

Computationele logica

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1 Exercise 1

1. The sentence θ encoding all information:

The Queen knows the following:

Alice knows Bob has a red hat. Alice knows Bob doesn't know it, and she knows the Queen knows this. Alice doesn't know her own hat.

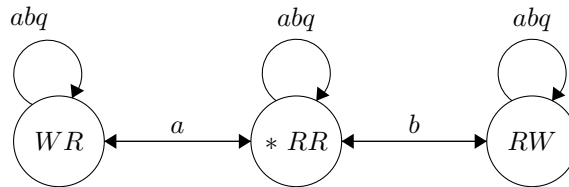
Bob knows Alice has a red hat. Bob knows Alice doesn't know it, and he knows the Queen knows this. Bob doesn't know his own hat.

$$\theta = K_q(K_a(r_b \wedge \neg K_b(r_b \vee w_b)) \wedge K_q((r_a \vee r_w) \wedge (r_b \vee r_w))) \wedge \neg K_a(r_a \vee w_a) \wedge K_b(r_a \wedge \neg K_a(r_a \vee w_a) \wedge K_q((r_a \vee r_w) \wedge (r_b \vee r_w))) \wedge \neg K_b(r_b \vee w_b))$$

2. A representation of the situation model **M**:

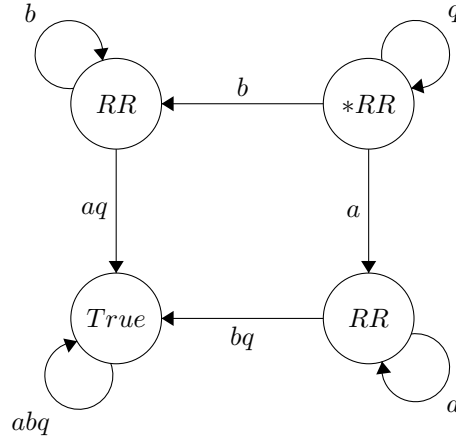
$\mathcal{A} = \{a, b, q\}$ the agents Alice, Bob, and the Queen

$\Phi = \{r_a, w_a, r_b, w_b\}$ written as WR for: a is white and b is red



This is an epistemic model: YES

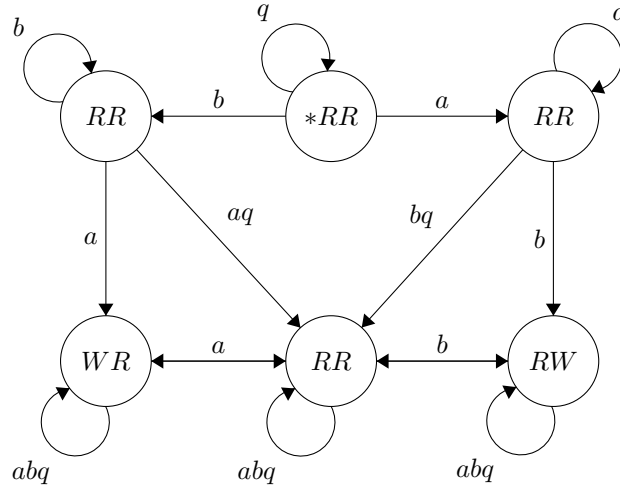
3. Separately a and b look in their mirrors and see their red hats, the queen sees everything, represented in the event model Σ with four actions:



This is an epistemic model: NO

This is a doxastic model: YES

4. The update product of the two models $\mathbf{M} \otimes \Sigma$:

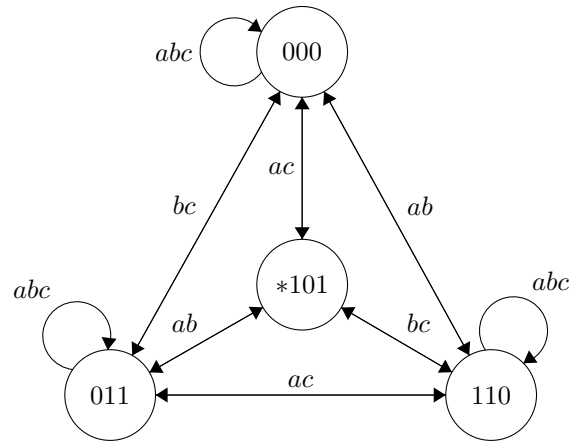


This is an epistemic model: NO

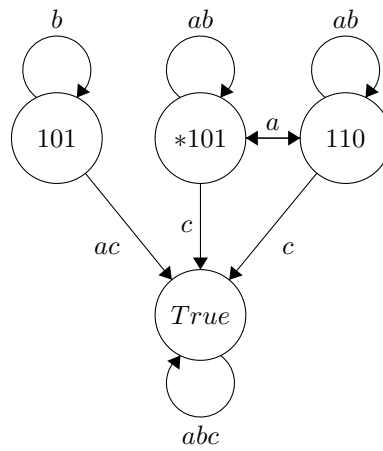
This is a doxastic model: YES

2 Exercise 2

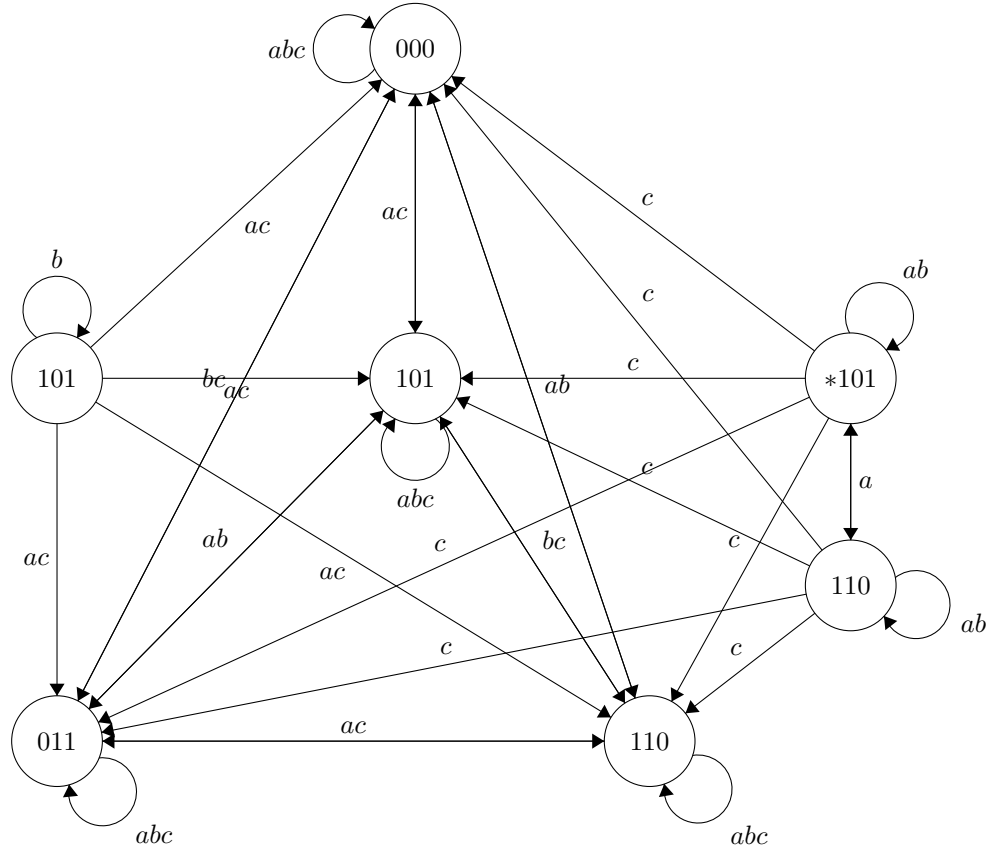
1. Representation of the bits world as an epistemic model \mathbf{M} :



2. Representation of event model Σ :



3. Representation of model \mathbf{M}' :

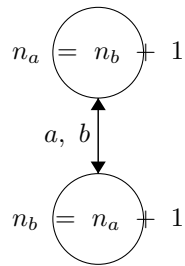


4. Representation of event model Σ' :

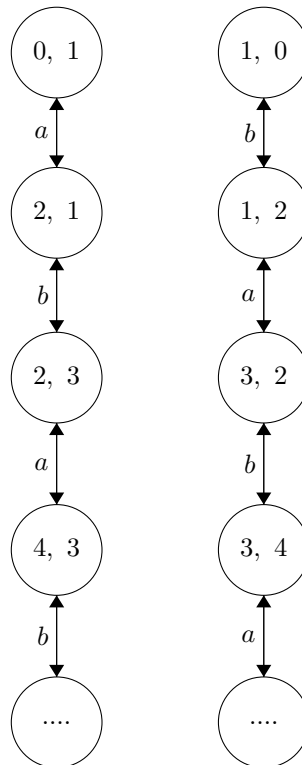
5. The update product of the two models $\mathbf{M}'' = \mathbf{M} \otimes \Sigma'$:

3 Exercise 3

1. *How many possible worlds* are there (that are consistent with the story above)?



2. Represent (draw) the above situation as an epistemic model M1, with two agents (a for Alice, b for Bob), using pairs of numbers (n_a, n_b) as “names” for the possible worlds. Draw the epistemic accessibility relations for each agent. but do not worry about the valuation (yet), since no atomic sentences are given yet.



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