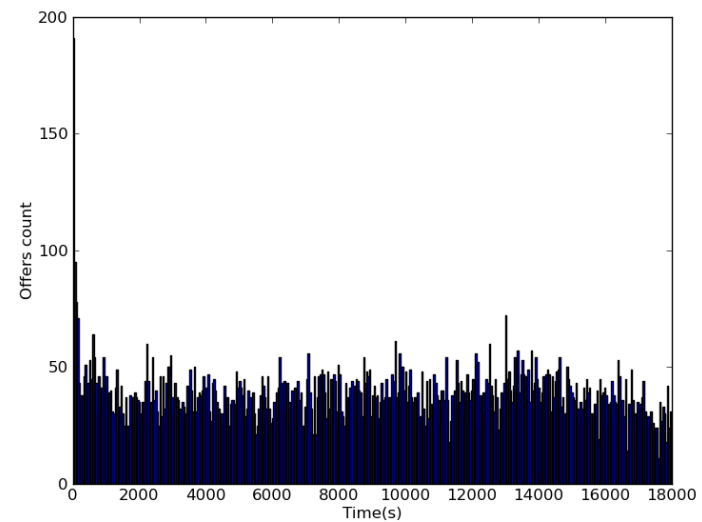
	2-offers	Heavy
Bids count	57%	43%
Bidders count	93%	7%
Auctions won	16%	84%

2-offers bidders

- Empirical distribution of bids made by 2-offers bidders superimposed with a bimodal truncated normal curve

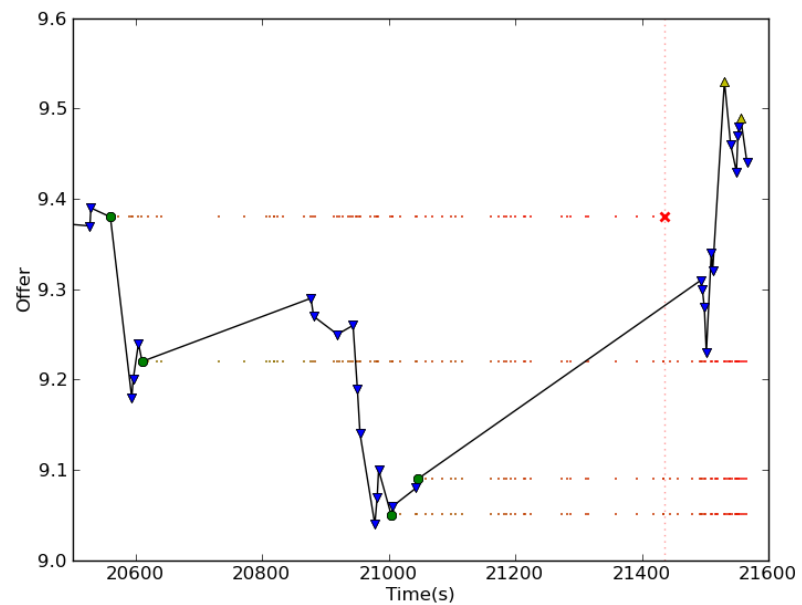
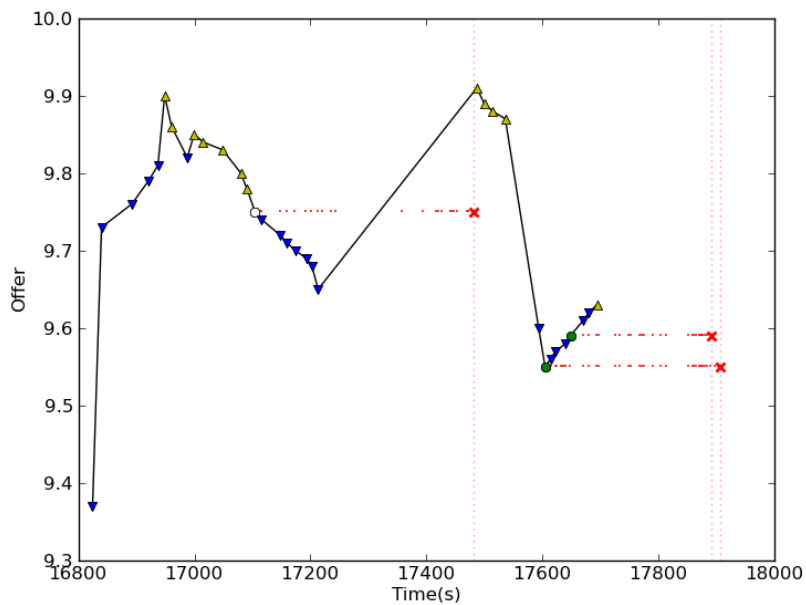


- Number of bids placed by 2-offers population over time



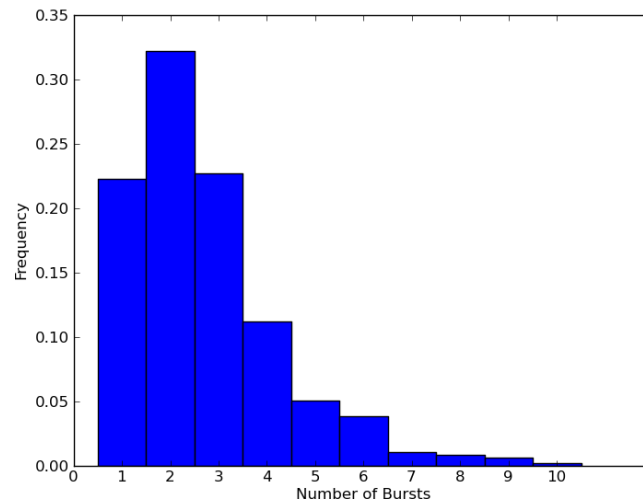
Heavy Bidders

- Extracted behaviors graphs
 - Down-point triangles are bids lower than the leading bid.
 - Up-pointing triangles are disqualified bid above the leading bid.
 - Filled circles are qualified bids. Empty circles are qualified leading bids.
 - X marks indicate disqualifications



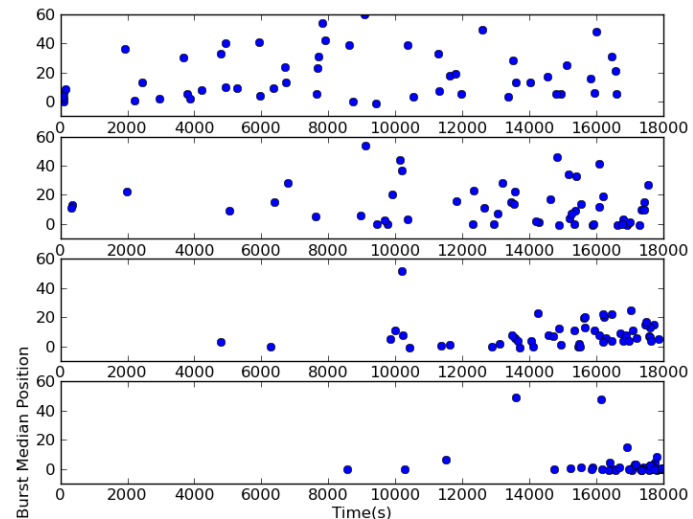
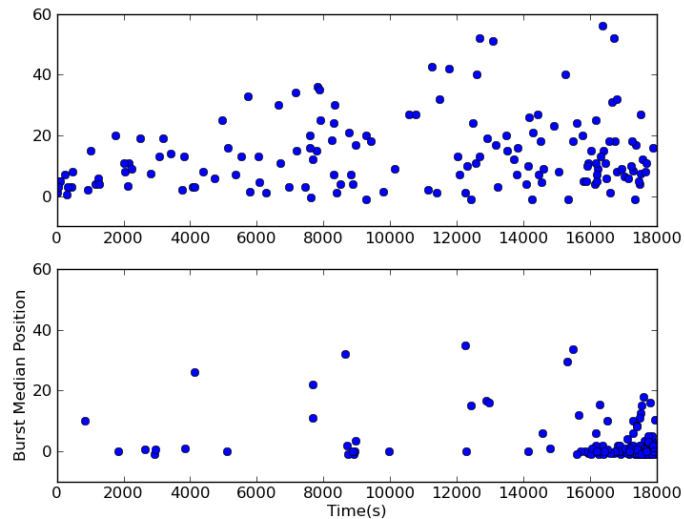
Bid Burstiness

- Bid burst – A series of bids made in rapid succession
- Heavy bidders bid in bursts
- The number of bursts varies:



Bid Burstiness

- We observed that bursts aim towards a target position
- Median positions in 2-bursts bidders and 4-bursts bidders:

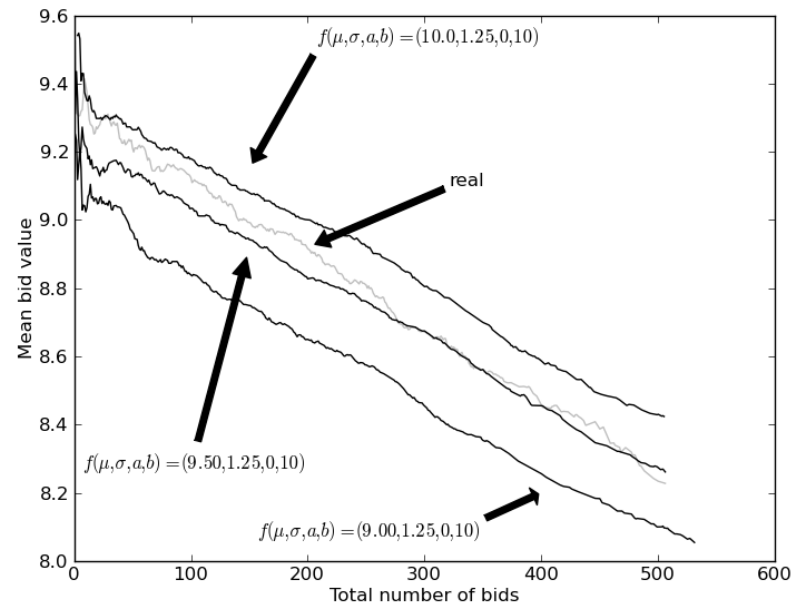
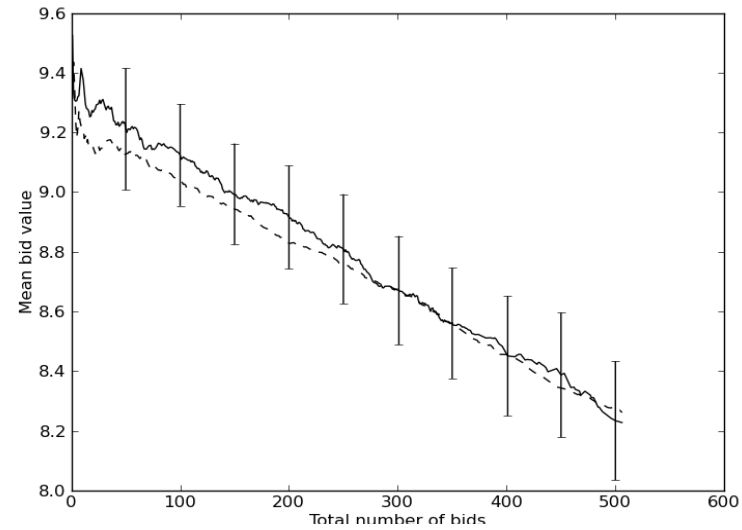
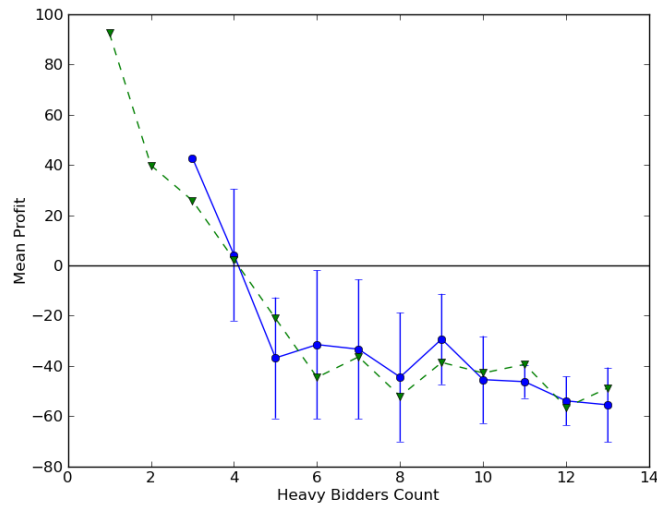


Simulation

- The simulation model was constructed based on observation we made from 90 real auctions
- We included the 2-offers bidders and heavy bidders population (2-bursts and 4-bursts)
- Simulation parameters were calibrated with the sampled auctions, e.g.:
 - Auction duration: 18000 sec
 - Numbers of bidders: $\mu = 132.41$ $\sigma = 29.216$
 - Max bid price: 10.00
 - Cost per bid: 6
 - Free bids: 2
 - Bidders ratio: $\mu = 13.5$ $\sigma = 5.8$

Model Validation

- Replicative validity



Automated Strategies

- “Catch all non disqualified bids”:
 - Track Q and DQ through all auction transactions to obtain a complete view of the **ordering** of all the bids, without the actual values
 - Introduce actual bids by bidding at intervals
 - Find gaps of non-disqualified bids at DQ by counting the disqualified groups in the interval
 - Gaps are either qualified bids or unique unbid values
 - Using binary searches, bid until hitting the gap
 - Repeat until having as many leading qualified bids as wanted

Catch all non-disqualified bids

ID	bid
5	
8	
2	

ID	bid
3	
4	
8	
1	
4	

ID	bid
8	
2	

ID	bid
3	
4	
8	
1	
4	
5	
2	

ID	bid
8	
2	

ID	bid
3	
4	
8	
7	
1	
4	
5	
2	

Catch all non-disqualified bids

ID	bid
8	
2	

ID	bid
3	
4	
8	
7	
1	
4	
5	
2	

ID	bid
8	
2	

ID	bid
3	
4	
8	
7	
10	10.0
1	
4	
5	
2	

ID	bid
8	
2	

ID	bid
3	
4	
8	
7	
10	10.0
1	
4	
5	
2	
10	9.97

Automated Strategies

- Bid Block:
 - Binary search for the leading position very close to the auction's end, and disqualify it
 - Make a series of decrementing bids until getting some qualified ones
- Real auction results showed that the average distance between the winning bid and the next unbid bid is

$$\mu = 29.76 \quad \sigma = 27.4$$

allowing a positive gain

Simulation with Automated Strategies

- “Catch all non-disqualified bids”
 - 100% win rate
 - Mean expense – 170.45
 - Mean profit – 129.55
- “Bid Block”
 - 93% win rate
 - Mean expense – 163.51
 - Mean profit – 118.12
- (Cost per bid – 6 ; Prize value – 300)

Live Experiments

- Automating the strategies on actual site:
 - Reverse-engineering the site protocol
 - Automating the bidding process in a program
- Results
 - We played the simple Bid Block strategy
 - Won 13/14 bid-credits auctions (50£ each)
 - Resembling the auctions of the simulation
 - 3/3 SanDisk Clip (32£ each)
 - 4/5 Kindle devices (80£ each)
 - (We did not claim the prizes)



Conclusion

- We extracted partial data from 90 real auctions, and using a back-propagation algorithm we successfully recovered the missing bid values
- With our detailed auctions dynamic temporal data we built a simulation model, and validated it
- We devised several automated strategies that performed well on our simulated environment
- Reversing and actual UK unique-bid auction site communication protocol allowed us to implement a program to deploy the automated strategies
- We let our program participate in several real auctions, to achieve 91% win rate and over 1000€