MTAT.03.083 – Systems Modeling

Practice Session #6 : Petri nets

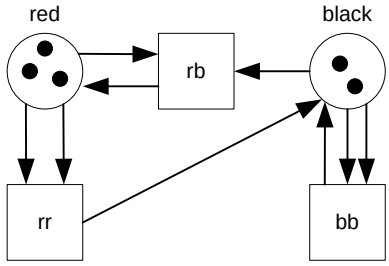
Exercise 1 (vending machine)

We consider a vending machine that sells chocolate bars. The machine sells small bars for 15 kroons and large bars for 20 kroons. The machine accepts bills of 5 kroons, 10 kroons and 20 kroons. The machine is not able to return bills/coins back to customers. Accordingly, the machine never allows a user to insert more than 20 kroons. Once the user has put 20 kroons, the machine will not accept any more bills. Instead, it will only allow the user to push the button and get a large bar. If the user has inserted 15 kroons, he/she may opt to get a small bar, or put an additional 5 kroons to get a large bar.

Capture this process as a state machine and as a Petri net.

Exercise 2 (Ball game)

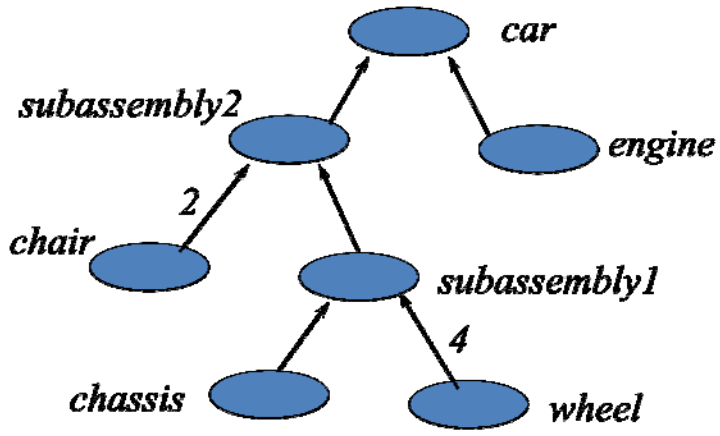
Model the following Petri net as a state machine.



Hint: initially the state machine is in the state “3 reds, 2 blacks” and there are three transitions from this initial state: rr, rb and bb. Transition “rr” leads to state “1 red and 3 blacks”.

Exercise 3 (Car Assembly) – taken from www.workflowcourse.com

Model as a Petri net the production process shown in the following Bill-Of-Materials.



Exercise 4 (Chair Assembly) – taken from www.workflowcourse.com

Model the manufacturing of a chair from its components: 2 front legs, 2 back legs, 3 cross bars, 1 seat frame, and 1 seat cushion as a Petri net. Select some sensible assembly order.

Exercise 5. Burning Alcohol– taken from www.workflowcourse.com

Model the chemical reaction $C_2H_5OH + 3 * O_2 => 2 * CO_2 + 3 * H_2O$ as a Petri net. Assume that there are two steps: first each molecule is disassembled into its atoms and then these atoms are assembled into other molecules.

Exercise 6. Circular rail network– taken from www.workflowcourse.com

A circular rail network consists of four tracks. Each track is in one of the following states:

- Busy, i.e., there is a train on the track.
- Claimed, i.e., a train has successfully requested access to the track.
- Free, i.e., neither busy nor claimed.

There are two trains driving on the circular track. Initially, one train is in track 1 while the other is in track 3. Trains can move from track 1 to 2, from track 2 to 3, from 3 to 4 and from 4 back to 1.

The track where a train resides is "busy“. To move to the next track a train first claims the next track. Only free tracks can be claimed. Busy tracks are released the moment the train moves to another track. One can abstract from the identity of trains only the state of the rail network is considered. Model the dynamic behavior of the rail network in terms of a Petri net.