Properties of Petri nets exercise

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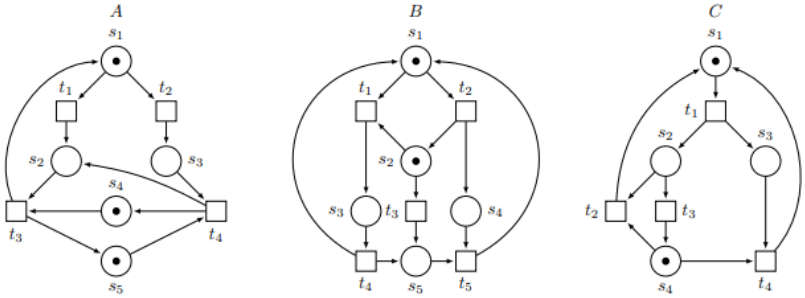
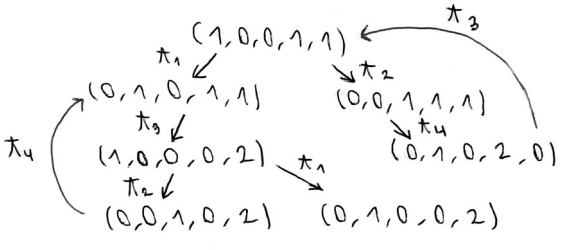
Check if the following Petri nets are bounded, live and deadlock-free:



A

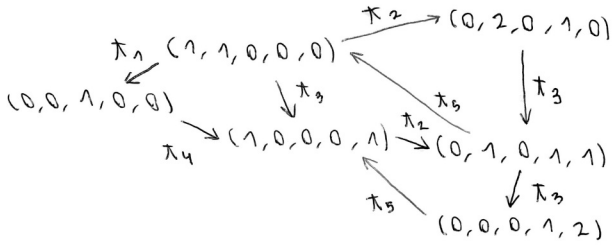
If we try to generate its reachability graph, it turns out to be finite, which implies that the net is bounded:



By having this graph available, we can also observe that the marking $(0, 1, 0, 0, 2)$ is reachable and dead (i.e. it does not enable any transition), so the net is not deadlock-free. As a consequence, the net is not live, because a dead marking has not any reachable marking from it which enables any one of the net transitions.

B

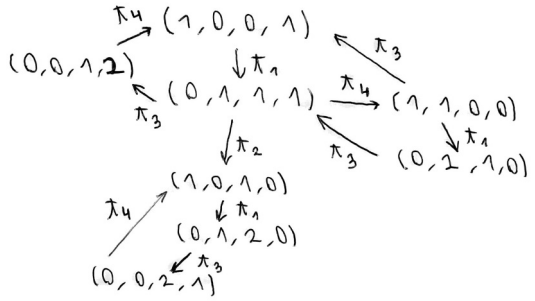
For this net, we can also obtain its finite reachability graph, so it is also bounded:



In this case, every reachable marking enables some transition and therefore the net is deadlock-free. Moreover, it is live because from every reachable marking and for every transition, we can find a reachable marking from it which enables that transition. This can be seen through the fact that the initial marking $(1, 1, 0, 0, 0)$ is reachable from every other reachable marking of the net, and every one of the net transitions appear in the reachability graph.

C

For the last net, we also obtain a finite reachability graph, so it is bounded:



As before, every reachable marking enables some transition and therefore the net is deadlock-free. Nevertheless, it is not live because it has reachable markings from which some of the net transitions cannot fire again. For instance, no reachable marking from $(0, 1, 2, 0)$ enables t_2.