Multi-Agent Systems

B. Nebel, F. Lindner, T. Engesser | University of Freiburg
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Exercise Sheet 9

Due: July 17th, 2017, 10:00

Exercise 9.1 (Matching Markets, 3+3)

(a) Consider the market with buyers $\mathcal{B} = \{1, 2, 3\}$, sellers $\mathcal{S} = \{a, b, c\}$, and valuations

$$v_{ij} = \begin{array}{c|ccc} & \text{a} & \text{b} & \text{c} \\ \hline 1 & 6 & 5 & 4 \\ 2 & 5 & 2 & 3 \\ 3 & 4 & 3 & 2 \end{array}$$

Construct a set of market-clearing prices and find a perfect matching in the resulting preferred-seller graph, using the algorithms from the lecture. Your submission should include all intermediate steps.

(b) Prove the theorem from slide 51 of lecture 14 (Market-Clearing Prices – Optimality II).

Exercise 9.2 (Auctions as Matching Markets, 3+3+3)

We want to model single-item auctions as matching markets. This means there is only one good but n potential buyers. For each potential buyer b, let the true valuation for the good be given as ν_b.

(a) Model this auction as a matching market by providing $\mathcal{S}$, $\mathcal{B}$, and v.

(b) Assume that there are four agents with true valuations of $3, 3, 2$, and 1. From which subset of agents should the winner be chosen and how much should he have to pay? Answer these questions by providing a set of market-clearing prices and identifying a perfect matching in the preferred-seller graph.

(c) How does this result generalize? Provide market-clearing prices for the general case with arbitrary many agents and arbitrary non-negative valuations (but still only one single item) and show that they induce a perfect matching in the PSG.