

Exercise Sheet 10/11: Petri Nets**Problem 23:**

Consider the Petri net defined by:

$$P = \{p_1, p_2, p_3\}; T = \{t_1, t_2, t_3\};$$

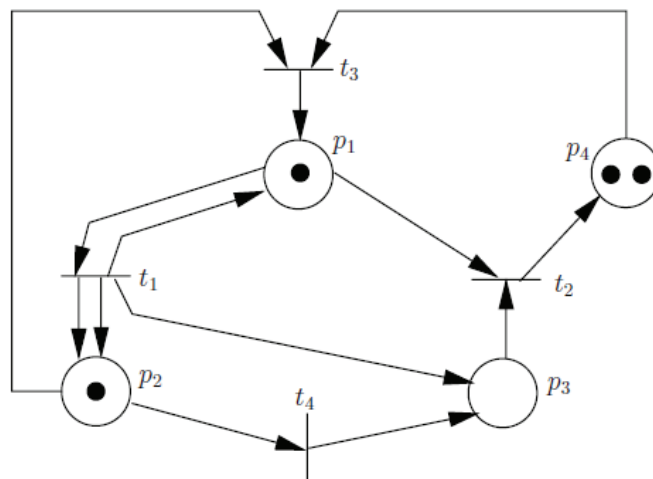
$$A = \{(p_1, t_1), (p_1, t_3), (p_2, t_1), (p_2, t_2), (p_3, t_3), (t_1, p_2), (t_1, p_3), (t_2, p_3), (t_3, p_1), (t_3, p_2)\}.$$

Assume that all arc weights are equal to 1 except for $W(p_1, t_1) = 2$.

- Draw the corresponding Petri Net graph.
- Let $m = [1 \ 0 \ 1]^T$ be the initial marking. Show that transition t_1 is not live.
- Let $m = [2 \ 1 \ 1]^T$ be another initial marking. Show that in any subsequent operation of the Petri net, either a deadlock occurs (no transition can be enabled) or a return to m results.

Problem 24:

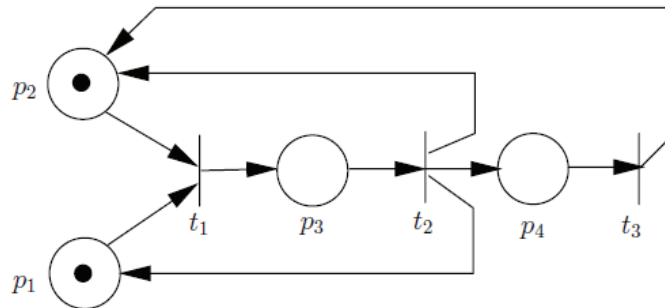
Consider the Petri Net shown in the following figure.



- After the Petri net fires twice, find a marking where all transitions are dead.
- Suppose we want to apply the firing sequence $(t_3, t_1, t_3, t_1, \dots)$. Show that this is not possible for all future times.
- Find the marking m' resulting from the firing sequence $(t_1, t_2, t_3, t_3, t_3)$.

Problem 25:

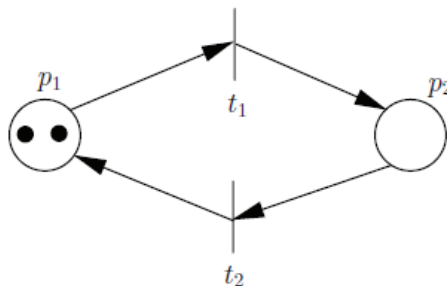
Consider the Petri net in the following figure.



- a. Construct its coverability tree and use it to show that the empty state $[0 \ 0 \ 0 \ 0]^T$ is not reachable. Is this Petri net bounded?
- b. Find a trap in the above Petri Net.
- c. Find a siphon in the above Petri Net.

Problem 26:

Consider the Petri net depicted in the following figure. Modify this Petri net in order to get a controlled Petri Net that satisfies the constraint $m'(p2) \leq m'(p1)$ for all reachable markings from the initial marking.



Problem 27:

Consider the Petri Net in the following figure, with the initial marking $m = [k \ 0 \ k \ 0]^T$. Show how to build a controlled version of this net where the following constraint is satisfied in all reachable marking (or explain why this is not possible): $m'(p3) \geq 3$.

