A Survey of Auction Types

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Two categories of auctions

- Single dimensional
  - The only bid dimensions are price and quantity of a single good
- Multi-dimensional

Single-dimensional auctions we'll cover

1. one sided
   - 1.1 English
   - 1.2 Dutch
   - 1.3 Japanese
   - 1.4 Sealed bid
   - 1.5 Elimination
   - 1.6 Hybrid
2. two sided
   - 2.1 Continuous double auction (CDA)
   - 2.2 Call market (periodic clear)

Single-unit English auction

- Bidders call ascending prices
- Auction ends at a fixed time / when no more bids
- Final bidder pays his bid

Multi-unit English auction are less straightforward

- Different pricing scheme
  - lowest accepted (uniform pricing, confusingly sometimes called "Dutch")
  - highest rejected (uniform pricing)
  - pay-your-bid (discriminatory pricing)
- Different tie-breaking rules
  - price
  - quantity
- Different restrictions on quantity change
  - descending rule
  - the problem with this rule
    - 10 units available; reserve price (and price quote) is $1
    - A bids $5/unit for 10 units (not AON); price quote is $6
    - B bids $6 for 2; price quote is still $6
    - A (re)bids $6 for 1; A's commitment dropped to from $40 to $6; price quote is $1

Dutch ("descending clock") auction

- Auctioneer calls out descending prices
- First bidder to jump in gets the good at that price
- With multiple units: bidders shout out a quantity rather than "mine". The clock can continue to drop, or reset to any value.

Japanese auction (name not universal)

- Auctioneer calls out ascending prices
- Bidders are initially "in", and drop out (irrevocably) at certain prices
- Last guy standing gets it at that price

- Multi-unit version: bidders call out quantities rather than simple "in" or "out", and the quantities decrease between rounds. Auction ends when supply meets or exceeds demand. (Note: what happens if exceeds?)

Sealed bid auctions

- Each bidder submits a sealed bid
- (Usually) highest bid wins
- Price is
  - first price
  - second price
  - k'th price
- Note: Can still reveal interesting information during auction
- In multiple units: similar pricing options as in English

Elimination (aka survival) auction

- New auction type invented at Stanford
- Motivation: the best of English/Japanese and sealed bid
- Process: Multiple sealed-bid rounds. In each round the lowest bidder drops out and their bid becomes the (revealed) reserve price for next round
- Can have more than one drop out at each round; the bid of the *lowest* drop-out is the new reserve price
- Can generalize to multiple units

Multi-phase auctions

- English to sealed bid
- Sealed bid to English
- *etc.*

Note reversal in reverse (buy-side) auctions

- English descending
- Dutch ascending
- Japanese descending
- Elimination descending

Two-sided (double) auctions

- Continuous double auction (CDA)
  - every new order is matched immediately if possible
  - otherwise, or remainder, is put on the order book
  - NASDAQ-like

- Call ("periodic clear") market
  - orders are matched periodically
  - Arizona stock exchange (AZX) -like

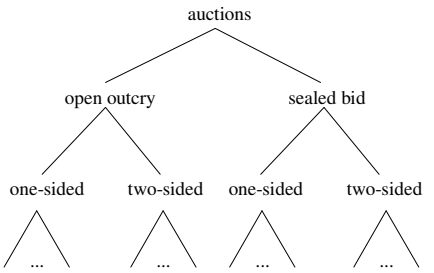
Multi-dimensional auctions we'll cover (briefly)

1. Multi-attribute
2. Multi-good
   - 2.1 Combinatorial
   - 2.2 Composite auctions
     - 2.2.1 global variables
     - 2.2.2 synchronization
     - 2.2.3 global clear
     - 2.2.4 example: Simultaneous Ascending Auction (SAA)

Intuitive comparison of the basic four auctions

	English	Dutch	Japanese	sealed bid
regret				
duration				
disclosure				
monitoring				
price discovery				

What we've done so far: zoological categorization



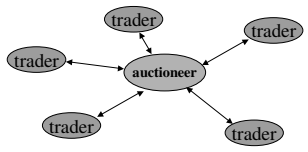
A deeper look at what auctions really are

Definition: An auction is any negotiation mechanism that is:

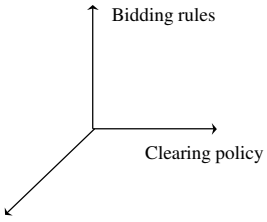
- Mediated
- Well-specified (runs according to explicit rules)
- Market-based (determines an exchange in terms of standard currency)

Auctioneer activities

- Receive Bids
- Disseminate Information
- Arrange trades (clear market)



Auction Dimensions



Information revelation policy

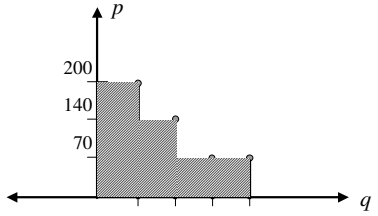
Bidding Rules

- Who can bid, when
- What is form of bid
- Restrictions on offers, as a function of
  - Trader's own previous bid
  - Auction state (everyone's bids)
  - Eligibility (e.g., financial)
  - …
- Expiration, withdrawal, replacement

Single-Good Offers

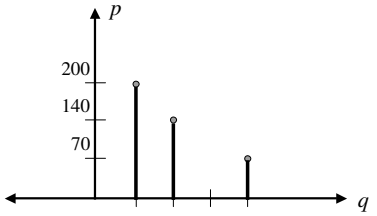
- General form
  - schedule: [q1@p1, q2@p2, q3@p3, …]
  - "willingness" interpretation
- Common restrictions
  - Single price/quantity point [q@p]
  - Single unit [1@p]
  - Monotonicity
  - Divisibility (all-or-none)

Price-Quantity Schedule



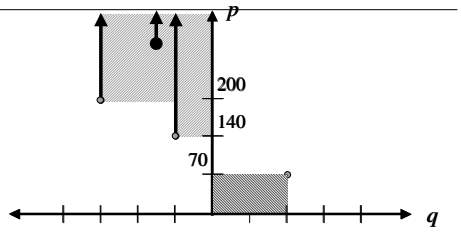
Offer: [1@200, 2@140, 4@70]
[10@200, 20@140, 40@70]

Indivisibility (All-or-None)



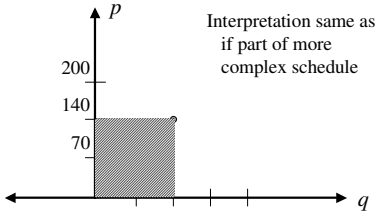
Offer: [10@200, 20@140, 40@70] **AON**

Sell Offers



Offer: [-3@200, -1@140]
[-3@200, -1@140, 2@70]

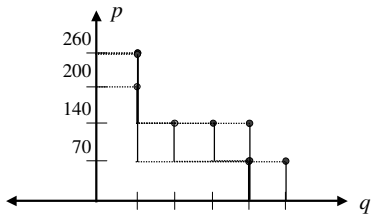
Single PQ Points



Interpretation same as if part of more complex schedule

Offer: [2@140]

Bid Dominance



Current offer: [1@200, 2@140, 4@70]

New offer: [1@260, 3@140, 4@70]

Dominance Special Cases

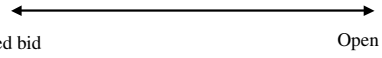
- Single PQ Point
  - Higher price and quantity
  - Higher price, same quantity
  - Same price, higher quantity
- Single Unit
  - Higher price

Dominance Fine Points, Issues

- Can require increase (NE) or decrease (SW)
- Can distinguish buy and sell side
  - Increase *strengthens* buy, *weakens* sell
  - Need increase on both sides to ensure price progression
- Adding AON weakens offer, dropping strengthens

Information Revelation

- When to reveal information
- What information
- To whom



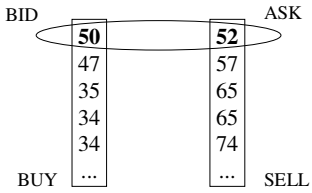
Sealed bid — Open outcry

Price Quotes

- Generic term for auction summary info revealed at periodic or event-driven times
- "Current Price"
  - ASK quote: Amount buyer would have to offer to be a winner, in current state
  - BID quote: Analogous, for seller
- Other info: quantities, trader IDs, etc.

"Bid-Ask" Spread

- Terminology comes from familiar CDA, as in financial exchanges.



Quotes in Common Auctions

- English
  - BID: highest price so far
  - ASK: + delta
- Dutch
  - BID: undefined
  - ASK: "clock"
- CDA: BID-ASK spread
- Sealed:

Price Quote Timing

- At specified intervals
- On each bid
- On inactivity
- On market clears

Beat the Quote

- General: New offer must increase (or maintain) magnitude of "winning" amount, according to current quote.
- Single-Unit: Buy offer price must meet or beat ASK (and Sell/BID).
- Multi-Unit: OK to ignore "out of the money" amounts.
- Can be applied in conjunction with Beat-your-Own (Dominance).

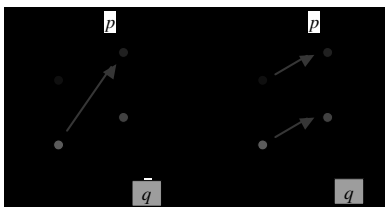
Clearing Policy

- *Clear*: Translates offers into agreed trades, according to specified rules.
- Policy choices:
  - When to clear
  - Who gets what (*allocation*)
  - At what prices

Clear Timing

- At specified intervals
- On each bid
- On inactivity
- On other designated events

Allocation



Pricing Policy

- Uniform vs. Discriminatory
- First (worst winning) vs. Second (best losing)
- Buyers' vs. Sellers'
- Earliest vs. Latest
- Anywhere in between...

That's it!