

CS-565

Business Process Management

1st assignment (individual)

Deadline: 22 March 2022

You will use the cpntools tool (<http://cpntools.org/download>) to implement the exercises in Petri Nets. Information on using the tool and examples can be found in the tool documentation (<http://cpntools.org/documentation/>). The exercises will be sent to the course email (hy565@csd.uoc.gr) in a zip file containing a document with the answers of the exercises, the cpn files and a report outlining the basic steps for modeling petri nets and the explanations.

Exercise 1 (20%)

Draw the reachability graphs of the following Petri nets in Figures 1 and 2. Describe whether they are bounded, terminating, live, deadlock free, and if there exist dead transitions.

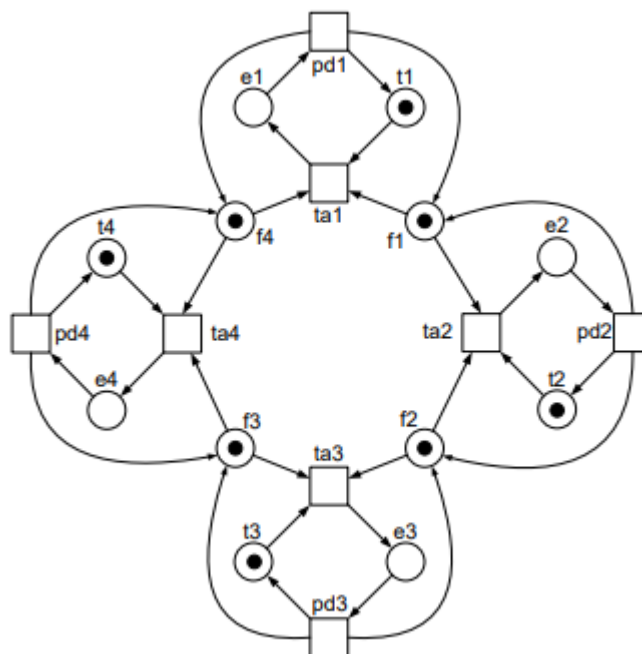


Figure 1: Petri net system for exercise 1

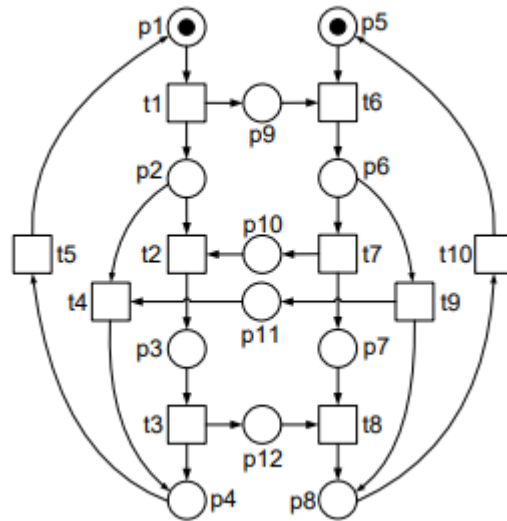


Figure 2: Petri net system for exercise 1

Exercise 2 (35%)

In this exercise, we consider a simplified transportation system; see Figure 3.

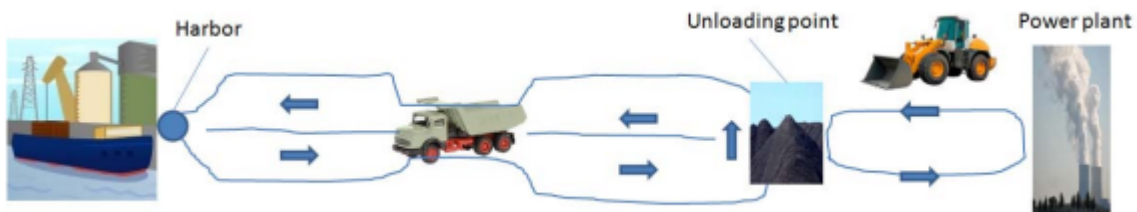


Figure 3: Illustration of a transportation system

From a harbor, trucks transport coal to a coal-fired power plant. More precisely, the trucks drive to an unloading point where they unload their coal and then drive back. The road has one lane from the harbor to the unloading point and another lane from the unloading point to the harbor. There is, however, a small part of the road where - because of reconstruction work - only one truck can drive (i.e., this part has a capacity of one truck). While a truck is passing this part, all other trucks - no matter which direction they go - have to wait. Initially, there are five trucks at the harbor. Each truck has a capacity of ten units of coal. The unloading point has a capacity of 100 units of coal. As long as this capacity is not reached, arriving trucks can immediately unload and drive back. If the capacity has been reached or unloading would exceed the capacity, the truck has to wait. There is no partial unload of trucks!

At the unloading point, there are two wheel loaders, transporting coal from the unloading point to the power plant. Each wheel loader has a capacity of one unit of coal.

Model this transportation system as a classical Petri net. The model must clearly reflect the capacities and that each truck always drives from the harbor to the unloading point, and vice versa.

Exercise 3 (45%)

The production process of a car toy consists of four steps: assembly, painting, drying, and packaging. In the assembly step, a production worker assembles four wheels and a chassis. This step takes five minutes. Next, a painter paints the product. This takes eight minutes. After painting, the product dries for at least twenty minutes before it can be packed. The room in which the products can dry is limited in size: at most ten products can dry there at the same time. Finally, a production worker is doing the packaging of the toy car. This takes ten minutes. The company employs three production workers and two painters. The capacity of every employee is one. Model the production process as a timed-CPN. Show the initial marking.