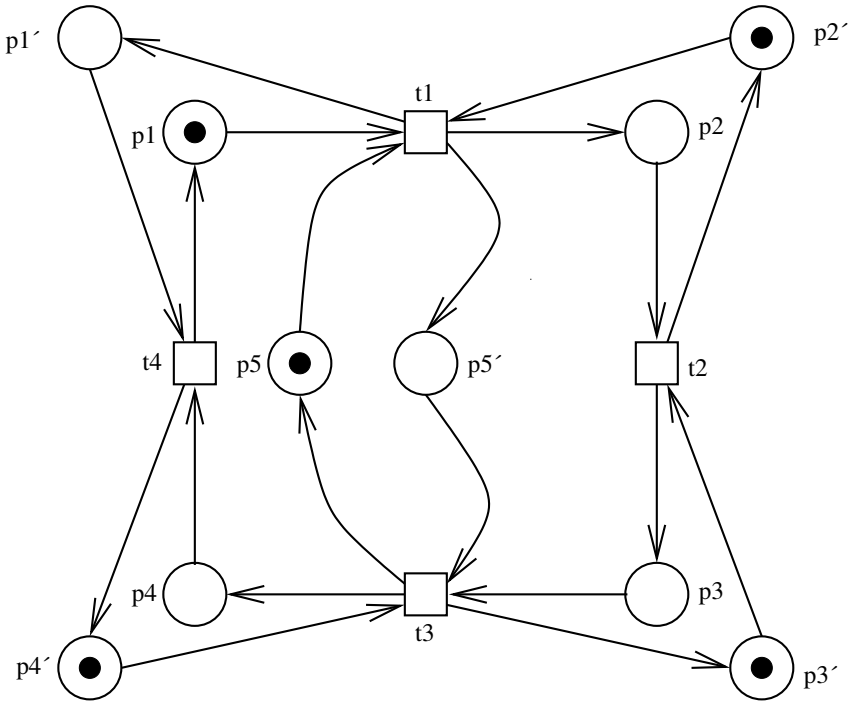
Tik-79.231 **Autumn 2000**
Parallel and Distributed Digital Systems
Answers to Tutorial 2
Oct 13, 2000

1. a) There are no contacts in the system.

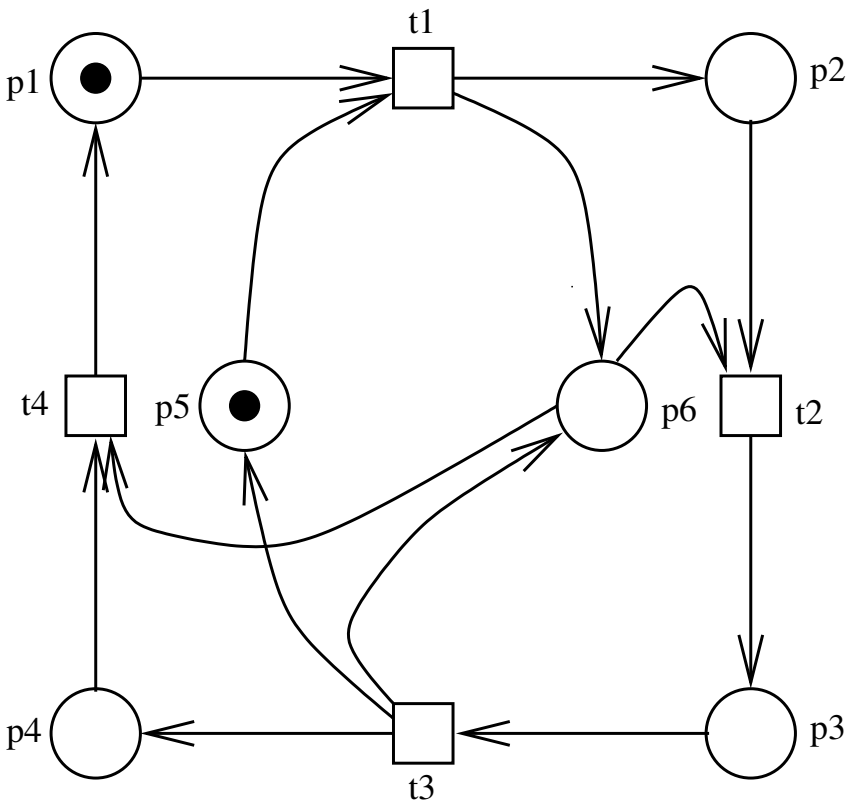
   b) As such, the complement construction for the net is unnecessary because the net has no contacts. For the purpose of exercise, it will be done to all the places in the net.



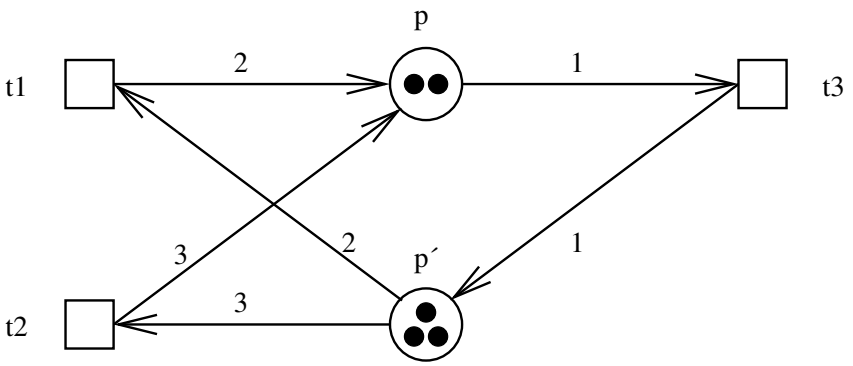
   c) When the net is 1-safe, as in this exercise, the complement place can be interpreted as the logical negation. Then the interpretation of the place $p1'$ is 'it is not spring'.

   If the net is not 1-safe, the token in the complement place models the following property: 'none of the resources modelled by the place are available in the system'.

   d) The place *p6* is added to the net. It models the state 'it is summer or winter'. In the initial marking it is spring so there are initially no tokens in *p6*.



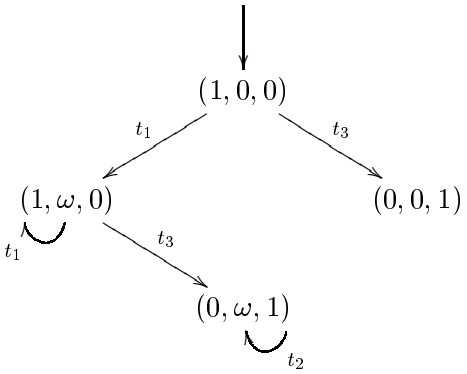
2. Build the complement construction as per definition. You should not forget the initial marking of the complement place.

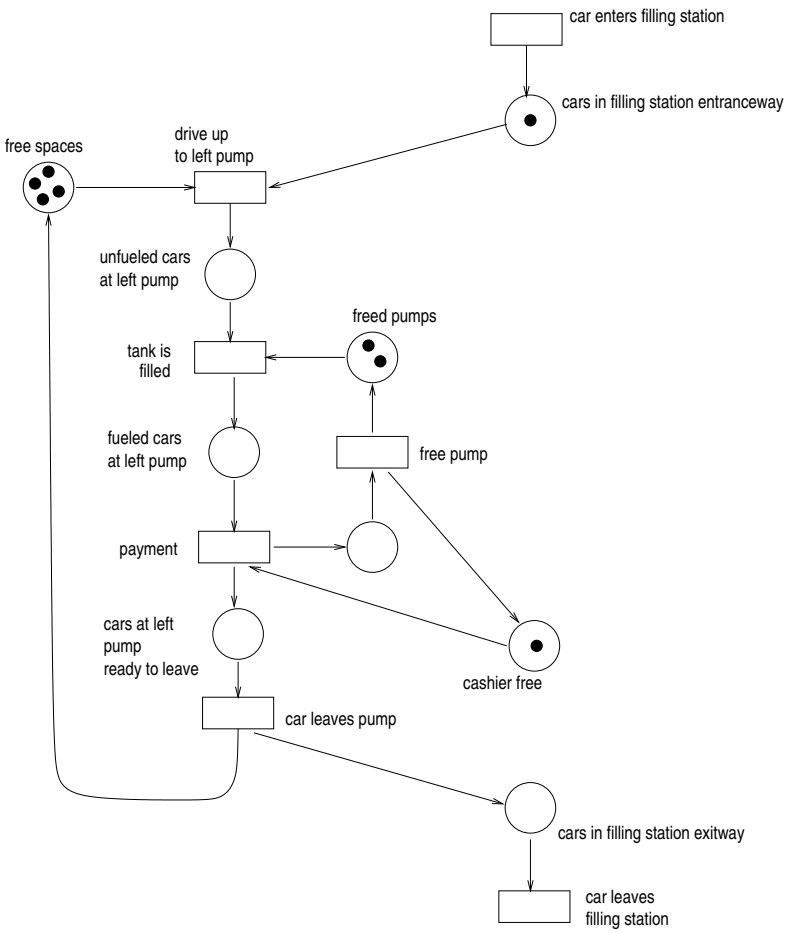


3. The coverability graphs of the nets are identical. The net N_1 cannot deadlock after it has fired the transition t_1 even once. The net N_2, however, can deadlock in the same situation, e.g. with the firing sequence t_1, t_3, t_2.

   Our conclusion is that the coverability graph does not maintain all information about the reachability of markings.

   Joint coverability graph:



4. a) Let us abstract away the information which pump is being used. We will obtain the following P/T net:

   b) Another cashier is added to the net by modifying the initial marking of the place *free cashiers* to contain 2 tokens. Correspondingly, two waiting slots can be added by modifying the initial marking of the place *free spaces* to contain 4 tokens.