

CMPT 882

Computational Game Theory

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Strategic Analysis of Auctions: Intro

Outline

- Common Auction Types
- Strategic Analysis of Private Value Auctions: English, Vickrey, Dutch.
- Late Bidding in Internet Auctions

- **Common Auction Rules**

- Auctions are a very old economic mechanism---known in the Roman empire.
- **Seller's Auction:** look for highest price.
- **Buyer's Auction or Reverse Auction:** look for lowest price.
E.g. suppliers, car shopping.
- **Ascending Bid or English Auction:** Start with low price and bid up.
Most common type; estimated 85% of Internet auctions.
- **Descending Bid or Dutch Auction:** Lower sales price until somebody accepts.
Amsterdam flower market, Barcelona fish market.
- **Sealed Bid Auctions:** Sealed bids are accepted until a deadline, then opened.
- **First Price Sealed Bid Auction:** Highest bid wins and pays the highest bid.
- **Second Price Sealed Bid Auction or Vickrey Auction:** Highest bid wins and pays the *second* highest bid.
- **Third Price Sealed Bid Auction:** Highest bid wins and pays the *third* highest bid.

Private vs. Common Value Auctions

- In a private value auction, the bidders and sellers each ascribe a **private value** to the auction object.
 - The private value is called the **reservation price**.
 - Seller's Auction: A buyer will buy below or at the reservation price. A seller will sell at or above the reservation price.
 - Buyer's Auction: The reverse.
 - Each participant knows their own reservation price, but not that of others.
- In a common value auction, the object has the **same (common) value** for all bidders.
 - But each bidder may have some uncertainty about what the value is.
 - e.g., rights to oilfield exploration, buying antiques, treasury bills.

Auction as Bayesian Games

- A private value auction is a simple Bayesian game where the types are the reservation prices.
- Each player knows his type (=reservation price), but not that of the other players.
- The payoff to each player is as follows: If he wins, then
(price paid – reservation price). Otherwise 0.
- How plausible is the Common Prior Assumption?

Strategy for Ascending Price, Private Value Auctions

- **Reservation Price:** amount that the item is worth to you.
- **Maximum bid:** maximum amount that you are willing to bid.
- Are there dominated strategies?

Decision Matrix

1. Let x = maximum bid of all the other players.
2. So you win if you bid $x + 1c$.
3. Suppose that your reservation price is \$100.
4. Let's put payoff 0 for when you don't win the object or when you get it for exactly \$100.

	States of the World		
	$x > \$100$	$x = \$100$	$x < \$100$
Options: your maximum bid is			
$> \$100$	0 or <u>pay $x + 1c$</u> ≤ 0	Pay $\$100 + 1c$ <u>$1c$</u> $-\epsilon < 0$	<u>Pay $x + 1c$</u> $\$100 - (x + 1c) > 0$
$= \$100$	0	Prob $\frac{1}{2}$: 0 Prob $\frac{1}{2}$: pay <u>$\\$100$</u> 0	<u>Pay $x + 1c$</u> $\$100 - (x + 1c) > 0$
$< \$100$	0	0	<u>0 or pay $x + 1c$</u> 0 or $\$100 - (x + 1c) > 0$

Equilibria in Ascending Price, Private Value Auctions

- Bidding exactly up to your reservation price *weakly dominates* all other bidding strategies.
- We expect rational players to bid their maximum price. This is also the natural Nash equilibrium of the auction as a game.
- E-Bay tries to help agents by advising them to bid their maximum price.

The Trouble With E-Bay

- An English auction with all bidders in one room can be run in real-time until every bidder has reached their maximum bid (“going once, going twice, gone”).
- An internet auction cannot work this way:
 - potentially unlimited number of bidders.
 - not everybody is paying attention at the same time.
- E-Bay’s Approach: run auction for an extended amount of time with a **fixed closing date**.
- It is still a dominant strategy to bid up to your reservation price – but **when** should you place your bid?

Late Bidding on E-Bay

- Consider the following scenario.
 - Your reservation price is \$100.
 - The current maximum bid is \$70 by Fred.
 - The maximum bid of other agents (which you don't know) is Fred's who is willing to pay \$80.
 - The auction closes in an hour.
- You want to place a higher bid for \$71 – but now or later?
- Most people want to wait in the hope that the other agents won't be paying attention or won't have time to raise them. e.g.,
 - if you start a bidding war with Fred an hour before the auction closes, you'll pay \$81.
 - But if you wait until 1 min is left, then bid \$71, Fred may not be able to raise you.
- So delaying bids is worth a try to many people.

E-Bay's Attempts to Stop Late Bidding: Proxy Bidding

- **Proxy Bidding**: E-Bay is set up so that bidders should specify their maximum bidding price immediately---the computer automatically increases bids for them.
 - If it is impossible to retract your specification, this leads to the decision matrix we already considered.
 - But users insist on being able to retract, which E-Bay allows but tries to discourage.
- E-Bay warns you about the risks of late bidding.
 - doesn't really help, *especially* with experienced users.
- Do you have any other ideas?

Sealed Bids with Second Price: The Vickery Auction

- Consider again the problem with E-Bay's proxy bidding: users can retract their maximum bids.
- What if we didn't let them?
 - Bidders submit their maximum bid.
 - The computer "simulates" the bidding.
- What will happen?
 - The person with the maximum bid wins, pays the second highest bid + 1c.
- Why not shortcut the "virtual" bidding?
 - Collect bids.
 - Highest bidder wins, pays second highest bid.
- Used to sell stamp collections.
- Are there dominated strategies in this game?

Decision Matrix for Sealed Bid, Second Price Auction

1. Let x = maximum bid of all the other players.
2. So you win if you bid $y > x$ and you pay x .
3. Suppose that your reservation price is \$100.
4. Let's put payoff 0 for when you don't win the object or when you get it for exactly \$100.

	States of the World		
Options: your bid y is	$x > \$100$	$x = \$100$	$x < \$100$
$> \$100$	0 or <hr/> pay x <hr/> ≤ 0	Pay \$100 <hr/> 0	Pay x <hr/> $\$100 - x > 0$
$= \$100$	0	Prob $\frac{1}{2}$: 0 Prob $\frac{1}{2}$: pay \$100 <hr/> 0	Pay x <hr/> $\$100 - x > 0$
$< \$100$	0	0	0 or pay x <hr/> 0 or $\$100 - x > 0$

Again, bidding your reservation price is the dominant strategy.

Pros and Cons of the Vickery Auction for E-Commerce

- + Easy to implement long distance:
 - set a deadline
 - collect mailed-in bids
- + Easy to explain optimal bidding behaviour (see E-bay)
- + Eliminates some possibilities for fraud
- Not as exciting