Lecture 9 Game Plan

- Angry Madness Tournament
- Examples of auctions
- Which auction is best?
  - Revenue Equivalence Theorem
- How to bid?
  - Winner's Curse

Yield This Round or Wait?

U	Risk of Waiting	Gain of Waiting	Critical threshold
100	$25	$100	p_K = 1/5 =20%
200	$50	$100	p_K = 1/3 = 33%
400	$100	$100	p_K = 1/2 = 50%

You want to yield this round whenever chances other yields is less than threshold

Round 1 Equilibrium Play

	Critical % Yielding	% Higher-Value Types
400-type	50%	0%
200-type	33%	33%
100-type	20%	67%

- No 200- or 100-types yield
  - if so, all 400-types must also yield
  - but 33%+ yielding means 200- and 100-types should *not* yield
- All 400-types yield
  - since 33%<50%, all 400-types have strict incentive to yield even when they all yield

Round 2 Equilibrium Play

	Critical % Yielding	% Higher-Value Types
400-type	N/A	N/A
200-type	33%	0%
100-type	20%	50%

- No 100-types yield
  - if so, all 200-types must also yield
  - but 50%+ yielding means 100-types should *not* yield
- Only *some* 200-types yield
  - since 50%>33%, 200-types would have incentive *not* to yield if they all yielded → only 1/2 of them yield

Round 3 Equilibrium Play

	Critical % Yielding	% Higher-Value Types
400-type	N/A	N/A
200-type	33%	0%
100-type	20%	33%

- All 200-types yield
  - If only some of the 200-types yield, then all of them want to yield
- No 100-types yield
  - since 33% > 20%, 100-types don't want to yield when all 200-types yield

Round 4 Equilibrium Play

	Critical % Yielding	% Higher-Value Types
400-type	N/A	N/A
200-type	N/A	N/A
100-type	20%	0%

- 20% of remaining 100-types yield
  - any less and all would want to yield
  - any more and none would want to yield

It's Tough to be Tough

- Suppose two 100-types face off
- In Rounds 1-3
  - 57.8% get angry; no one yields
- In Rounds 4-9
  - about 16.9% more get angry
  - about 13.4% yield
  - about 10.8% don't yield & get yielded to
- Only about 1.1% reach 10^{th} round.
- **Average payoff only about $36.**

Signaling Toughness

- Suppose you could (credibly) reveal your toughness, i.e. that U = 100
- Would you want to? What would happen?

Auctions

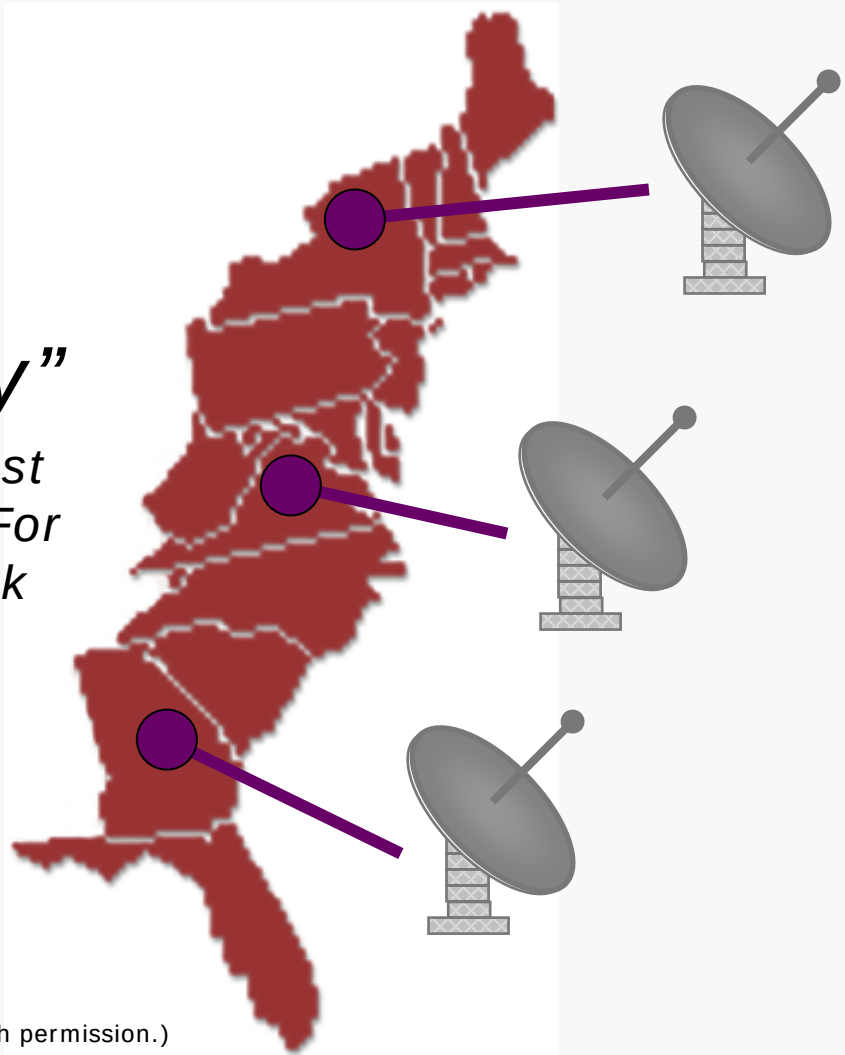
“A Cynic Knows the Price of Everything and the Value of Nothing”

-Oscar Wilde, Lady Windemere’s Fan, 1892

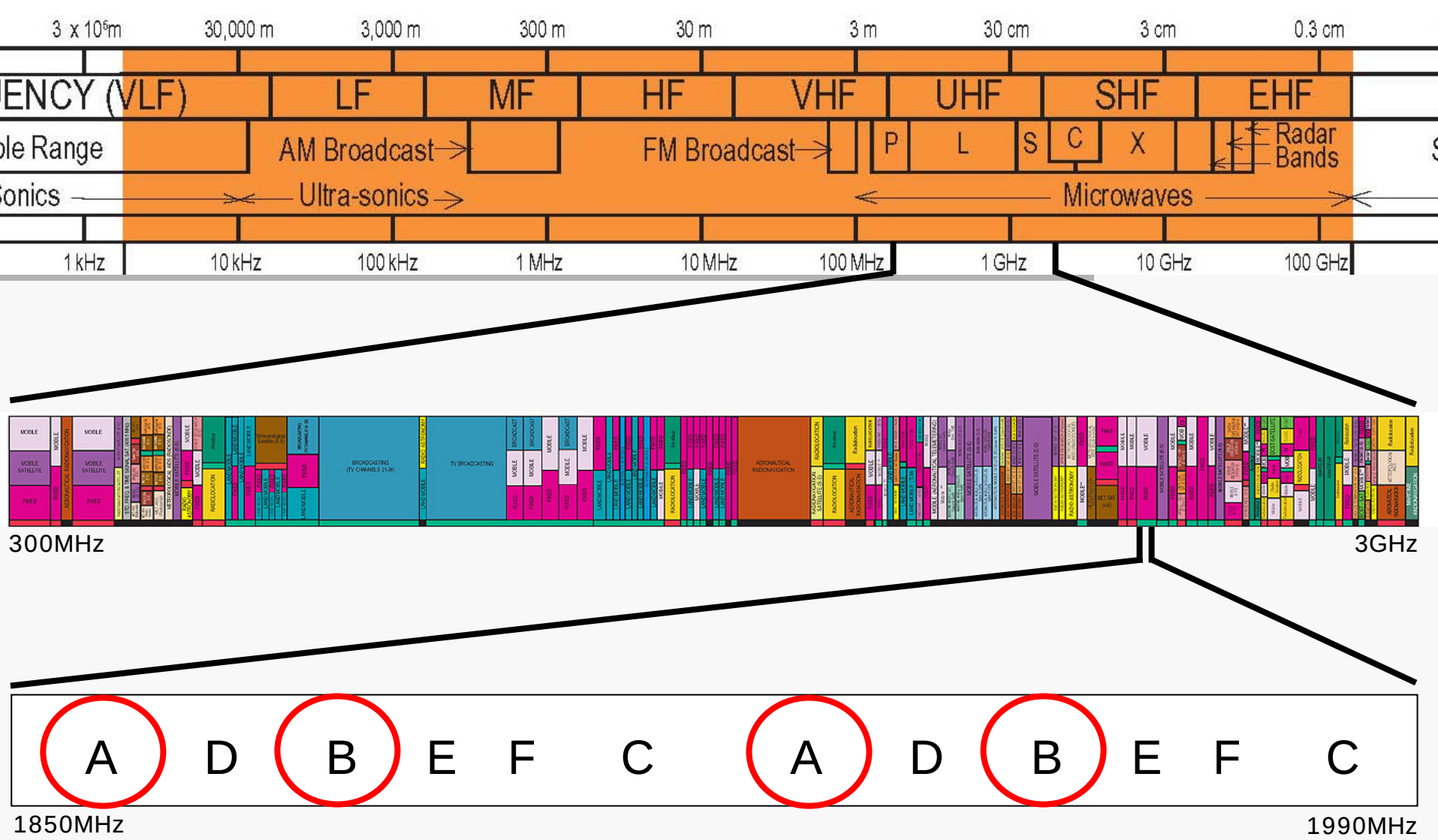
PCS Spectrum Auctions

"The Greatest Auction in History"

- *Safire, William. "The Greatest Auction Ever: Get Top Dollar For the Spectrum," The New York Times, 16 March 1995.*



(Map courtesy of http://www.theodora.com/maps used with permission.)



- 99 licenses (corresponding to the red circles) were sold to 18 companies for a total price of $7.7 billion

Images of spectrum courtesy of U.S. Department of Commerce's National Telecommunications and Information Administration (http://www.ntia.doc.gov/, accessed 16 July 2004).

What is an Auction?

auc•tion

1. A public sale of property or merchandise to the highest bidder.
2. A market institution with explicit rules which determine prices and the allocation of resources based on bids.
3. Bidding in the game of bridge.

Derivation: From the Latin “auctus”, which is the past participle of “augere”, to increase.

Examples of Auctions

- FCC Spectrum
- Procurement
- Electricity generation
- Treasury Bills
- Internet
- Wine
- Quota Rights

Types of Bidders

- Auctions have *rules* and *bidders*
  - Auctioneer decides what rules to use but takes bidders (“the environment”) as given
- Two main types of bidders
  - private value
  - common value

Private Value

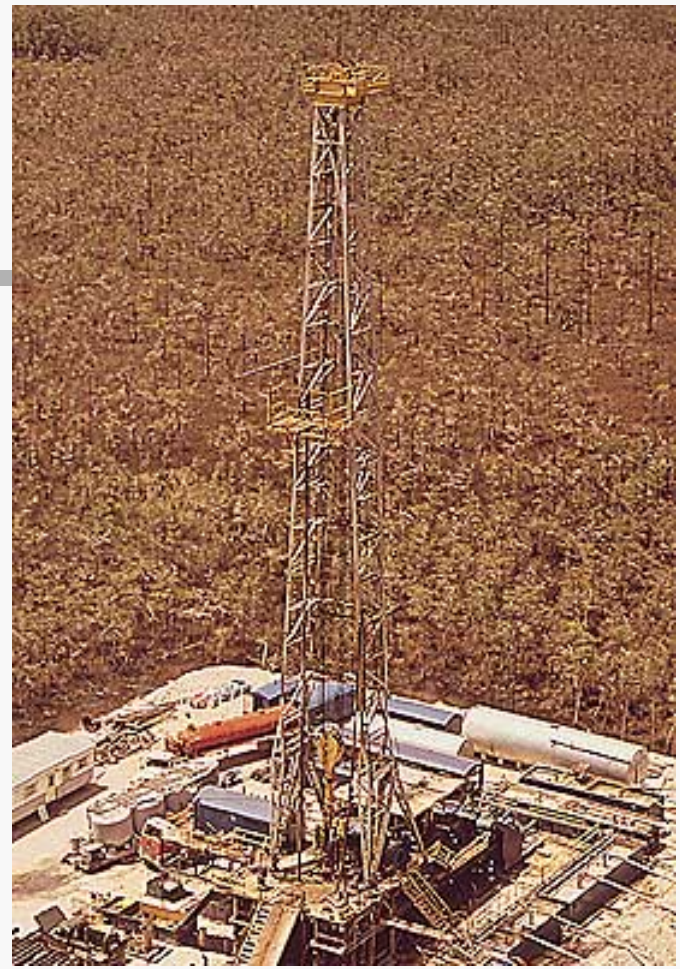
- Dinner

Source: Photograph courtesy of Erik Dungan, http://sxc.hu (accessed August 10, 2004). Used with permission.

- What others know does not effect your willingness to pay

Common Value

- Unproven oil fields
- Object has *same* value to all bidders, but each only has an *estimate* of that common value



Source: Photograph No. 544512; “New Oil Rig, North of Gum Slough, in Big Cypress Swamp,” August 1972; Still Picture Records LICON, Special Media Archives Services Division (NWCS-S), National Archives at College Park, MD.

Types of Rules: Open Outcry

Bidders interact ("call out bids"). Most common sorts:

1. *English auction*. Price increases until only one bidder remains
2. *Dutch auction*. Price decreases until some bidder jumps in
3. *War of Attrition*. War continues until only one bidder remains.

Types of Rules: Sealed Bid

Bidders tell auctioneer their bids without interacting with each other

1. *First-price*. Winner pays its own bid. Losers pay nothing.
2. *Second-price*. Winner pays highest losing bid. Losers pay nothing.
3. *All-pay*. Each bidder (including losers) pays its own bid.

“Auctions in Disguise”

Many interactions have the hallmarks of an auction:

1. There is a **prize**
2. Prize has **value** that is never less if others value it more
3. Each party makes a **bid** where highest bidder gets prize
4. Bidding has a **cost**, where higher bids don’t cost less

Hiring Decision

- McKinsey and Charles River are trying to recruit Sven
- Whoever makes the highest wage offer will get Sven
- What type of bidders?
- What type of rules?

Labor Dispute

- Labor and management have a dispute over new work rules
- Work stops until some side gives in

- What type of bidders?
- What type of rules?

Promotion Tournament

- Amande and Mert are contenders to become the firm's next CEO
- Whoever spends the most weekends in the office gets the job

- What type of bidders?
- What type of rules?

Competitive Negotiation

- Boeing and Airbus are each trying to get Iberia's business
- Iberia's CFO forces the two firms to continue beating each other's best offers and counteroffers until someone gives up

- What type of bidders?
- What type of rules?

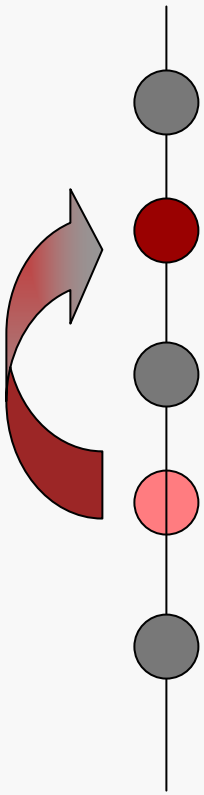
Second Price Auction

- Bidding strategy is easy!
- Bidding one's true valuation is a (weakly) dominant strategy

- *Intuition:* your bid determines whether you win, not what you pay

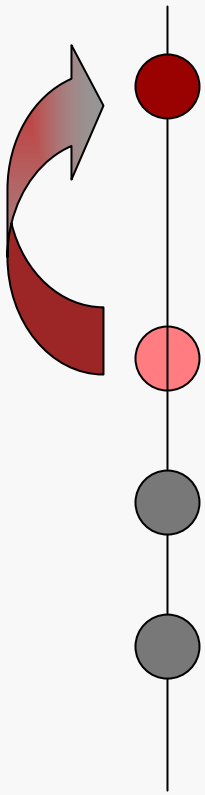
Bidding Higher Than My Valuation

Case 1



No difference

Case 2



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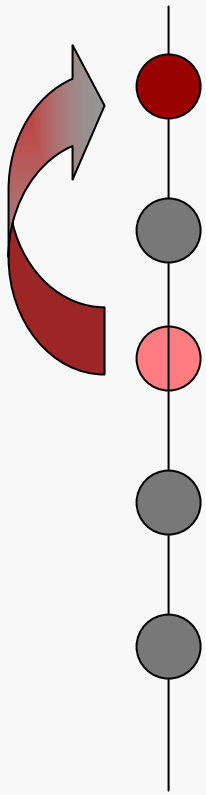
Case 3

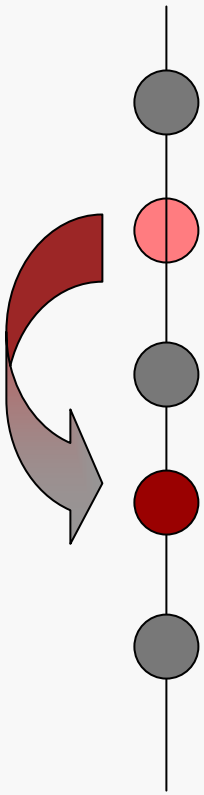


Lose money

Slide courtesy of Mike Shor, Vanderbilt University.

Bidding Lower Than My Valuation

Case 1



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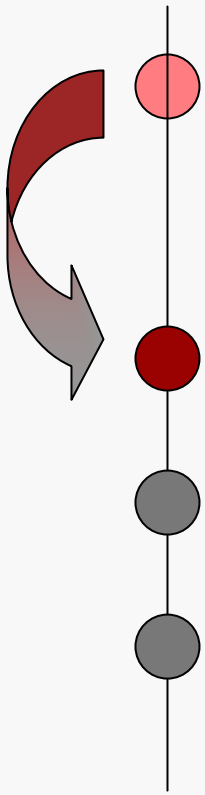
Case 2



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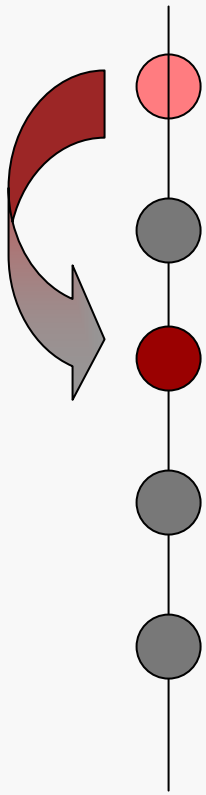
Case 3



Lose money

Slide courtesy of Mike Shor, Vanderbilt University.

First Price Auction

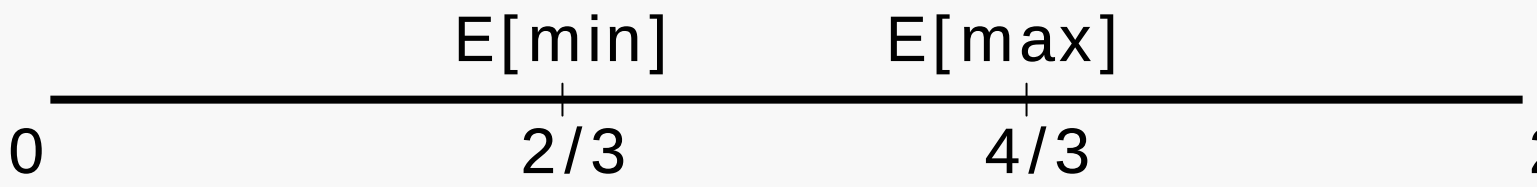
- Bidding your valuation guarantees you get no surplus
- But bidding lower risks regret, i.e. losing when willing to pay the winning bid
- *Optimal bid trades off risk of not winning vs. extra gain from winning with lower bid*

Revenue Equivalence

- Amazingly, there are many settings in which first-price, second-price and other auctions yield
  - same expected revenue for auctioneer
  - same expected surplus for each bidder

Revenue Equivalence in Simple Example

- Suppose two bidders, each with private value random from 0 to 2
- First-price auction: turns out equilibrium is for each bidder to *bid half its value*.
  - E[revenue] = 50% of E[maximum] = 2/3
- Second-price auction: bid true value
  - E[Revenue] = E[minimum] = 2/3



Conditions for Revenue Equivalence

1. **Bidders play equilibrium strategies in both auctions**
2. **Bidders have private values that are not correlated with one another**
3. **Both auctions lead (in equilibrium) to the same allocation of the prize**
4. Bidders are risk neutral
5. A bidder with the lowest possible value gets zero surplus in both auctions

Usefulness of Revenue Equivalence Theorem (RET)

- If conditions of RET are met, then for given bidders it doesn't matter which auction you choose
  - *just focus on attracting more bidders!*
- But when some of the conditions fail (as they often do) RET gives insight into *why* one auction is likely better than another
  - better for auctioneer and/or better for bidders

What if private values fails?

- When private values fail, this means that bidders care about the information that others possess.
- Which is better, open auction or sealed-bid auction:
  - for bidders?
  - for the auctioneer?

What if there is correlation?

- When bidders' values are correlated, each expects others to have higher values when it has high value
- Which is better, first-price or second-price auction:
  - for bidders?
  - for the auctioneer?

What if they are risk averse?

- In this case, a stronger version of RET tells us that bidders must still get *same expected utility* from the two auctions
- Which is better, first-price or second-price auction:
  - for the auctioneer?

What if they don't follow equilibrium strategies?

- There are many ways that people might fail to play in equilibrium
- One is "*animal spirits*", i.e. you want to win more if someone else is trying to win
- Which is better, open or sealed-bid:
  - for bidders?
  - for the auctioneer?

What if they don't follow equilibrium strategies?

- Another way not to play in equilibrium is to *collude*, i.e. bidders try to maximize joint surplus rather than individual surplus
- Which is better, open or sealed-bid:
  - for bidders?
  - for the auctioneer?

Case Study: Iberia and Boeing vs. Airbus

- You are CFO of Iberia
- Boeing and Airbus both want your business
- What sort of auction is probably best for you, the auctioneer?

On-Line Game #8

The Winner's Curse

Uncertain Value

- Uncertain Valuation
  - A company is worth between $0 and $1000 per block of shares
- Synergy
  - Worth of company increases by 50% if purchased
- Adverse Selection
  - Offer only accepted if company is worth less than offer

Levels of Thinking

What would I be willing to pay given

what I know before submitting my bid

versus

what I know before submitting my bid,
and
that I will only win if no one else is willing to bid higher than me

Slide courtesy of Mike Shor, Vanderbilt University.

Avoiding Winner's Curse

- Since winning means you have the highest signal, always bid *as if* you have the highest signal
- If you have highest signal – what is the object worth?
- Use that as the basis of your bid

Slide courtesy of Mike Shor, Vanderbilt University.

FCC Spectrum Auctions: Blocks C & F

- Gov't wanted to encourage minority and female-owned firms to bid but licenses are very expensive.
- Reserved "blocks C & F" for smaller bidders.
- Allowed 10% down, low interest, remaining principal owed in 7 years.
- What happened?

Slide courtesy of Mike Shor, Vanderbilt University.

Adverse Selection and Blocks C & F

- Bid high – if licenses end up being worth less, default!
- 83 winners:

Of the four largest, …

… went bankrupt and defaulted

… got $1B reduced to $66M in bankruptcy court

… was a front for Qualcom

… was sold to Siemens

Slide courtesy of Mike Shor, Vanderbilt University.

Summary

- *As auctioneer*, understand the bidders to determine which auction to use:
  - private vs. common values?
  - correlated signals?
  - risk-aversion?
  - collusion? animal spirits?
- *As bidder in common-value settings*, bear in mind the selection effect that you only win when others have bid less than you
- *Next time*: more on selection (signaling) as well as incentives

Online Game #7 (Incentives)

- Play Online Game #7 prior to midnight before next lecture.
- Note: We are *not* playing the games in their numerical order!!