

Dynamic Epistemic Logic

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Exercise Sheet 7

Due: December 15th, 2016, 10:00

Exercise 7.1 (Applicability of events, 4 points)

Recall the example from the lecture concerning a composition of read actions and its simplified form (in both cases, the precondition for e_1, e'_1 is p and the precondition for e_2, e'_2 is $\neg p$. For both e_1, e'_2 and e_2, e'_1 , the precondition is \perp):

$$\begin{array}{ccc}
 & & \text{b} \\
 & e_1, e'_1 & \text{-----} & e_2, e'_1 \\
 & \left| \text{a} \right. & & \left. \text{a} \right| \\
 (Read_a; Read_b) = & & & \\
 & e_1, e'_2 & \text{-----} & e_2, e'_2 \\
 & & \text{b} & \\
 \\
 Bothread = & e_1, e'_1 & & e_2, e'_2
 \end{array}$$

Show that from an arbitrary state, the application of $(Read_a; Read_b)$ and its simplified version $Bothread$ is equivalent, i.e., for any epistemic state s and formula $\varphi \in \mathcal{L}_{KC\otimes}^{\text{act}}(A, P)$, it holds that $s \models [(Read_a; Read_b)]\varphi$ iff $s \models [Bothread]\varphi$.

Exercise 7.2 (Public announcements, 4 points)

Show that $[pub(\varphi)]\psi$ (using the semantics of action model logic) is equivalent to $[\varphi]\psi$ (using the semantics of public announcement logic). Recall that the action model $pub(\varphi)$ is defined as $(\langle S, \sim, pre \rangle, s)$ with domain $S = \{s\}$, precondition $pre(s) = \varphi$, and $s \sim_a s$ for all agents a .

Exercise 7.3 (Action model for *Bothmayread*, 4 points)

Consider again the letter example from the lecture. Define an action model *Bothmayread*, in which both agents consider it possible that the other may have read the letter, and where, in fact, both read the letter. Apply the action to the example's initial state where both agents don't know the content of the letter and this is common knowledge.