MAS Assignment 2:
Auctioning with Leveled Commitment

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Introduction

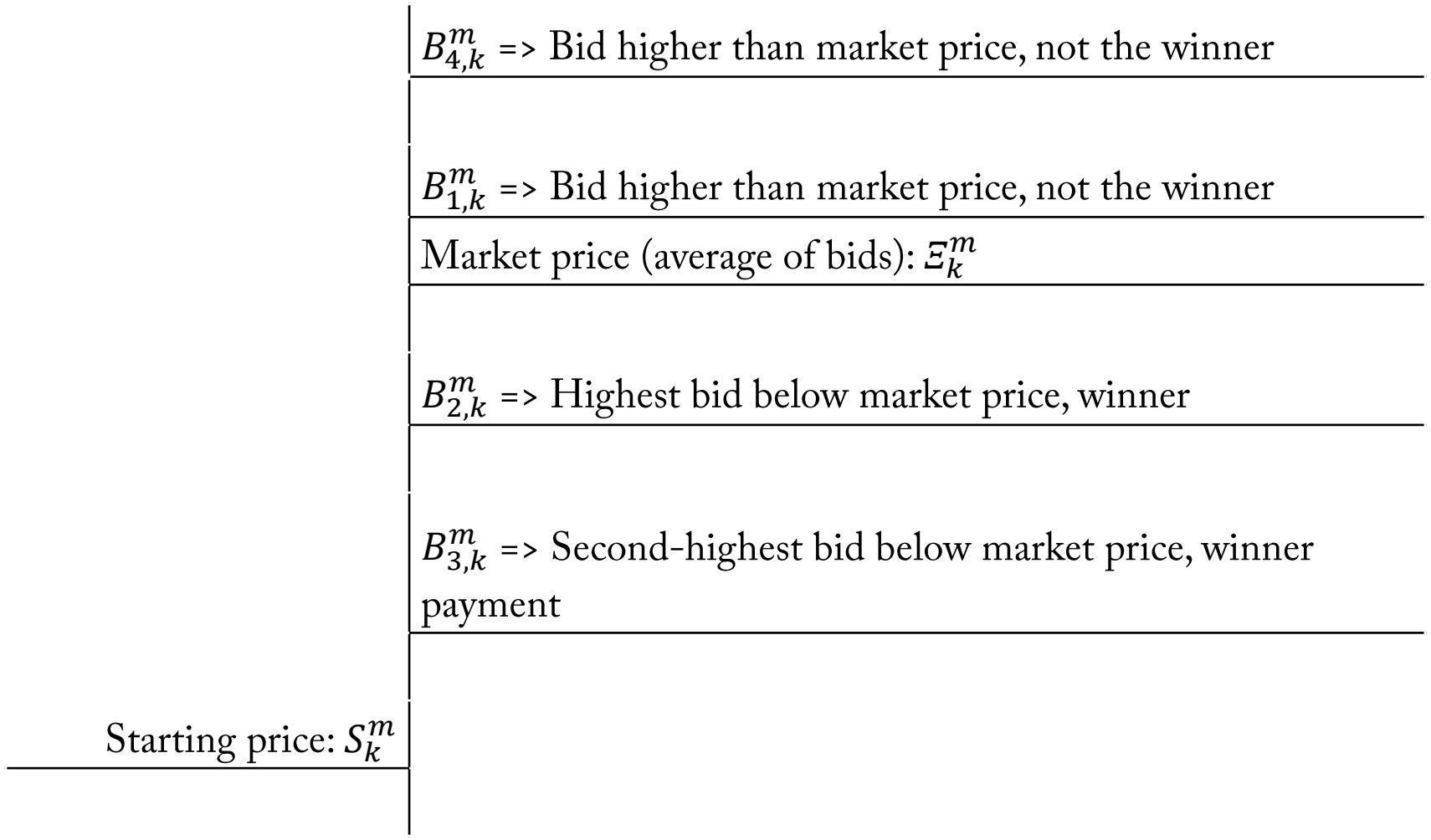
One way to organize the process of resource distribution is to organize an auction, where the one who values the resource the most is going to win paying a high price. In "**pure**" auctioning buyers are not allowed to decommit from the deal made in an auction.

In order to make the auctioning process more flexible we might want to allow the buyers to break a previous deal, paying a penalty to the seller, in favor of a more profitable new deal. Auctions of that type are called **auctions of leveled commitment**.

Auction Scenario

- Modified second-price sealed-bid (Vickrey) auction organized in rounds
- Each seller organizes one auction in every round
- Seller sets an auction starting price and buyers place their bets
- Based on the bid values, a market price (average) is computed
- Auction winner is the buyer which bid was highest below the market price
- The winner pays the amount of the second-highest bid (below market price) to the seller
- Buyer can be a winner of only one auction per round
- Both buyers and sellers aim to maximize their profits

Example Auction Visualization



Profits of Buyers and Sellers

b_i - a value of second-highest bid paid in auction i.

Ξ_i - a value of market price in auction i.

Profit of seller k: $p_{s_k} = \sum b_i$

Profit of buyer n: $p_{b_n} = \sum(\Xi_i - b_i)$

Bidding Strategy

An example strategy is provided in the Assignment Description.

In the example bids of every buyer are adapting to the results of participating in auctions organized by a particular seller.

Bid of buyer n in an auction of seller k: $B_{n,k} = \alpha_{n,k} S_k$

Bidding factor of buyer n in an auction of seller k:

$$\hat{\alpha}_{n,k} = \begin{cases} \underline{\Delta}_n \alpha_{n,k}, \text{ if } (B_{n,k} \text{ won}) \vee (B_{n,k} \geq \Xi_k) \\ \overline{\Delta}_n \alpha_{n,k}, \text{ otherwise} \end{cases}$$

Note: that you are free to experiment and implement something of your own.

Leveled Commitment

If a buyer won an auction it is still interested to make more profit, than it currently secured.

Therefore the buyer is going to participate in the following auctions in the same round. But the buyer will bid such that the expected profit from the new deal will be at least the profit currently secured + value of penalty fee to be paid for annulling a result of the previous auction.

f_i - a value of decommitment fee paid in auction i.

$$p_{s_k} = \sum b_i + \sum f_j$$

$$p_{b_n} = \sum (\Xi_i - b_i) - \sum f_j$$

$$B_{n,k} = \alpha_{n,k} S_k \ - \left(\left(\Xi_x \ - b_{n,x} \right) + f_{n,x} \right)$$

Goal

Design and implement the described auctioning scenario for “pure” and leveled commitment cases.

Model Outputs

For each auction simulation output:

- Statistics of market price development across rounds
- Resulting profits of sellers
- Resulting profits of buyers

For details see Assignment Description.

Remarks

- Buyers are assumed to have unlimited resources. Only the profits matter.
- Any random number generated is assumed to be generated from the uniform random distribution, same for all affected entities (buyers/sellers/items).

Report

In your report address the following key questions:

1. What can you deduce from your experiments with different parameter values?
2. What is combination of the parameters in your opinion comes closest to the “ideal” auction?
3. How realistic is the developed model? In what ways can it be improved?

How to start?

- Understand the problem.
- Apply the described auctioning mechanism in basic scenarios without leveled commitment.
- More information on the suggested timeline is in the Assignment Description.

- Now, we need to form groups of 4. Please self-enroll through Student Portal **before leaving the class!**
- In case of problems in self-enroll please send **one** e-mail per group with your names to amir.ahangi@maastrichtuniveristy.nl.

Questions?