Dynamic Epistemic Logic

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Exercise Sheet 11

Due: February 2nd, 2017, 10:00

Exercise 11.1 (Avoiding infinite executions; 2+2+2+2 points)

In this exercise, we want to have a closer look at the partially observable chess example from the lecture (the one with uncertainty about the goal fields). In particular, we want to analyze how we can get rid of infinite executions by enabling the agents to draw additional conclusions from observed movement actions.

We define the *execution graph* for a group of agents $(a, T_a)_{a \in A}$ and a planning task $\Pi = \langle s_0, Act, \omega, \gamma \rangle$ as the directed graph $\langle V, E \rangle$ such that (1.) V is the set of all global states reachable from s_0 and (2.) $(s, s') \in E$ iff there is an $a \in A$ and an $\alpha \in T_a(\Pi)(s)$ s.t. $\omega(\alpha) = a$ and $s' \in Globals(s \otimes \alpha)$. The execution graph for a given agent type is the union of all execution graphs over all groups of agents of that type. The execution graph (for arbitrary agents) is the union of all execution graphs over all agent types.

(a) Draw the execution graph for the partially observable chess example.

(b) Define a modified version of the planning task, where a movement action towards the left (right) also signals the existence of a goal field at the left (right) to the other agent.

(c) Draw the execution graph for the modified task and optimally eager agents.

(d) What does the execution graph say about deadlocks and infinite executions?

Exercise 11.2 (Optimally eager agents; 2+2 points)

Prove the following propositions from the lecture:

(a) Let Π be a planning task and $(a, T_a)_{a \in A}$ a group of optimally eager agents. If $\pi_a = T_a(\Pi)$ is a maximal strong policy for each $a \in A$, then all executions of $(\pi_a)_{a \in A}$ are deadlock-free.

(b) Let Π be a uniformly observable and solvable planning task, and $(a, T_a)_{a \in A}$ a group of optimally eager agents. Then all executions by $(a, T_a)_{a \in A}$ of Π are finite.