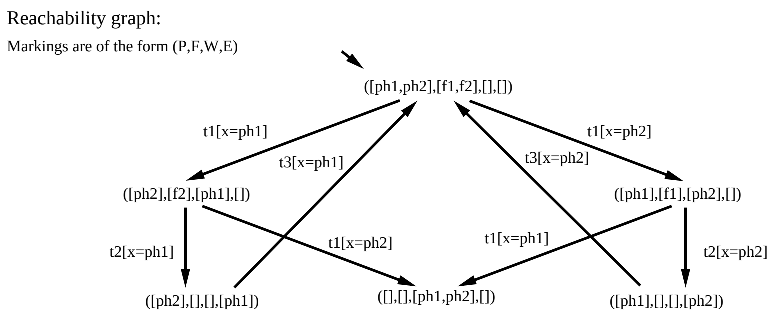
T-79.231 **Autumn 2002**
Parallel and Distributed Digital Systems
Answers to Tutorial 3
Oct 7th 2002

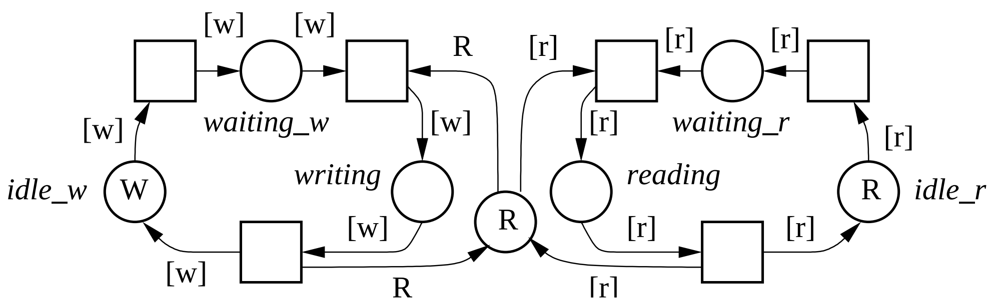
1. Both philosophers may starve in the 2 philosophers net in a deadlock which is accomplished by firing the transitions $t_1\,[x \mapsto ph_1]$ and $t_1\,[x \mapsto ph_2]$ consequtively in either order.

   Another case where a philosopher may starve is a so called livelock. If all the conflicts are resolved in favour of one philosopher, the other never gets to eat. In the reachability graph this can be seen in the cycle comprising the transitions $t_1 = [x \mapsto ph_1]$, $t_2 = [x \mapsto ph_1]$ and $t_3 = [x \mapsto ph_1]$

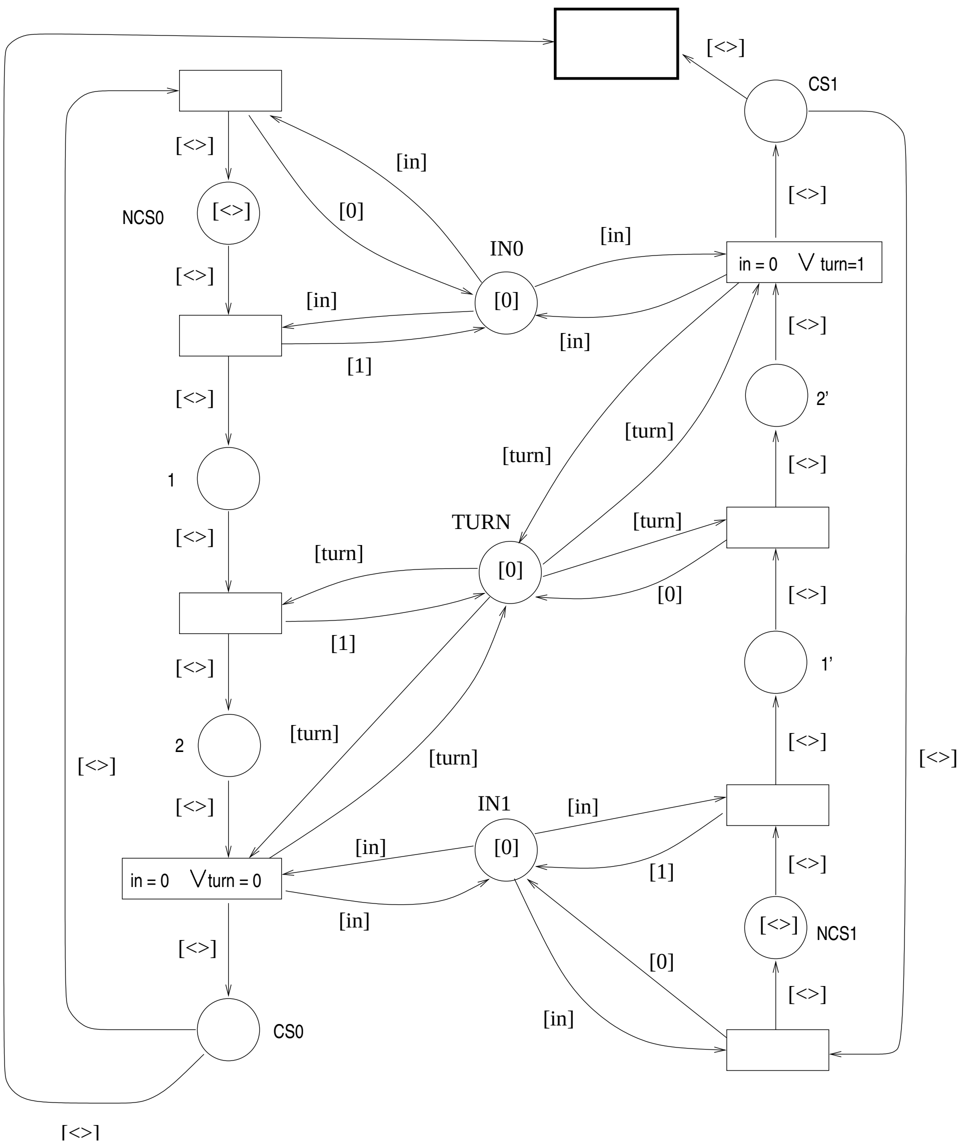
   Beacuse of the symmetry in the reachability graph, one can also find a cycle where the philosopher 1 never gets to eat.

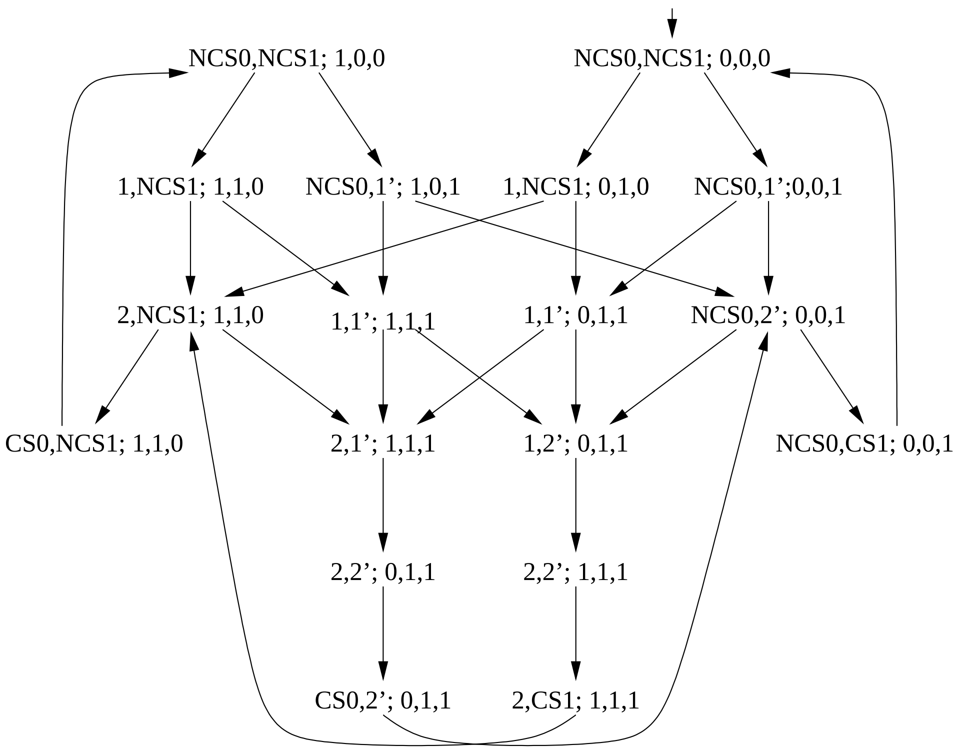


2. The solution to the problem is given below. Let us denote the set of readers as $R = [r_1, r_2, \ldots, r_n]$ and the set of writers as $W = [w_1, w_2, \ldots, w_m]$.



3. An algebraic net model of Peterson's algorithm is given below. The reachability graph shows that it is impossible to find a marking where both processes are in their critical sections. The same can be concluded because the *fact transition* in the top of the net is never enabled.





NCS0,NCS1; 1,0,0
NCS0,NCS1; 0,0,0
1,NCS1; 1,1,0
NCS0,1'; 1,0,1
1,NCS1; 0,1,0
NCS0,1';0,0,1
2,NCS1; 1,1,0
1,1'; 1,1,1
1,1'; 0,1,1
NCS0,2'; 0,0,1
CS0,NCS1; 1,1,0
2,1'; 1,1,1
1,2'; 0,1,1
NCS0,CS1; 0,0,1
2,2'; 0,1,1
2,2'; 1,1,1
CS0,2'; 0,1,1
2,CS1; 1,1,1