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Deadline: Beginning of next lecture

Algorithmic Game Theory

Fall 2016

Exercise Set 10

Exercise 1: (2 Points)
Consider TCP games on **general networks** where each edge is a channel of some capacity. Each player sends at a certain rate s_i along a predetermined path, and his/her utility is the rate r_i at which the traffic arrives at the destination.

Show that, if all channels use the same **Strict Priority Queuing** policy (see lecture notes), then the result proved for a single channel extend (the game is NBR-solvable with clear outcome and therefore PIED converges and is incentive compatible).

Exercise 2: (2 Points)
Prove that the Best-Response Mechanism for Stable Matching converges and is incentive compatible for any acyclic instance (see the lecture notes for definitions).

Exercise 3: (2+1+2 Points)
Consider auctions for selling one item and n bidders with valuations $v_1, \ldots, v_n$ of this item. Both the valuations and the possible bids belong to a set of discrete values:

$$\{0, \delta, 2\delta, \ldots, k\delta, \ldots\}$$

where $\delta > 0$.
Consider a **repeated** 1^{st}**-price** auction. Go over the bidders in a fixed order (round robin):

1. The bidder under consideration can increase his/her bid, or pass.
2. If in a certain round all bidders pass, the auction terminates: the highest bidder wins the item and pays his/her bid.

Your task is:

1. Formalize this auction as a best-response mechanism, and show that the latter converges and it is incentive compatible.

   (Imagine for simplicity that, if an equilibrium is reached, then no player changes his/her bid anymore and the auction terminates.)

2. Given the valuations v_i, describe the equilibrium of this best-response mechanism.
3. Explain how you can deduce from this that 2^{nd}**-price** auction is truthful (reporting a bid different from the true valuation does not improve the utility of the corresponding bidder).

Note: You can assume that the auctioneer breaks ties in a fixed manner (if two or more bidders have the highest bid the auctioneer gives the item to the one with smallest index).