Assignment 2

Mila Hendrikse, 11839058

November 16, 2017

1   The queen and the heads

1.1

Write a sentence θ in epistemic logic encoding all of the above information

$\theta = (r_a \wedge r_b) \wedge$

$(K_q r_a \wedge K_q r_b) \wedge$
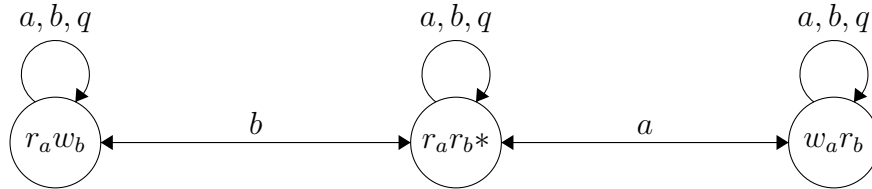
$(K_a r_b \wedge K_b r_a) \wedge$

$Ck(K_a(r_a \vee w_a)) \wedge Ck(K_b(r_b \vee w_b)) \wedge$

$Ck((r_a \wedge w_b) \vee (r_a \wedge r_b) \vee (w_a \wedge r_b))$

1.2

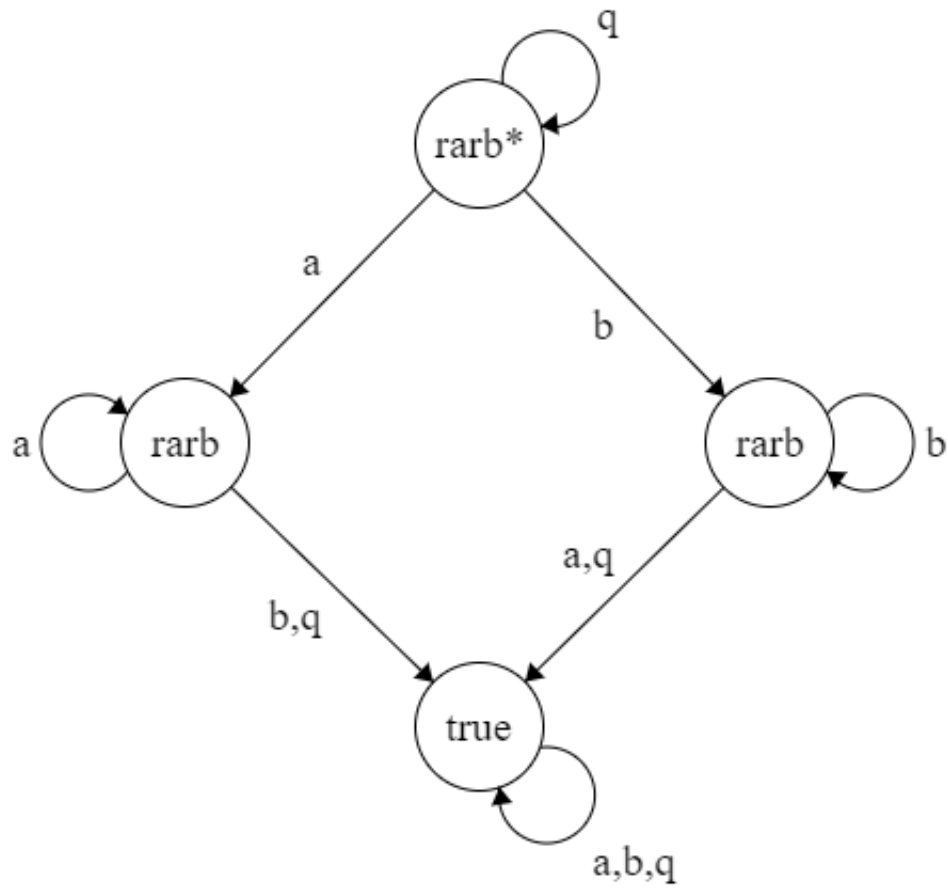*Represent the above situation as a state model M*

$M =$

Is this an epistemic state model?

Yes. It is reflexive, transitive and symmetric

1.3

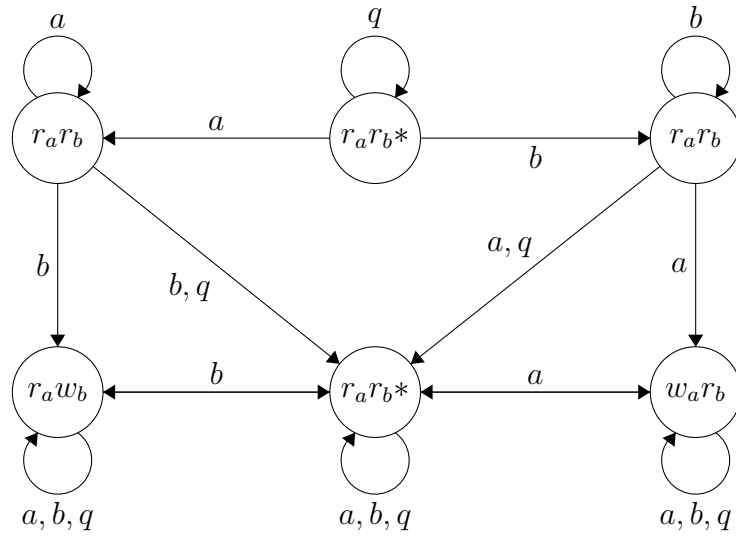*Represent all this scenario using a event model , with 4 actions.* $\Sigma =$

Is this an epistemic (event) model? No. It is not symmetric and not reflexive
Is it a doxastic (event) model? Yes.

1.4

Draw the resulting state model
$M \otimes \Sigma =$

a $\qquad$ q $\qquad$ b

$r_a r_b$ $\xleftarrow{\quad a \quad}$ $r_a r_b *$ $\xrightarrow{\quad b \quad}$ $r_a r_b$

b $\qquad$ b, q $\qquad$ a, q $\qquad$ a

$r_a w_b$ $\xleftarrow{\quad b \quad}$ $r_a r_b *$ $\xleftarrow{\quad a \quad}$ $w_a r_b$

a, b, q $\qquad$ a, b, q $\qquad$ a, b, q

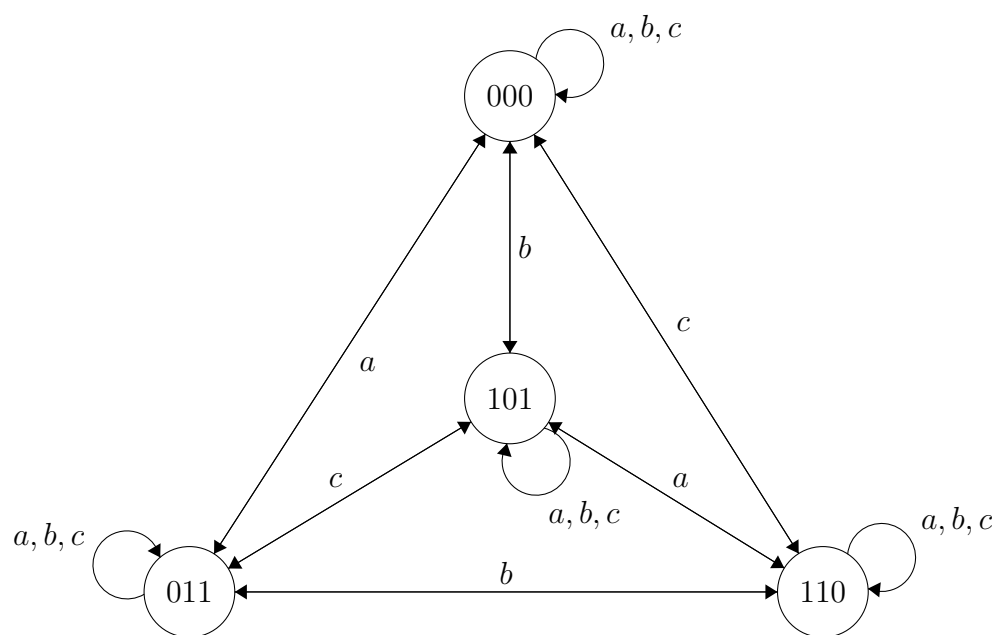*Is this an epistemic (event) model?*
No. It is not reflexive nor symmetric
Is it a doxastic (event) model?
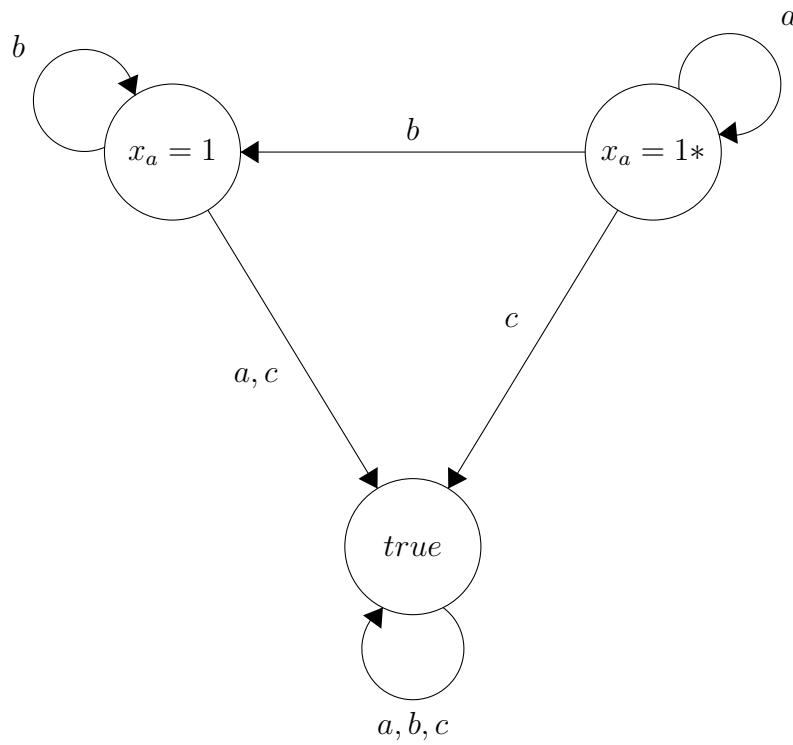Yes.

2 Bit problem

2.1

$M =$

2.2

Represent (draw) this action using an event model Σ with 3 actions.
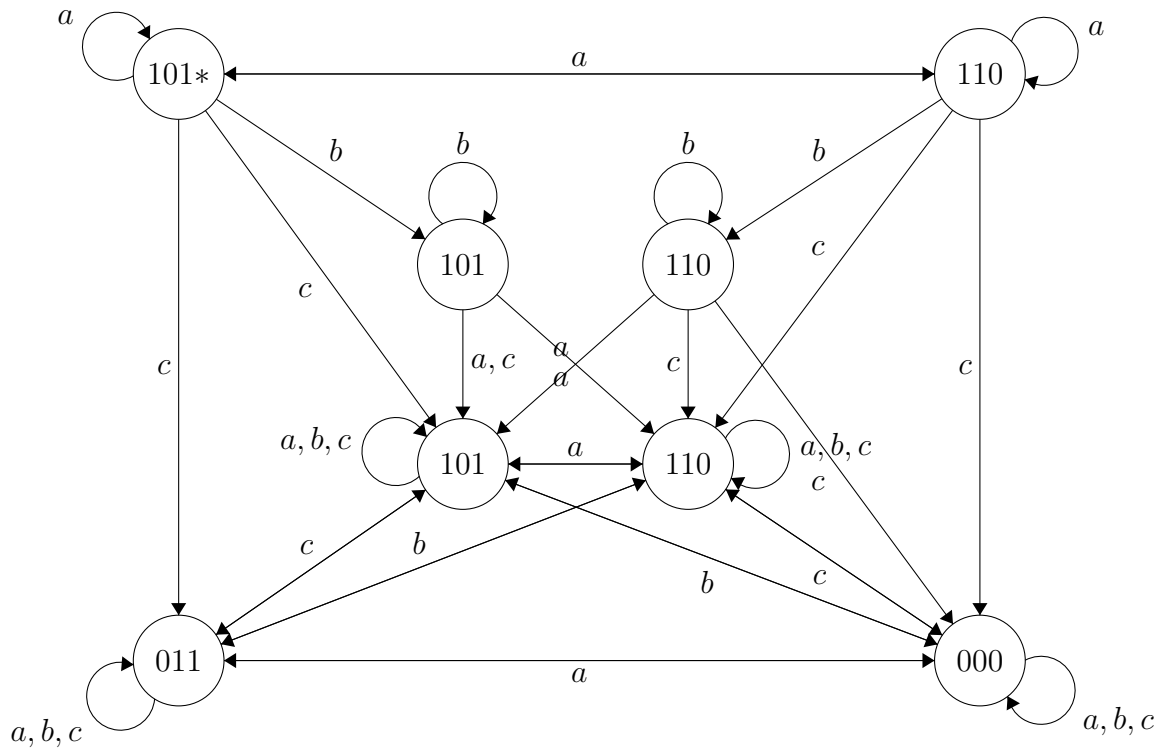$\Sigma =$

Is this an epistemic model, a doxastic model or none of the two? It is not epistemic (it is not reflexive nor symmetric). It is doxastix
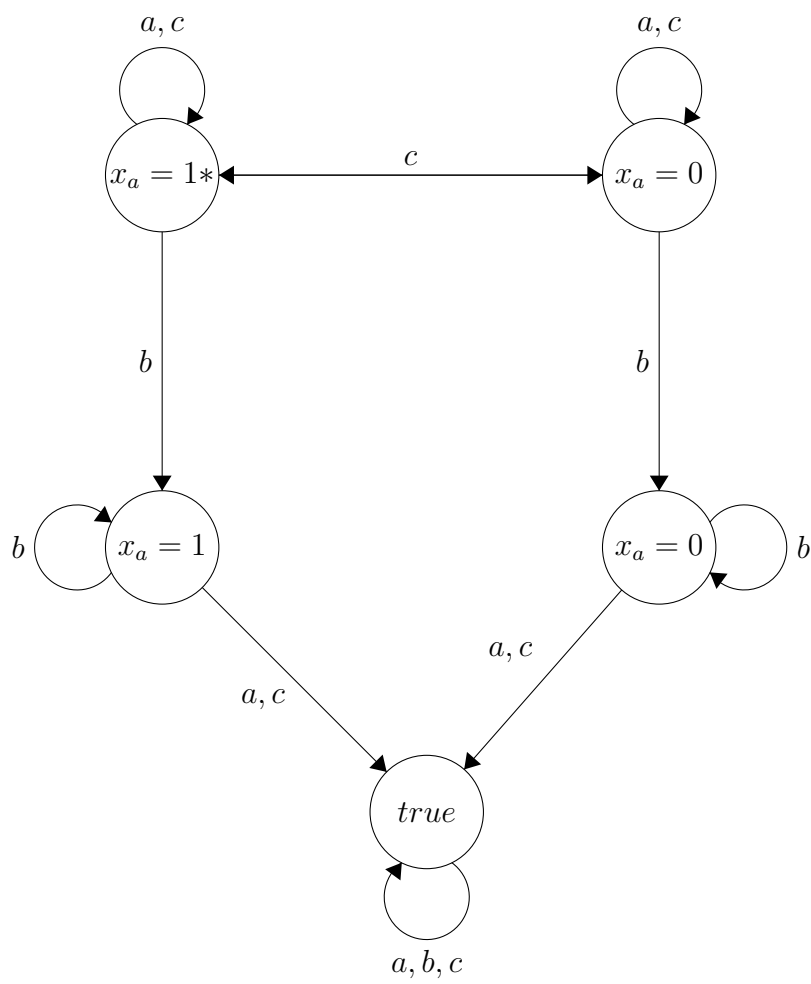
2.3

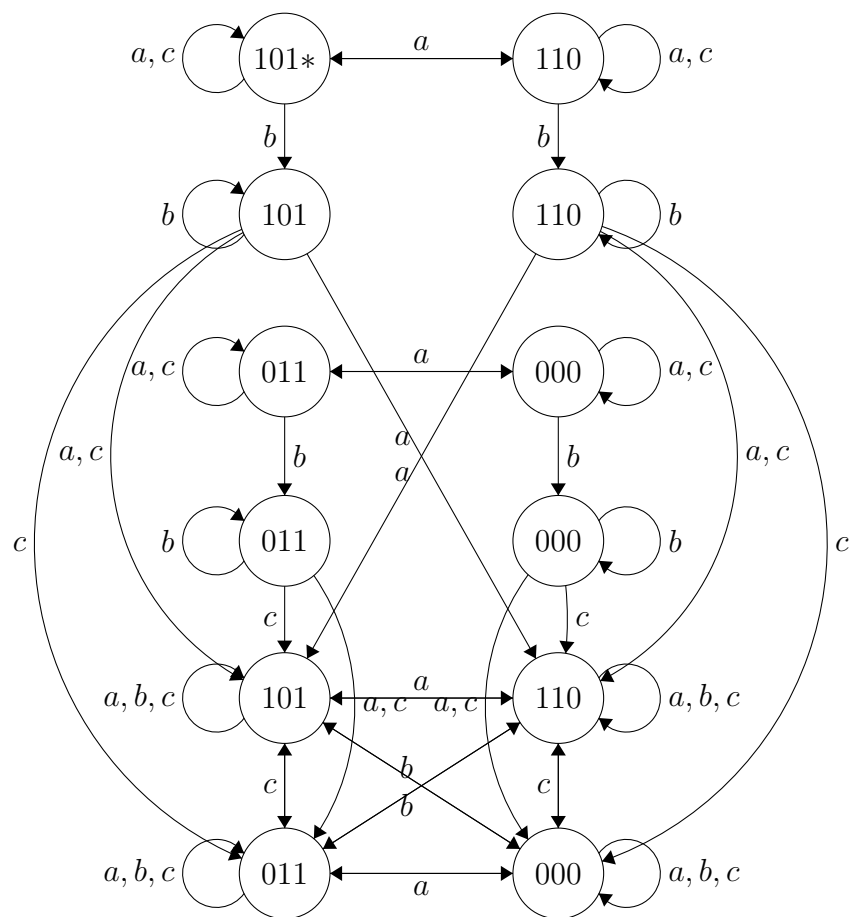*Represent (draw) a model M' for the situation after the action described in the previous part*

M' =

2.4

$\Sigma' =$

2.5

$M'' =$

3 Back of the head

3.1

How many possible worlds are there?
Because n can be any natural number from 0 to infinity, it is possible to make create infinitely many worlds that are pared, like this:
$W = \{(0,1), (1,0), (1,2), (2,1), (2,3), (3,2), ...\}$

3.2

Represent (draw) the above situation as an epistemic model M_1
Note: The accessibility relations of agent b (Bob) are not displayed in the model. This is because Bob has no knowledge of his number nor of Alice's number, so he considers every possible world as a possibility. So to finish the next model there should be a symmetric arrow for b from each world to each and every other world.

$M_1 =$
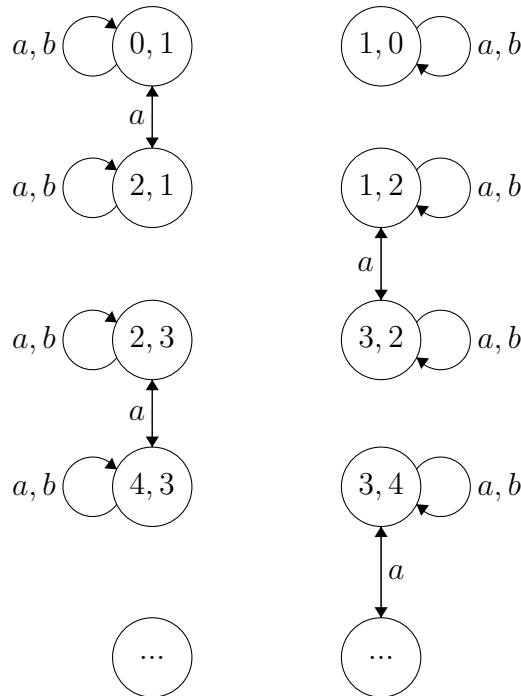
3.3

Note: If (y, z) is in the set of a valuation it represents the world where $n_a = y$ and $n_b = z$, so for example $(0, 1)$ is the world where $n_a = 0$ and $n_b = 1$

Answer:

Valuation of $0_a = \{(0, 1)\}$

Valuation of $0_b = \{(1, 0)\}$

Valuation of $1_a = \{(1, 0), (1, 2)\}$
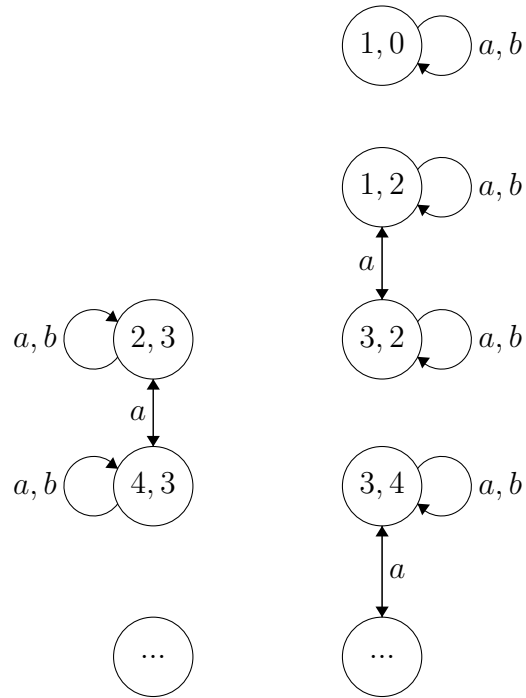
Valuation of $1_b = \{(0, 1), (2, 1)\}$

3.4

"I know that my number is NOT equal to 0"

$\phi = K_a(n_a \neq 0)$

3.5

Note: Again the accessibility relations of agent b (Bob) are not displayed in the model. To finish the next model also here there should be a symmetric arrow for b from each world to each and every other world. $M_2 =$
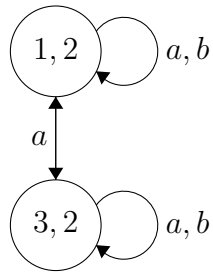
3.6

This announcement of Bob changes nothing compared to the last State Model, so $M_3 = M_2$

3.7

"I dont know"
$\psi = K_a(n_a = 1 \vee n_a \neq 1)$

3.8

$M_4 =$

3.9

Bob: *"I know that my number is not 1 because I know that my number is 2!"*
Bobs number is 2.