Network Analysis SS 17
Model checking

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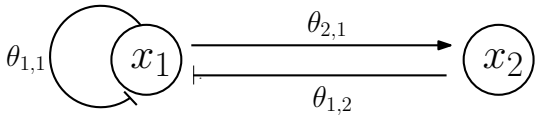
Deadline: Wednesday, 31 May, 08:00 am

1 Exercise *Tutorial*

Consider the model from the last exercise, with $\theta_{2,1} = \theta_{1,2} = 0.5$, and $\theta_{1,1} = 1.5$:

X_1	X_2	X_1'	X_2'
0	0	$\mathbf{K}_{11+12}$	0
0	1	$\mathbf{K}_{11}$	0
1	0	$\mathbf{K}_{11+12}$	$\mathbf{K}_{21}$
1	1	$\mathbf{K}_{11}$	$\mathbf{K}_{21}$
2	0	$\mathbf{K}_{12}$	$\mathbf{K}_{21}$
2	1	0	$\mathbf{K}_{21}$



The following CTL formulas are given:

$$a)\ AF(X_2 = 1) \qquad b)\ AG(X_2 = 1) \qquad c)\ EX(AG(X_2 = 1))$$

1. Consider the state transition graph for $\mathbf{K}_{21} = 1, \mathbf{K}_{11} = \mathbf{K}_{12} = \mathbf{K}_{11+12} = 2$. For each formula give the set of states for which it is true.

2. Consider the state transition graph for $\mathbf{K}_{21} = 1, \mathbf{K}_{11} = \mathbf{K}_{12} = 0$ and $\mathbf{K}_{11+12} = 2$. For each formula give the set of states for which it is true.

3. Consider the state transition graph for $\mathbf{K}_{21} = 1, \mathbf{K}_{11} = \mathbf{K}_{12} = 1$ and $\mathbf{K}_{11+12} = 2$. For each formula give the set of states for which it is true.

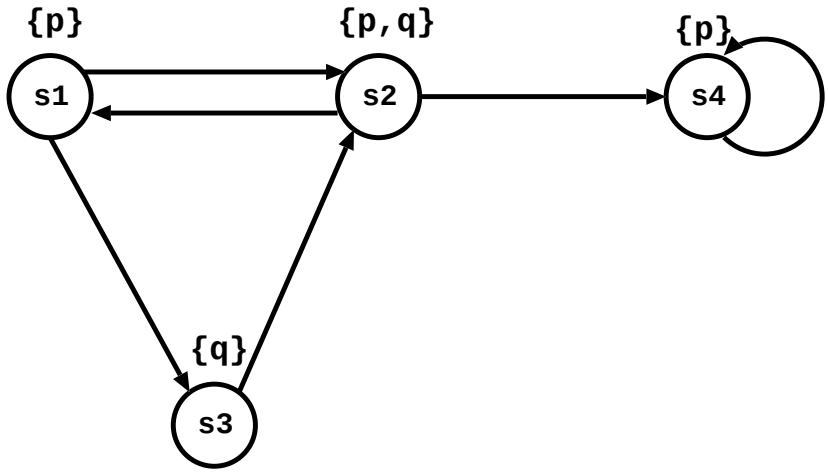
2 Exercise *Tutorial*

Which of the following pairs of CTL formulas are equivalent ?

1. EFp and $EG\,p$
2. $EFp \vee EF\,q$ and $EF(p \vee q)$
3. $AFp \vee AFq$ and $AF(p \vee q)$
4. AFp and $A[p\,U\,\text{true}]$
5. $EF(\neg p)$ and $\neg AFp$

3 Exercise

Given the following state transition graph:



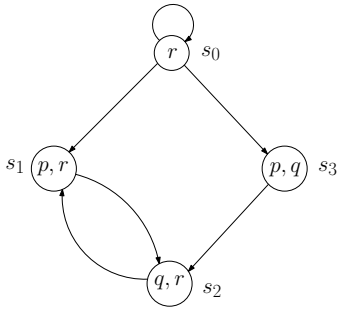
Use the labelling algorithm to determine all those states of G in which each the CTL formulas

1. *tutorial* $AF(E[p \cup q] \wedge EXp)$
2. *homework* $AF(EG(p \wedge q))$

are true.

4 Exercise *Homework*

Consider the transition system $(S, \to, L)$ where:



- The set of states is $S = \{s_0, s_1, s_2, s_3\}$
- The state transitions are
  $(s_0, s_0),\ (s_0, s_1),\ (s_0, s_3),\ (s_1, s_2),\ (s_2, s_1),\ (s_3, s_2)$
- The lableing function is given by
  $L(s_0) = \{r\},\ L(s_1) = \{p, r\},\ L(s_2) = \{q, r\},\ L(s_3) = \{p, q\}$.

Which of the CTL formulas below are satisfied in state s_0?

1. $AF(q \wedge r)$
2. $AG(p \to AF(p \wedge r))$
3. $A[r \cup q]$
4. $AG(p \to AG(p \vee r))$
5. $AG\ EF(\neg r)$

Justify your answers and send the solutions for exercise 3.2 and 4 until Wednesday 31. May, 08:00 am to `Annika.Roehl@fu-berlin.de`