EFREI | Master 1
Jeudi 7 avril 2016 | Documents non autorisés

DE (SCV)

Petri nets

Question 1 : Give, in each of the following four cases, either an arbitrary Petri net which has the given properties, or, if such a Petri-net does not exist, explain briefly why it does not exist.

— A live, deadlock free Petri-net..
— A Petri net which is quasi-live but not live.
— A Petri net which is live but not quasi-live.
— An unbounded Petri net which has a deadlock.

Hint : You do not need to give complex Petri nets. Petri nets with two places and two transitions (or less) are sufficient.

Question 2 : Consider the following Petri-net :

1. Draw the reachability graph of the Petri-net.
2. Is it bounded ?
3. Is the net quesi-life ? Does it contain a deadlock ?
4. Is it possible to fire transition t4 in this net ? If not, modify the net as little as possible so that t_4 can be fired.

Justify your answers.

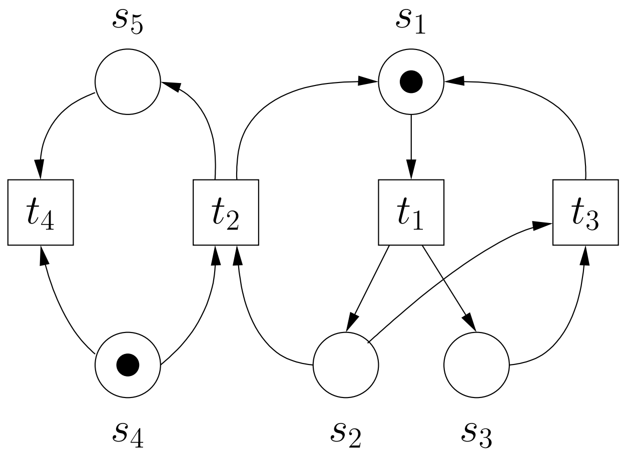

FIGURE 1 – A Petri net

Question 3 :

1. Give a Petri net with the reachability graph of Figure 1.

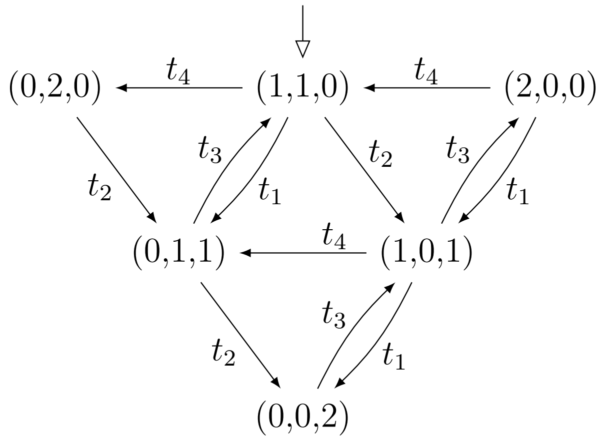

FIGURE 2 – Reachability graph

2. Give, if it does exist, a Petri net having the reachability graph of Figure 2. In case such a net does not exist, explain why.

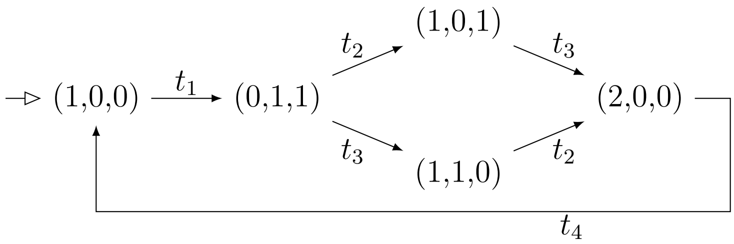

FIGURE 3 – Reachability graph

3. Give a Petri net with the coverability graph of Figure 3.

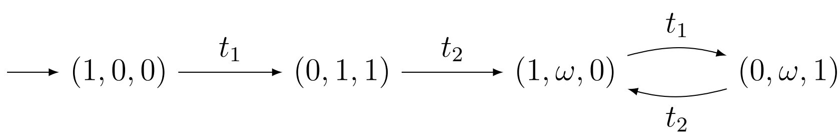

FIGURE 4 – Coverability graph

LTL and Büchi automata

Question 1 : Warm-up exercise on LTL

1. Express the `G` operator in terms of the `F` operator.
2. Express the `F` operator in terms of the `U` operator.

Question 2 :

1. Encode the following properties in LTL :
   (a) The light is always green.
   (b) Whenever the light is red, it eventually becomes green.
   (c) Whenever the light is green, it remains green until it becomes yellow.
   (d) Whenever the light is yellow, it becomes red immediately after.
2. Check whether the four LTL properties in the previous exercise are satisfied by our simple controller. For three over these four formulae justify your answer in English. For one of these four formulae, prove your answer by building the synchronized product of the negation of the formula and the model of Figure 4.

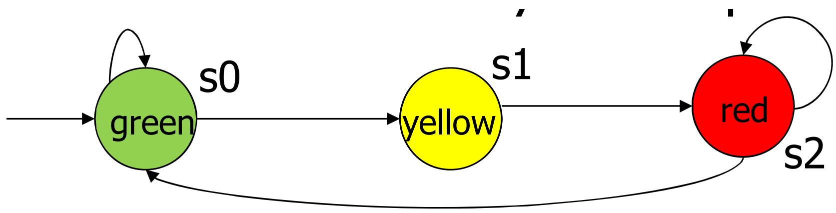

Figure 5 – Traffic light controller

Question 3 : Show that the following pairs of temporal logic formula are not equivalent. You should construct an example system model which satisfies one of them but not the other. You may assume that p,q are atomic propositions.

1. `FGp` and `GFp`
2. `(trueUp)and (pUtrue)`
3. `GF(p∧ q)` and `GFp∧GFq`.