Assignment 2

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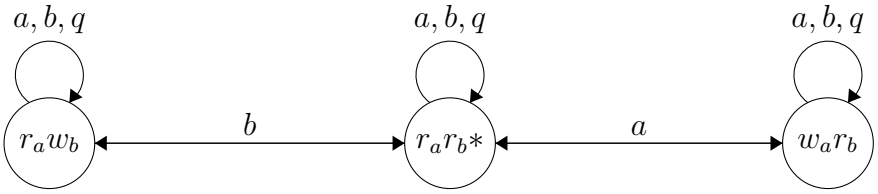
1 The queen and the heads

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

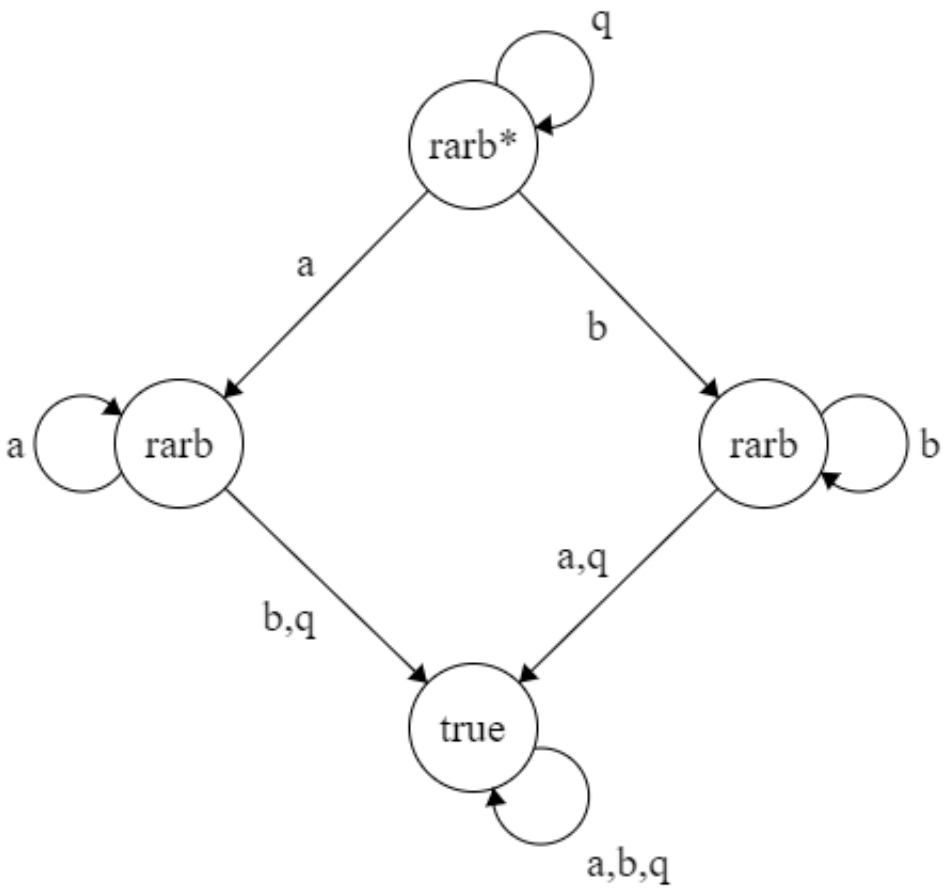
Represent the above situation as a state model M



Is this an epistemic state model?
Yes. It is reflexive, transitive and symmetric

1.3

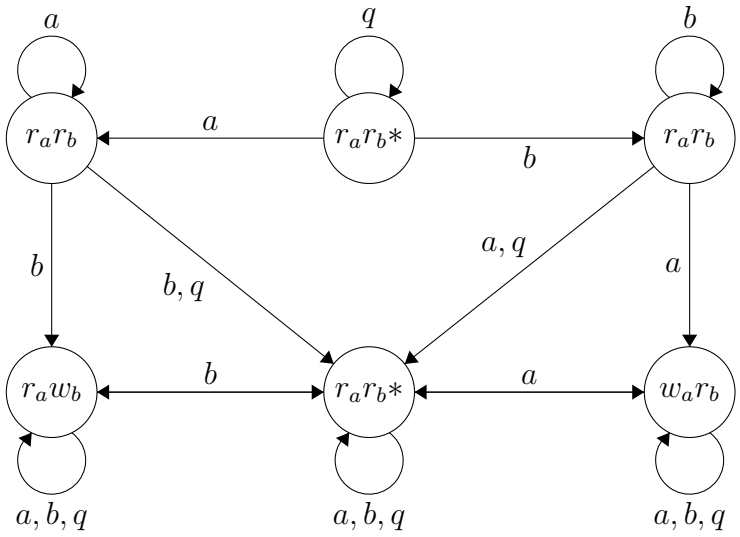
Represent all this scenario using a event model , with 4 actions.



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

1.4

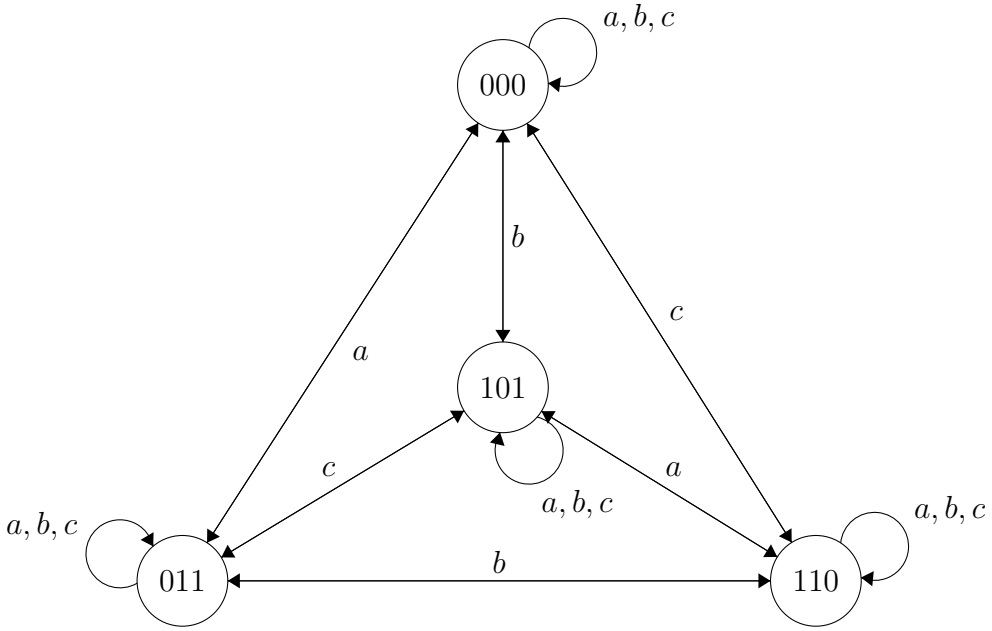
Draw the resulting state model



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

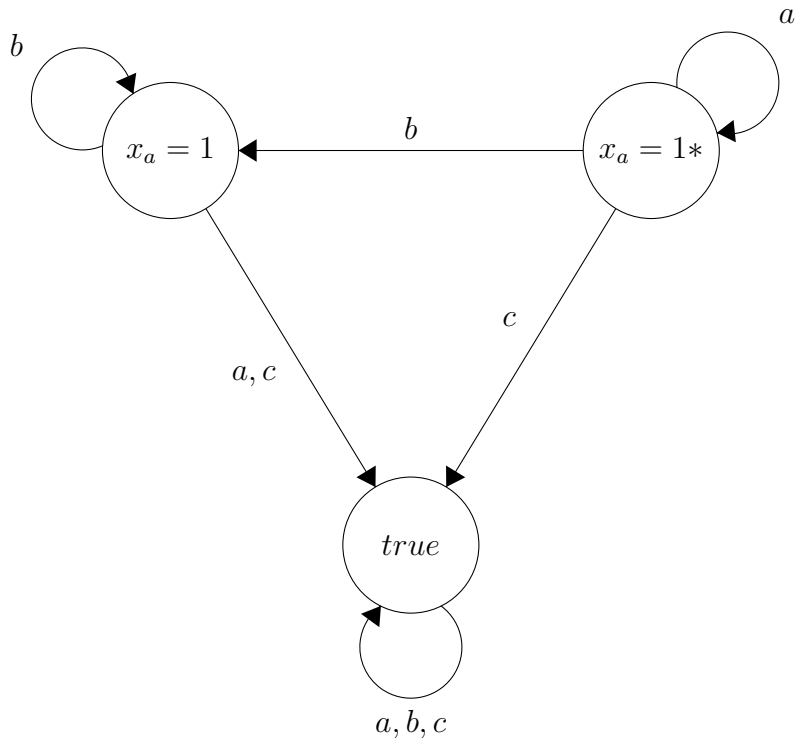
2 Bit problem

2.1



2.2

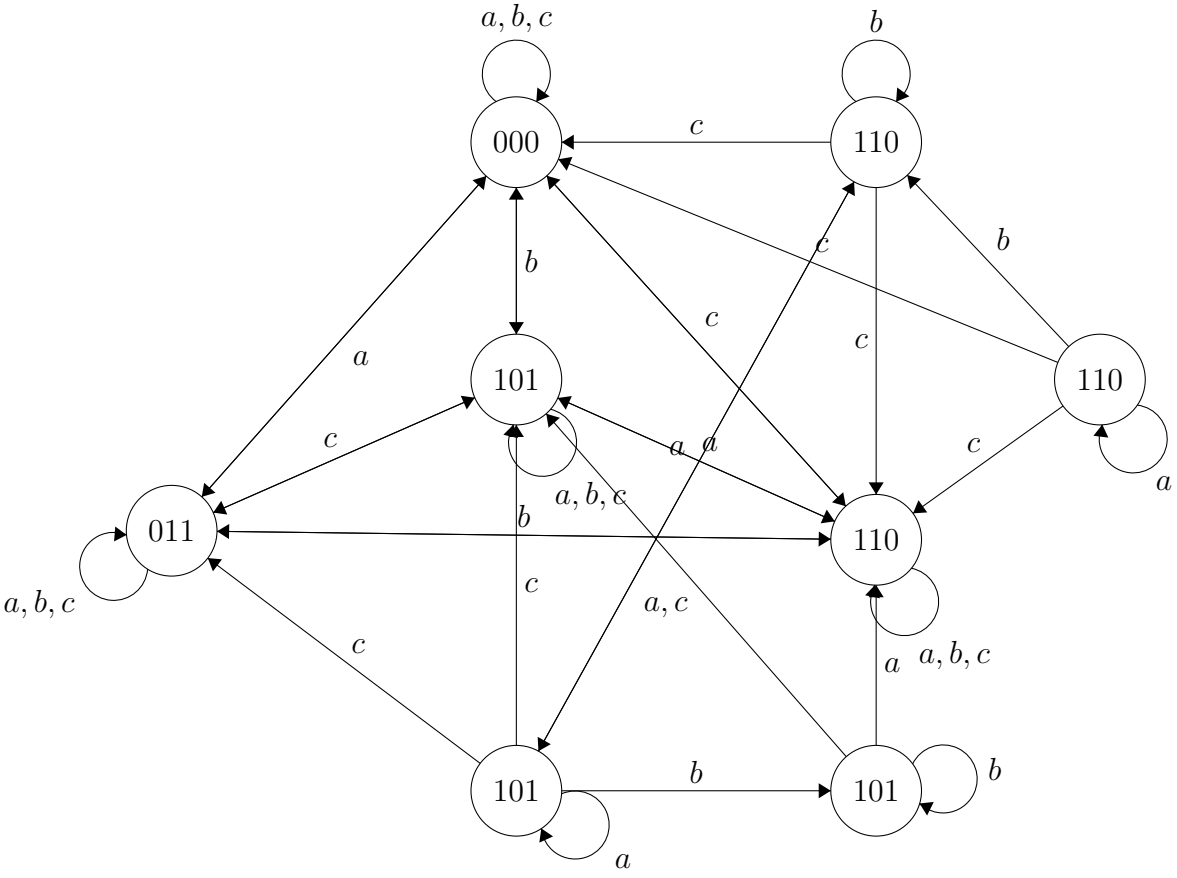
Represent (draw) this action using an event model Σ *with 3 actions.* M

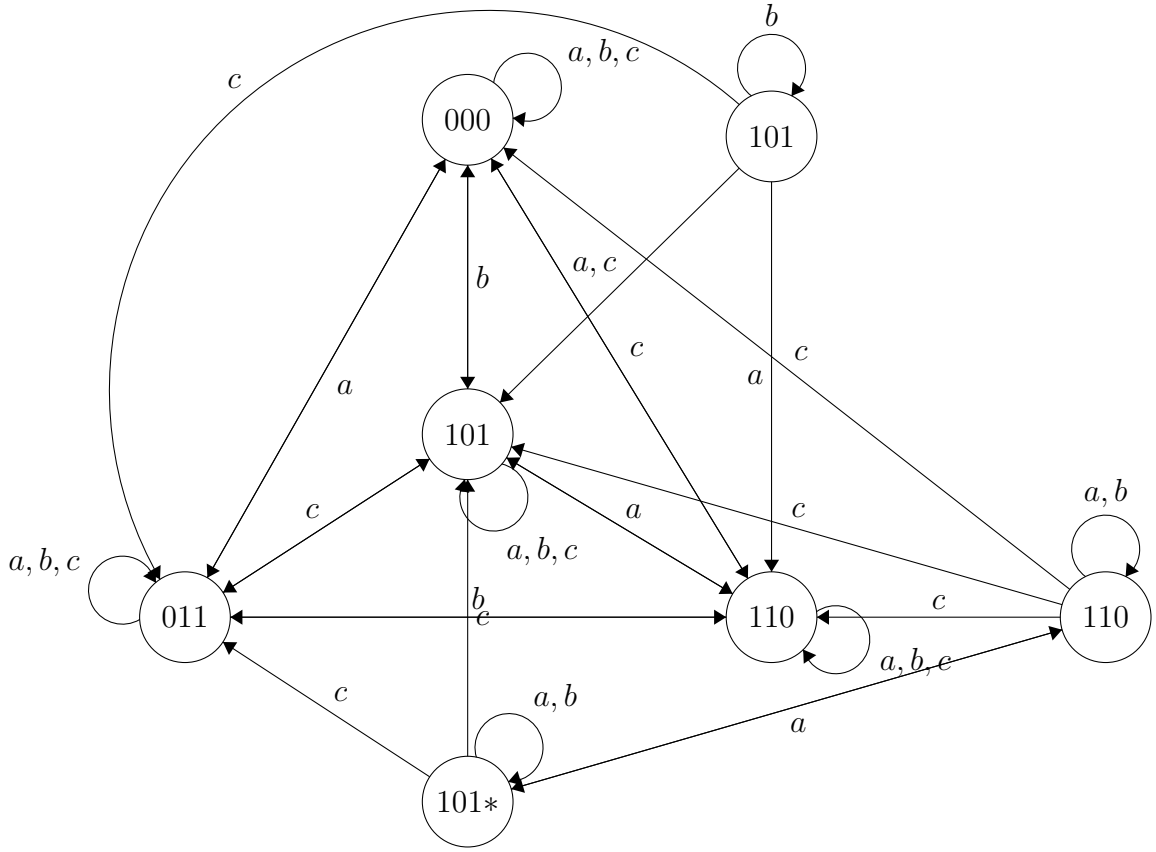


Is this an epistemic model, a doxastic model or none of the two? It is not epistemic (it is not reflexive not symmetric). It is doxastix

2.3

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





2.4

2.5

3 Back of the head

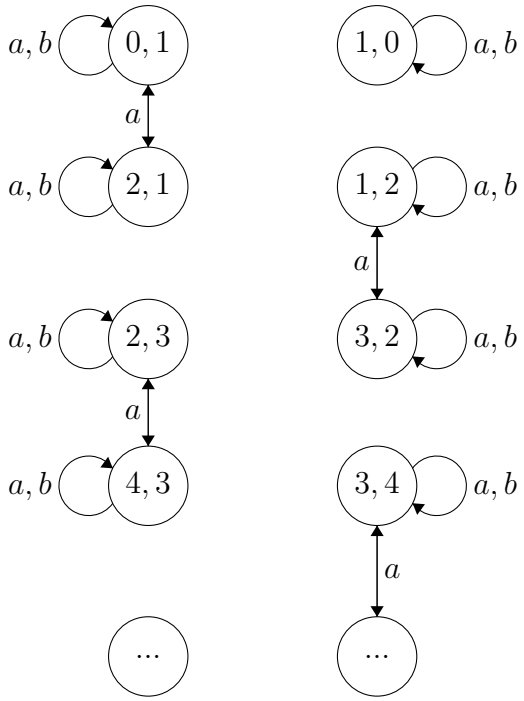
3.1

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

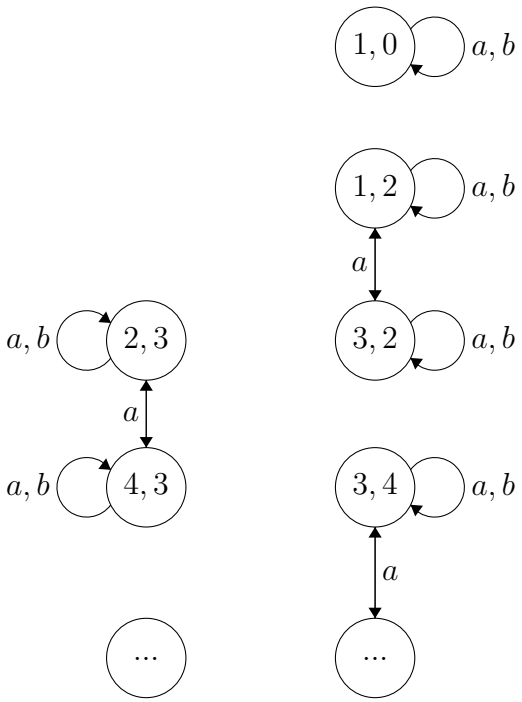
Valuation of $0_a = \{(0,1)\}$
Valuation of $0_b = \{(1,0)\}$
Valuation of $1_a = \{(1,0),(1,2)\}$
Valuation of $1_b = \{(0,1),(2,1)\}$

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

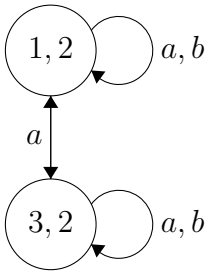
This anouncement of Bob changes nothing compared to the last State Model, so $M_3 = M_2$

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.