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Solution Exercise Set 10 - Petri Net

Exercise 1

Answer the following questions: (0.5 point each)

1. How can nets model concurrency and synchronization? **Answer:**

   If it is possible activate different transition at the same moment that transitions are operating concurrently. To ensure synchronization you can use a semaphore that is a shared input between transitions.

2. What is the reachability set of a net? How can you compute this set? **Answer:**

   The reachability set R(C,μ) of a net C is the set of all markings μ' reachable from initial marking m. You can use different ways, for example you can build a tree of all transition and collect the subsets of states by layers. A layer can be define like the subset of elements that are reachable form the root with the same number of transition.

3. What kinds of Petri nets can be modeled by finite state processes? **Answer:**

   Petri net net that are bounded can be modeled using FSP. If the net is not bounded you need an infinite number of state.

4. What are some simple conditions for guaranteeing that a net is bounded? **Answer:**

   For example if all transitions in the net have the same number of input and output or if the number of output is lesser that the number of input the net is bounded.

5. What could you add to Petri nets to make them Turing-complete? **Answer:**

   Adding zero tests to the definition the petri nets became turing complete.

Exercise 2 (3.5 points)

1. Provide the definition of the Petri net in figure 1. **Answer:**

   $P = \{a,b,c,d\}$
   $T = \{x,y\}$
   $I(x) = \{a,b\}$ $O(x) = \{b,c,d\}$
   $I(y) = \{c,d\}$ $O(y) = \{b\}$
   $m = \{a,a,b\}$

2. Is the Petri net in Figure 1 bounded? Safe? Conservative? Are all the transitions live?

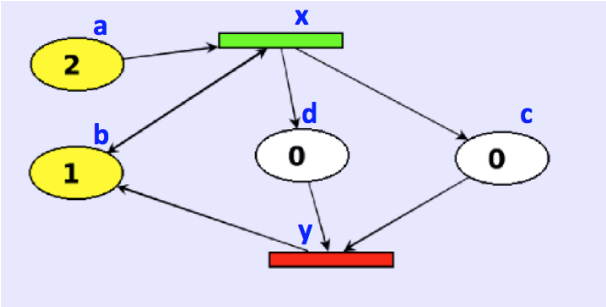

Figure 1: Net

Answer:

The petri net in figure 1 is 3-bounded because places never hold more than 3 tokens, it also means that is not safe. It's not conservative because the number of tokens is not constant. All transition are not live because if you hit twice x and twice y the net is deadlocked.

Exercise 3 (4 points)

Two machines need to interact with a database. The machines can read, write or stay idle. Model the situation using Petri nets ensuring that the machines cannot write at the same time. Use the Petri net editor in the web site of the course[1]. Hand-drawn Petri net diagrams are acceptable, but make them readable please!

Answer:

See figure 2.

[1] http://scg.unibe.ch/download/petitpetri/

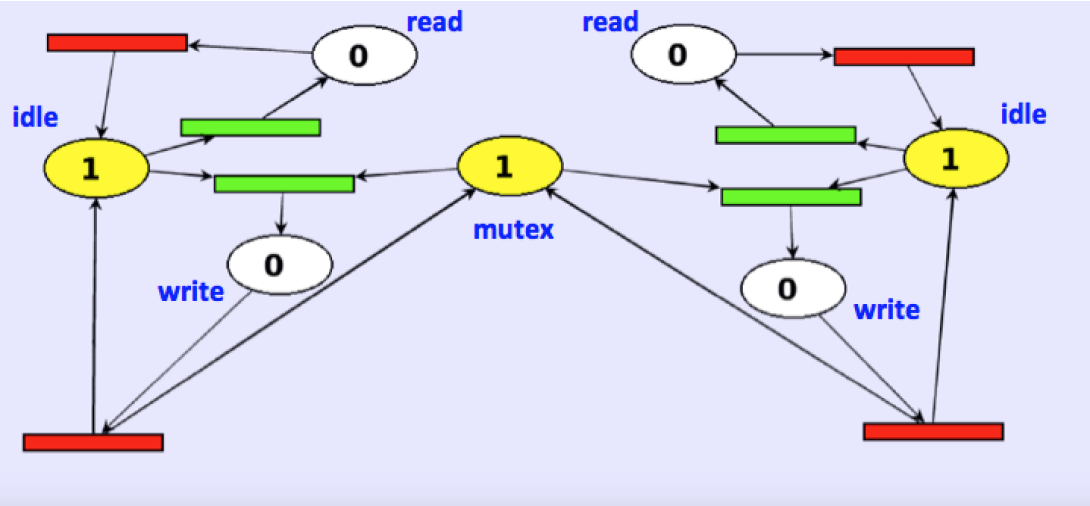

Figure 2: Petri net ex 3 solution