T-79.231 Parallel and distributed digital systems
Tutorial #5
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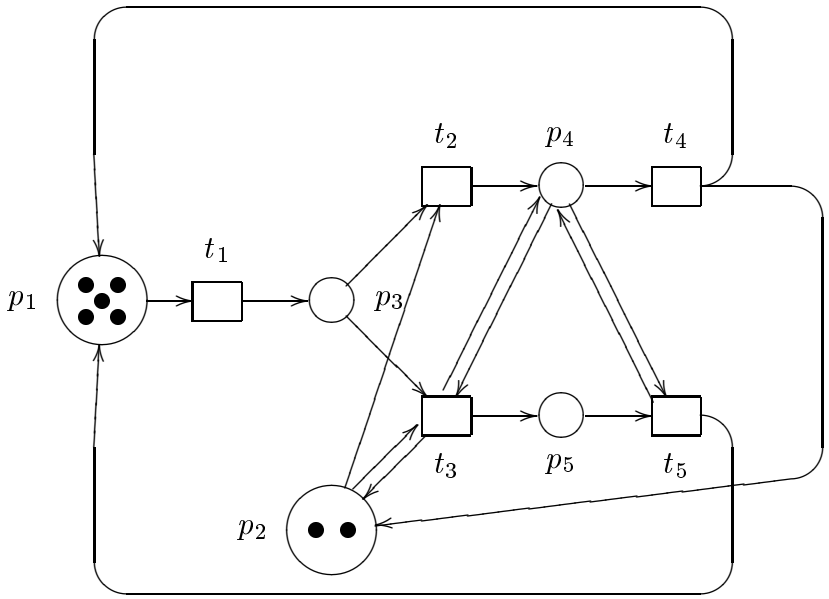
1. Consider the following multiprocessor system:



where

- p_2: the free busses.
- p_4: the processor has access to the memory.

(a) Prove with invariants that at most 2 processors can access the memory concurrently (i.e. the place p_4 has at most 2 tokens).

(b) Prove that the following holds in all reachable states of the system: $M(p_1) + M(p_3) + M(p_4) + M(p_5) = 5$.

2. Present the Pr/T net model of the TicketME algorith in the Maria net description language. Cf. Lecture 5, page 20-21.

   (a) Specify the following properties in LTL logics and do the model checking with Maria:

   - Two processes are never concurrently in the critical section.
   - The process 1 never makes it to the critical section.
   - If the process 1 wants to access the critical section, it will eventually make it there.
   - If the process 2 is in the critical section, it will eventually leave the critical section.

   (b) Add explicit process scheduling to your Maria model. (Cf. Lecture 5, page 25). Adopt the following fairness assumption: Fair runs are all the infinite runs where both processes fire infinitely many transitions. Do the model checking regarding the following property:

   - If the process 1 wants to access the critical section, it will eventually make it there.

   (c) Does the following LTL formula hold in the new model?

$$(\Diamond\Box\neg scheduler(\langle 1\rangle) \wedge \Diamond\Box\neg scheduler(\langle 2\rangle)) \Rightarrow$$

$$\Diamond(procs(\langle 1, CRIT\rangle) \wedge procs(\langle 2, CRIT\rangle))$$