Bidding Clubs

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What kind of intelligent system could help bidders in an auction?

- proxy bidders (eBay, etc.)
  - really just transform English into 2nd-price auction
- automation
- aggregation of information from different auctions
- bidding advice, decision support
- bidding clubs
  - instead of helping one user, help a group
    - aggregate bidders' market power
    - unlike "buyer clubs", bidders' interests not aligned
  - self-enforcing collusive agreement: increase expected utility

Collusion Example

- Imagine a first-price auction with 6 bidders, 3 of whom decide to collude in advance
  - Is there a pre-agreement that can benefit some, but penalize none?
- Naïve proposal:
  - each bidder submits her valuation
  - the two low bidders drop out
  - the bidder with the highest valuation bids lower in the main auction
- Bidders have an incentive to lie in the pre-auction!
  - this is true even if the high bidder pays the other two to drop out

Bidding Clubs

* *with Y. Shoham, M. Tennenholtz* (EC'00)

- Bidders:
  - $N = \{1, 2, ..., n\}$: a set of bidders who will participate in an auction, A
  - $G \subset N$: a set of bidders who are invited to participate in a pre-auction
- Coordinator c:
  - Can c hold a pre-auction that will benefit some of G and penalize none?

Assumptions: Coordinator

The coordinator:

- invites some subset of bidders to participate
  - non-binding invitation
- may enforce payments from, between bidders
- cannot cost money to operate
- acts only as a representative of bidders
  - why can it be trusted to act reliably?
  - one way of looking at it is that c combines with A to form a new mechanism
  - c's behavior is fully specified, common knowledge

Assumptions: Bidders

- IPV model, no externalities
- IID from distribution F
- First-price auction equilibrium bid:
  - $b(F, n, v)$
- F regular:
  - $b(F, n{+}1, v_i) > b(F, n, v_i), n \geq 2$

Deviation from standard GT setting

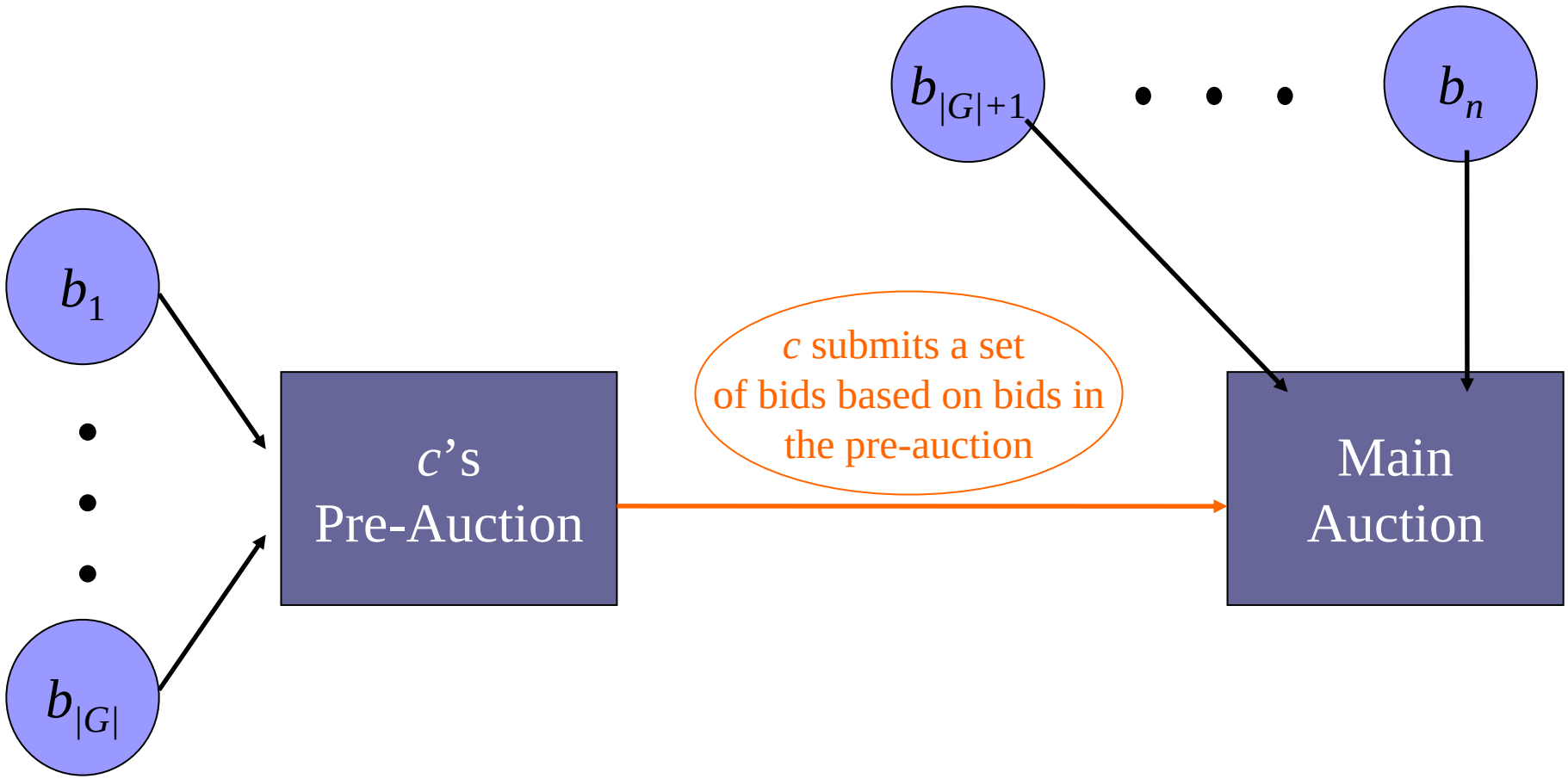
- Uninvited agents are not aware of the possibility of the existence of a coordinator
  - they believe that each bid placed corresponds to a single bidder
    - they may be wrong about the number of bidders "actually" participating in auction
  - Is this realistic? Maybe so for electronic auctions.
- Equilibrium concept
  - "Bayes-Nash with misconceptions"

Bidding Club Protocol

1. Coordinator c invites agents from G to participate in a pre-auction
2. Bidders decide whether to accept the invitation
3. c asks agents for their valuations
   - agents may lie!
4. c bids on behalf of some or all bidders in the main auction
5. c may impose monetary transfers between and from bidding club members

Problem Illustration

(assuming all invited bidders participate in the pre-auction)



Utility-Improving Coordinator

1. Every agent in G who would have participated in A will choose to participate in the bidding club

2. Each agents' expected utility from participating in the bidding club is greater than his expected utility in A

Second-Price Auction: Protocol

** in the spirit of Graham & Marshall, 1987*

A utility-improving coordinator exists for second-price auctions.

1. Agents from G submit valuations to coordinator c
2. If any agent chose not to participate:
   - submit a bid for each agent i who did elect to participate with price offer v_i, and end the protocol
3. Let v_1, v_2 be the two highest valuations announced, by agent 1 and agent 2 respectively
4. Only agent 1 is represented in the main auction, with a bid of v_1
5. If agent 1 wins, he must pay v_{sec} to the auctioneer and max(v_2 – v_{sec} , 0) to c
6. c gives a payment of p to all agents in G

Calculating p

Assume agents truthful, participate

- Taking into account only n, $|G|$, F, it is possible for c to calculate his expected gain, g
  - c gains whenever both the global highest and second-highest bids are members of the bidding club
- Pick any $s \geq |G|$; set $p = g/s$
- On expectation c will:
  - be budget balanced when $s = |G|$
  - make a profit when $s > |G|$

Why this works

- Incentive Compatibility:
  - With $p = 0$, the allocation rule and payment rule are exactly the same as in second-price auction
    - the standard argument for incentive compatibility applies
  - p does not depend on agents' declarations, so this payment does not affect agents' strategies
- The bidding club increases agents' expected gain
  - Exactly the same outcome as in second-price auction
    - But: all bidders receive an additional payment of $p > 0$
  - Declining participation is not informative:
    - All bidders from G will bid their valuations

Observations

- The coordinator's maximum loss in a given round is $|G|p = |G|g/s$.
  - Since s may be arbitrarily big, maximum loss may be set arbitrarily close to 0
  - c keeps all but an arbitrarily small fraction of g
- Efficiency of the auction is preserved
  - Revenue equivalence: doesn't hold because a bidder in G who bids 0 can still gain p

First-Price Auction: Protocol

A utility-improving coordinator exists for first-price auctions

1. Agents from G submit valuations to c
2. If any agent declined to participate
   - submit a bid for each agent i who did elect to participate with price offer $b(F, n, v_i)$, and end the protocol
3. Submit a bid for (only) the bidder from G with the highest valuation, of $b(F, m, v_1)$, $m = n - |G| + 1$
4. If he wins, his payment to c is $b(F, n, v_1) - b(F, m, v_1)$
5. c gives a payment of p to all agents in G

Calculating p

Assume agents truthful, participate

- Taking into account only n, $|G|$, F, it is possible for c to calculate his expected gain, g
  - c gains $b(F, n, v_1)$ - $b(F, m, v_1)$ whenever the globally highest bidder is a member of G
- Pick any $s \geq |G|$; set $p = g/s$ as before

Why this works

- Incentive Compatibility:
  - With $p = 0$, the allocation rule and payment rule are exactly the same as in first-price auction
    - c implements a revelation mechanism
  - p does not depend on agents' declarations, so this payment does not affect agents' strategies
- The bidding club increases agents' expected gain
  - Exactly the same outcome as in first-price auction
    - But: all bidders receive an additional payment of $p > 0$
  - Declining participation is not informative:
    - Every agent in G will follow the equilibrium strategy
- The bidding club benefits agents outside G
  - their equilibrium bids are reduced

Other bidding club protocols

- I've described:
  - Second-Price (/Japanese)
  - First-price (/Dutch)
- Other protocols:
  - General mechanisms
    - with valuations drawn from a finite set
  - N parallel 2nd-price auctions for substitute goods
  - Two parallel auctions for complementary goods