



## Exercises for Algorithmic Game Theory

<http://www.mpi-inf.mpg.de/departments/d1/teaching/ss11/AGT/>

### Assignment 5

Deadline: Mo 17.11.2012

#### Exercise 1 *Greedy mechanisms for single-minded bidders*

Consider variants of the greedy mechanism presented in class, where agents are sorted differently, and the payments are adjusted accordingly (payments are still critical). Explain why these variants do not perform as well as the presented mechanism, and explain what exactly is the problem with each of these modifications. Give (small) examples where appropriate.

- sort agents by decreasing valuation
- sort agents by increasing size of their desired subset
- sort agents by decreasing order of  $v_i^*/|S_i^*|$

#### Exercise 2 *Interval auctions*

Consider an auction for items  $1, \dots, m$ , where each bidder is single-minded and desires an interval of consecutive items, i.e.  $S_i = \{j | a_j \leq j \leq b_j\}$  where  $1 \leq a_j \leq b_j \leq m$ . Prove that in this case the socially efficient allocation can be determined in polynomial time.

Hint: use dynamic programming.

#### Exercise 3 *An efficient auction*

Consider a combinatorial auction for  $m$  items among  $n$  bidders, where each valuation is represented as a vector of  $2^m - 1$  numbers (a value for each possible subset). Prove that the optimal allocation can be computed in polynomial time. What is the size of the input?