Auctions

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Dot Auction

- Next slide has some number of dots
- The winner of the auction will get 2 cents per dot.
- Estimate the number of dots!
- Playing for real money!

Things Sold by Auction

radio spectrum, prize bulls, race horses, off-shore oil leases, timber, antiques, tobacco, fresh fish, used cars, cut flowers (Holland), coins, stamps, wine, art, houses (80% in Australia), U.S. Treasury bills, stocks, pork bellies, OJ, gold, wheat, foreign currency, TV broadcast rights for sports, corporations, celebrities' signatures…

FCC Auctions

"The Greatest Auction in History" (William Safire, *New York Times*, March 16, 1995)

"The Auction of the Century" (*Liberation*, Paris, March 15, 1995)

"The most dramatic example of game theory's new power. It was a triumph, no only for the FCC and the taxpayers, but also for game theory (and game theorists)." (Fortune, February 6, 1995)

"The government is smoking something to think they are going to get $10 billion for these licenses." [$20 billion raised]
(MCI chairman Bert Roberts, October 20, 1993)

"For once, the government is doing a great job of dragging money out of people."
(McCaw chairman Wayne Perry, June 6, 1994)

English (Oral Ascending) Auction

- An auctioneer calls out an increasing series of prices, until no bidder is willing to top the current price.
- To buy things, prices go in the reverse direction.
- *Examples:* antiques, real estate, art, wine, tobacco
- Used by the Babylonians.
- Low transactions costs

English Auction: How to Bid

- If you know your value
  - –Bid up to your value
  - –Dominant strategy
  - –Ignore jump bids
- If your value is uncertain
  - –Other bids signal something about value

English Auction, Continued

- If bidders know their values, price is (approximately) *second highest* value
- Effect of *bid increments*

$$v_{(2)} - \Delta \leq p \leq v_{(2)} + \Delta$$

First Price Sealed-Bid Auction

- Each bidder submits a bid in an envelope. The bids are opened at the same time, and the high bid wins the object and pays his bid.
- *Examples:* Government sales of timber and offshore oil, government purchases of french fries, airplanes, road construction, pencils, zero gravity toilets…
- Typically used by bureaucracies (government or large firms) to sell or buy things .

Equilibrium Construction

- n bidders with values uniformly distributed on [0,1]
- Hypothesize a linear bidding rule $b = \lambda v$
- A bidder with value v who bids b earns

$$\pi = (v - b)\left(b/\lambda\right)^{n-1}$$

- since $b \geq \lambda v_j$ if and only if $b/\lambda \geq v_j$
- Thus the bidder wins with probability $\left(b/\lambda\right)^{n-1}$

First Order Conditions

- First order condition

$$0 = -\left(\frac{b}{\lambda}\right)^{n-1} + (v_i - b)(n-1)\frac{b^{n-2}}{\lambda^{n-1}}$$

- solves for

$$b = \frac{n-1}{n}v$$

"Bayes-Nash Equilibrium"

- Construction: hypothesize that all bidders bids λ times their value, then show any given bidder follows the same rule
- This works when $\lambda = \frac{n-1}{n}$
- This is an equilibrium strategy, and each bidder bids the expected second highest value, given their value is highest.

$$Ev_{(2)} = \int_0^{v_{(1)}} v_{(2)}(n-1)\frac{v_{(2)}^{n-2}}{v_{(1)}^{n-1}}dv_{(2)} = \frac{n-1}{n}v_{(1)}$$

Dutch Auction

- Opening price starts high, falls until a bidder accepts
- Used to sell cut flowers in Holland
- *Strategically equivalent* to sealed-bid auction
- In both auctions, a strategy *b* results in a win at price *b* provided all others chose strategy < *b*.

Vickrey Auction

- Second price sealed-bid
- High bidder wins, pays second highest bid
- With private values, yields dominant strategy to bid value

Vickrey Auction

- Used to sell spectrum licenses in New Zealand
- Nationwide cellular
  - –High bid of $110 M
  - –Price of $11 M
  - –Sometimes revelation of value is bad politically

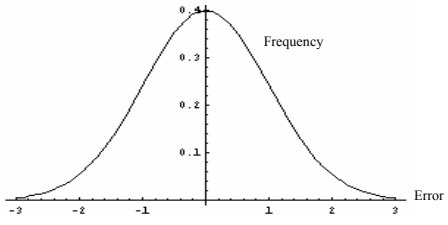
The Winner's Curse

- "I paid too much for it, but it's worth it."
  -Sam Goldwyn
- The winner's curse is the fact that *the bidder who most overestimates the value of the object wins the bidding*.
- Uncertain resale value can induce winner's curse.
- Should reduce bid to adjust for this effect.
- Reduce bids more the more bidders there are.

The Winner's Curse

- Estimates tend to follow a normal distribution, or bell curve.
- The highest estimate, on average, is larger than the average estimate.
- Average estimate reflects actual value.

Distribution of Value Estimates



Size of Adjustment

Average Adjustment Needed, in Standard Deviations, for Given Number of Bidders										
2	3	4	5	10	15	20	50	100	500	1000
0.56	0.84	1.03	1.16	1.54	1.74	1.87	2.25	2.51	3.04	3.24

Standard deviation is a measure of the "average error" in forecast.

Conclusions

- Winner's curse requires a downward adjustment in estimate which is larger the more bidders there are.
- Problem of winner's curse is smaller in English auction, because other value estimates revealed, reducing uncertainty.
- English auction will tend to have higher prices than sealed-bid auctions.

Conclusions, Continued

- English auction reduces regret.
- Winner's curse effect is smaller the higher one's signal, because the fact that others had lower signals is less meaningful the higher a bidder's signal.

RCA Transponder Auction, 1981

Order	Winning Bidder	Price Obtained
1	TLC	$14,400,000
2	Billy H. Batts	$14,100,000
3	Warner Amex	$13,700,000
4	RCTV	$13,500,000
5	HBO	$12,500,000
6	Inner City	$10,700,000
7	UTV	$11,200,000
AVG		$12,871,428

Olympic Competition

Year	City	Network	$M	$M 1983
1960	Rome	CBS	0.4	1.35
1964	Tokyo	ABC	1.5	4.83
1968	Mexico	ABC	4.5	12.9
1972	Munich	ABC	7.5	17.9
1976	Montreal	ABC	25	43.9
1980	Moscow	NBC	87	105.7
1984	Los Angeles	ABC	225	216.2
1988	Seoul	NBC	300	253.8
1992	Barcelona	NBC	401	281.9
1996	Atlanta	NBC	456	290.9
2000	Sydney	NBC	705	423.0*
2004	Athens	NBC	793	475.8*
2008	TBA	NBC	894	536.4*

Linkage

- Tying or linking prices to actual outcomes
  - –Reduces uncertainty
  - –Mitigates the winner's curse
  - –Reduces regret
  - –Increases prices on average

Examples of Linkage

- Royalties -- Seoul Olympics
- Cost-sharing
- Oral auction
- Second-price (Vickrey) auction
- Accurate information provision

Linkage Conclusions

- It is in the seller's interest to adopt the policy of revealing accurate information about value, to reduce winner's curse.
- Cost-sharing and royalties reduce winner's curse problem by sharing risk.

Auction Design

- Impose an appropriate reserve price or minimum bid
- Use ascending price (English) auctions rather than sealed-bid
- Reveal information about the value of the item
- Conceal information about the extent of competition
- Handicap bidders with a known advantage