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June 15, 2026
Due date: June 22, 2026 at 8:00 p.m.

Algorithmic Game Theory

Summer Term 2026

Exercise Set 7

If you would like to submit your solutions for this problem set, please send them via email to aheuser1@uni-bonn.de by Monday evening. Submitting solutions in groups is also possible.

If you would like to present one of your solutions in class, please use the following link to book a presentation slot by Monday evening:
https://terminplaner6.dfn.de/b/d2405c9e09de3d9a053139554df6413c-1799178
A short meeting to discuss your solution is mandatory before presenting it in class. To book a time slot for this meeting, please use the following link by Monday evening as well:
https://terminplaner6.dfn.de/b/5d3b459adc92851c2723a9bb0c5eadc1-1799186

Exercise 1:
Recall the auction of k identical items from the previous exercise sets. Bidder i has value v_i if he/she gets one of the items, 0 otherwise.
We define a mechanism as follows: the bidders who reported the k highest bids win an item. Each of them has to pay their respective bids.
Show that if losers (i.e. bidders who do not get any item) pay their bids, this mechanism is $(\frac{1}{2}, 2)$-smooth.

Exercise 2:
Recall the valuation functions of single-minded bidders from Definition 12.2. Let the maximum bundle size be defined by $d = \max_{i \in \mathcal{N}} |S_i^*|$. Show that in the case of single-minded bidders with maximum bundle size d, item bidding with first price payments is $(\frac{1}{2}, 2d)$-smooth.

Hint: In order to define deviation bids $b_{i,j}^*$, consider a welfare-maximization allocation on v. If bidder i does not get his bundle in the optimal allocation, then define $b_{i,j}^* = 0$ for all items $j \in M$. Otherwise, define $b_{i,j}^* = \frac{v_i}{2d}$ for all $j \in S_i^*$ and $b_{i,j}^* = 0$ if $j \notin S_i^*$. That is, each winner in the optimal allocation equally divides the value for his bundle among all items of the bundle and bids half of it.

Exercise 3:
Show that if a mechanism is (λ, μ)-smooth and players have the possibility to withdraw from the mechanism then $PoA_{\mathsf{CCE}} \leq \frac{\max\{1,\mu\}}{\lambda}$.