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?

<table>
<thead>
<tr>
<th>U</th>
<th>Risk of Waiting</th>
<th>Gain of Waiting</th>
<th>Critical threshold</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>$25</td>
<td>$100</td>
<td>$p_K = 1/5 = 20%</td>
</tr>
<tr>
<td>200</td>
<td>$50</td>
<td>$100</td>
<td>$p_K = 1/3 = 33%</td>
</tr>
<tr>
<td>400</td>
<td>$100</td>
<td>$100</td>
<td>$p_K = 1/2 = 50%</td>
</tr>
</tbody>
</table>

You want to yield this round whenever chances other yields is less than threshold.
Round 1 Equilibrium Play

<table>
<thead>
<tr>
<th>Type</th>
<th>Critical % Yielding</th>
<th>% Higher-Value Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>400-type</td>
<td>50%</td>
<td>0%</td>
</tr>
<tr>
<td>200-type</td>
<td>33%</td>
<td>33%</td>
</tr>
<tr>
<td>100-type</td>
<td>20%</td>
<td>67%</td>
</tr>
</tbody>
</table>

- 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

<table>
<thead>
<tr>
<th></th>
<th>Critical % Yielding</th>
<th>% Higher-Value Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>400-type</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>200-type</td>
<td>33%</td>
<td>0%</td>
</tr>
<tr>
<td>100-type</td>
<td>20%</td>
<td>50%</td>
</tr>
</tbody>
</table>

- **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

<table>
<thead>
<tr>
<th>Type</th>
<th>Critical % Yielding</th>
<th>% Higher-Value Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>400-type</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>200-type</td>
<td>33%</td>
<td>0%</td>
</tr>
<tr>
<td>100-type</td>
<td>20%</td>
<td>33%</td>
</tr>
</tbody>
</table>

- **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

<table>
<thead>
<tr>
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<th>Critical % Yielding</th>
<th>% Higher-Value Types</th>
</tr>
</thead>
<tbody>
<tr>
<td>400-type</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>200-type</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>100-type</td>
<td>20%</td>
<td>0%</td>
</tr>
</tbody>
</table>

- 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 10th 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*”

(Map courtesy of [http://www.theodora.com/maps](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.

What is an Auction?

**au•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

Slide courtesy of Mike Shor, Vanderbilt University.
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

■ 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

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
No difference

Case 3
Lose money

Slide courtesy of Mike Shor, Vanderbilt University.
Bidding Lower Than My Valuation

Case 1: No difference
Case 2: No difference
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*.
  - \( E[\text{revenue}] = 50\% \text{ of } E[\text{maximum}] = 2/3 \)
- Second-price auction: bid true value
  - \( E[\text{Revenue}] = E[\text{minimum}] = 2/3 \)
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.
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.
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 Qualcomm
    ... 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!!