

Multi-Agent Systems, october 2006

Provide short and clear arguments with each answer; answering with *yes* or *no* is not sufficient. Moreover, the answer given must be relevant for the question. Finally, your handwriting should be readable.

Open book exam All information provided on the EleUM pages of the course may be used during the exam.

This exam paper must be handed in together with the answers!

Agent architectures

question 1.a Discuss the advantages and disadvantages of reactive agents and of Brook's subsumption architecture in particular.

question 1.b Does the BDI architecture avoid the disadvantages of reactive agents without giving up the advantages of reactive agents? Motivate your answer!

Agent communication

vraag 2 Discuss all sub-problems of the Interoperability problem. What are the issues and what are possible solutions. Given your own example of each problem discussed.

Distributed rational decision making

question 3.a In an English and a Dutch auction used by humans, the auctioneer cannot improve its position by lying. Explain why.

question 3.b Should we consider the possibility of a lying auctioneer when designing English auction and Dutch action protocols for a multi-agent system. If the answer is yes, what should we do to make lying impossible. If the answer is no, why is lying impossible in a protocol implementing a English or a Dutch auction.

question 4 Show by giving an example that by making contracts between three agent i , j and k with $|T_{i,j}| = |T_{j,k}| = |T_{k,i}| = 1$ and $|T_{g,h}| = 0$ for all other agents, we need not be able to reach maximum social welfare.

question 5 Show with an example of two agents that the Grove mechanism is not individually rational if we use the following payment rule:

$$p_i = \sum_{j \neq i} v_j(\hat{x}, \theta_j) - 2 \cdot \sum_{j \neq i} v_j(\arg \max_x \sum_{k \neq i} v_k(x, \theta_k), \theta_j).$$

Note that this is an adapted Clark Mechanism.

Multi-agent planning

Agents Alice and Bob each have three tasks to perform,

$$t_1^{\text{Alice}}, t_2^{\text{Alice}}, t_3^{\text{Alice}}, t_1^{\text{Bob}}, t_2^{\text{Bob}}, t_3^{\text{Bob}}.$$

These tasks cannot be performed in an arbitrary order. The agents must satisfy the following execution order: $t_3^{\text{Bob}} < t_1^{\text{Alice}}, t_2^{\text{Alice}} < t_2^{\text{Bob}}$. Agents Alice and Bob wish to autonomously plan their tasks according to their personal preferences.

question 6.a Discuss how coordination *before* planning, coordination *during* planning and coordination *after* planning can be used to resolve possible conflicts in the above multi-agent planning problem.

question 6.b Give all minimal solutions of applying *coordination before planning* to the above multi-agent planning problem.