Dynamic Epistemic Logic

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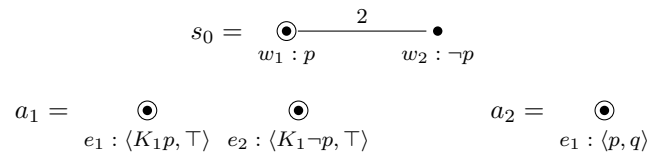Summer Semester 2019   Department of Computer Science

Exercise Sheet 8
Due: June 26th, 2019, 16:00

Exercise 8.1 (Action modalities; 1+1+1+1 points)

Consider the following epistemic state and actions:

$$s_0 = \quad \overset{2}{\underset{w_1\,:\,p \qquad w_2\,:\,\neg p}{\odot \text{———} \bullet}}$$

$$a_1 = \quad \underset{e_1\,:\,\langle K_1 p, \top\rangle}{\odot} \quad \underset{e_2\,:\,\langle K_1 \neg p, \top\rangle}{\odot} \qquad\qquad a_2 = \quad \underset{e_1\,:\,\langle p, q\rangle}{\odot}$$

Check whether the following formulas hold in s_0:

(a) $K_2[a_2]q$

(b) $K_2\langle a_2\rangle q$

(c) $K_1[a_1]K_2[a_2]q$

(d) $K_1\langle a_1\rangle K_2\langle a_2\rangle q$

Exercise 8.2 (Partially observable ontic actions; 2+2+2+2 points)

Let $s_0 = \odot\, w_1 : \neg p$ be a state where it is common knowledge between two agents 1 and 2 that $\neg p$. We now want to define two actions $Maysetp_1$ and $Maysetp_2$, where agent 1, respective agent 2, sets the value of p to $\top$ and the other agent is unaware whether or not this switch from $\neg p$ to p actually occurs (analogously to the $Mayread$ actions from last exercise sheet). E.g., one could imagine each agent having a private light switch for a room that both agent cannot observe.

(a) Define the actions $Maysetp_1$ for agent 1 and $Maysetp_2$ for agent 2.

(b) Calculate the composition $BothMaysetp = (Maysetp_1 \; ; \; Maysetp_2)$.

(c) Verify that $s_0 \models [BothMaysetp](K_1 p \wedge K_2 p \wedge \neg K_1 K_2 p \wedge \neg K_2 K_1 p)$.

(d) Let $Maysetp_2'$ be the action where agent 1 is unaware whether or not agent 2 sets the value of p to $\top$, but the switch actually does not occur. Verify that $s_0 \models [Maysetp_1][Maysetp_2'](K_1 p \wedge \neg K_2 p \wedge \neg K_1 \neg K_2 p \wedge \neg K_2 K_1 p)$.