Due: Friday, Nov. 20, by 11:59 pm

Twenty-five points. Please upload your solutions and associated SPIN models via K-State OnLine.

1. Construct a Promela model for the following Petri Net. In a Petri Net, a transition (ti) is enabled if all places (pi) immediately preceding the transition contain at least one token. Among all of the enabled transitions, one is non-deterministically selected and fired. When a transition is fired, one token is removed from each place before the transition and a single token is placed in each place after the transition. For example, transition t1 is enabled in the figure shown below. If t1 is fired, a token is removed from p1 and tokens are added to places p3 and p4. Then, t1, t3, and t4 are all enabled. If t4 fires, a token in p4 is removed and a token is added to p6, so then t6 is also enabled. Note that the system is initialized with two tokens in p1, and a single token in places p3 and p4 (as shown below).
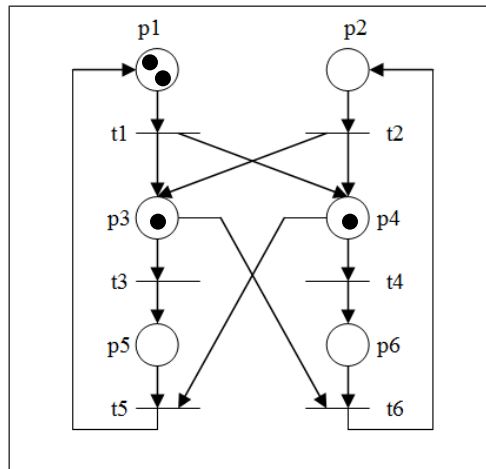
Construct a Promela model of the Petri Net.

(a) Describe how you would test the model for deadlock using SPIN. If deadlock is possible, describe how the system could deadlock.

(b) Can places p1 and p2 contain a token at the same time? Show how you would verify your conclusion.

(c) What is an upper bound on the total number of tokens in the system if the system is initialized as shown above? Show how you would verify your conclusion.

2. Translate the above problem into a model using UPPAAL. Complete steps (a) – (c) above using the verifier in UPPAAL. Specify the queries used and the results obtained.