Lecture 8c

Auctions: Applications

Lecture Outline

- The Winner's Curse and the Dependence of Values or "Common Values".
- Real World Application: The FCC Spectrum Auctions
- https://www.google.com/search?q=the+magic+christian+auction+scene&oq=the+magic+christian+auction&aqs=chrome.1.69i57j0.6417j1j7&sourceid=chrome&ie=UTF-8

Winner's Curse

- "I would not join any organization that would have me as a member."
  - Groucho Marx
- Sometimes, winning can be the harbinger of bad news.

Winner's Curse

- A winner's curse can arise in an auction for an object where all bidders differ in information but were they to know ALL information, would value the object the same (Thus, "common value")
- In situations like this, when you outbid all other bidders, what have you learned about their information?
  - Bad news!

Winner's Curse Example

- Suppose you are one of two buyers bidding on a house.
- The house is old and with 50% probability might have termites. With termites, it is worth $100K, without, it is worth $200K. (Same for both buyers)
- Both bidders hire (different) house inspectors.
- Each house inspector may or may not find termites even if they are present.
- If she finds termites, you know it is worth $100K. If she does not find termites, then there is a 75% chance the house is worth 200 and 25% chance it is worth 100.
- You bid on the house and, if you are the highest bidder, you get the house and pay your bid.

Winner's Curse Example

- If the inspector finds termites, you know it is worth 100 and bid accordingly (assume you bid $100K).
- But if she doesn't, is it worth $175K to you if you outbid the other bidder?
- If you bid more than $100K and outbid the rival, what should you think the rival learned from his inspector?
- If he bids low, then he has learned bad news from the inspector, the house has termites!

Winner's Curse Example

- But if you bid only $100K you only win when it is bad.
- Figuring out what to bid when your inspector says it is good requires playing with probability theory and game theory together but intuitively, you must reduce your average value of the house by more than $25K.
- My computations tell me winning at a price of about $164 breaks even.
- The general insight is that in order to avoid regret upon winning when there is a winner's curse effect, bidders will lower their bids.

Probabilities: I

- To derive the appropriate conditional probabilities, I assume that conditional on the quality of the house, the inspector yields a report to each bidder with the same probabilities.
- The information tells us that if the house is good (which happens with probability ½, the probability it reports termites (T) is zero and the probability it reports no termites (NT) is 1.
- If the house is bad, the probability it reports T is 2/3 and the probability it reports NT is 1/3.

Probabilities:II

- This means, for example, the probability that the house is good and there are two NT,NT reports is 1/2
- And, the probability that the house is bad and there are two NT,NT reports is ½(1/3)(1/3)=1/18.
- This type of reasoning gives the following probability table
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	NT,NT	NT,T	T,NT	T,T
Good	1/2	0	0	0
Bad	1/18	2/18	2/18	4/18

Winner's Curse

- When the inspector tells you she did not find termites, if that was all you knew, the expected value of the house would be $175K (=.75*200+.25*100).
- Suppose you and your rival both bid $175K when the report is no termites and $100K when the report is termites.
- When you bid, you do not know your rival's report, which could be good or bad.
- When both of you hear it is good (NT), the average value of the house is 190K= (200*(1/2)+100*(1/18))/(10/18)=(9*200+100)/10 .
- Notice, when you hear NT, the probability your rival hears NT is 5/6.
- When at least one of you hear it is bad (T), it is worth $100K.
- If you hear NT, then the probability your rival heard T is 1/6.

Winner's Curse

- If you both bid 175, you get an equal chance of getting the house. Therefore, if you bid 175, your expected payoff is
- (E(V|NT,NT)-175)*(1/2)*(5/6)+E(V\NT,T)-175)*(1/6)

  =(190-175)*(5/12)+(100-175)*(1/6)

  =25/4-75/6

  =-75/12 <0.
- So you would lose money!
- Try what would happen if you bid $164.
- (190-164)*5/12-64/6 = 26*5/12-128/12 = (130-128)/12
- Which is close to zero.

Winner's Curse: Comments

- With a second price auction, some (but not all) of this problem diminishes because when your opponent has bad news, you only pay his bid.
- Try what would happen if you bid $190K when you hear NT, and $100K when you hear T.
- The problem is more significant with more bidders because then winning tends to be even worse news.
- With English or ascending bid auctions, you at least can monitor when rivals stop bidding so you can infer their private information

Winner's Curse: Final Comments

- in auctions where the winner's curse is present (usually with common values) the equivalence of revenues across auction types is no longer true.
- Second price auctions make bidders less cautious than first price auctions
- English auctions make bidders less cautious than second price auctions.

FCC Spectrum Auctions: Background

- Cellular phone signals are controlled by license rights to use parts of the radio frequency spectrum
- Prior to the 1990's, these rights were allocated by consideration of applications, generally given to telecom companies.
- These rights became very valuable, and in order to be more "fair", the FCC used lotteries to allocate the licenses.
- Winners of these lotteries enjoyed significant windfall profits as they turned around and resold them to the telecom companies.

FCC Spectrum Auctions

- In 1994, the FCC was given a mandate by Congress to use auctions to allocate spectrum licenses.
- But how should the auctions operate?
  - many licenses
  - need for telecom "footprints"
  - Problem of selling them in sequence
  - winner's curse issues?
- The FCC invited auction theorists to suggest a way to sell them

Simultaneous Multiple Round Auctions

- After much discussion and debate, the FCC adopted a proposal by two prominent auction theorists, Robert Wilson and Paul Milgrom: The SMA
- In 1995-1996, the A and B Block Broadband auctions took place and raised over $7B.
- Since then, there have been over 70 auctions and around $100B in revenues raised.

Rules (Simplified)

- At the beginning of the auction, bidders acquire (by paying a deposit) eligibility to bid on a maximum number of licenses.
- in the first round, they bid on a number of licenses. If they do not bid on enough, their eligibility level will fall (or go to zero).
- In any other round, if the bidder is the highest bidder for a given license, he does not need to submit a new bid on that license.
  - On licenses where the bidder is not highest, again he must bid or lose eligibility.
  - A new bid must be higher than the previous round bid.
  - Bidders are NOT required to bid only on licenses they bid on in the past.
- The auction closes when no new bids are received on any license.
- Allows bidders to go after different footprints. If one fails, can change footprint.
- Withdrawals were also allowed but at a penalty.

Modifications

- Package bidding
- 700MHZ experience.
- Incentive Auctions
- Reserve Price Auctions
- Bidding off the wall
- The Afternoon Effect

Incentive Auctions

- Two-sided auctions
  - Need broadcasters to “suppy” spectrum
  - Need Telcos to “demand” spectrum
- Problem:
  - Do not know ahead of time how much it will take to induce broadcasters to give up spectrum
  - Do not know ahead of time how much Telcos are willing to pay.
  - Cannot subsidize the auction.

Incentive Auctions

- Problem
  - Cannot force broadcasters to go off air.
  - Have to “repack” spectrum to make sure continuing broadcasters can use the sp
- Problem
  - Belief that VZ and ATT have too much market power vis a vis (say) TMO.

Incentive Auctions

- Solution
  - Use a two-sided auction
  - Set a target amount of spectrum and run a reverse auction to see how much it would cost to clear the spectrum
  - Use a modified version of a second price auction.
  - Continually “repack” exiting bidders.

Incentive Auctions

- Solution
  - Once Reverse auction closes (clearing target is met), run a multi-object auction for Telcos
  - Example: if clearing target allows 10 licenses per area, Telcos bid in an ascending clock auction buy indicating at each round, how many licenses they desire.
  - Auction stops when demand in this side of the auction equals the clearing target (supply)
  - Price is highest losing bid (like second price.)

Incentive Auction

- Solution
  - If total revenue raised in the regular auction is enough to pay off broadcasters, auction closes.
  - If not, go back to reverse auction and run it again with a lower clearing target of spectrum
  - The process is then repeated until demand equals supply.

Incentive Auction

- Solution
  - If total revenues equal total cost and demand still equals supply, VW and ATT will be restricted in amount of spectrum they can buy.
  - Only certain bidders will be allowed to bid on some reserved spectrum