Tik-79.231 Parallel and distributed digital systems
Tutorial #5
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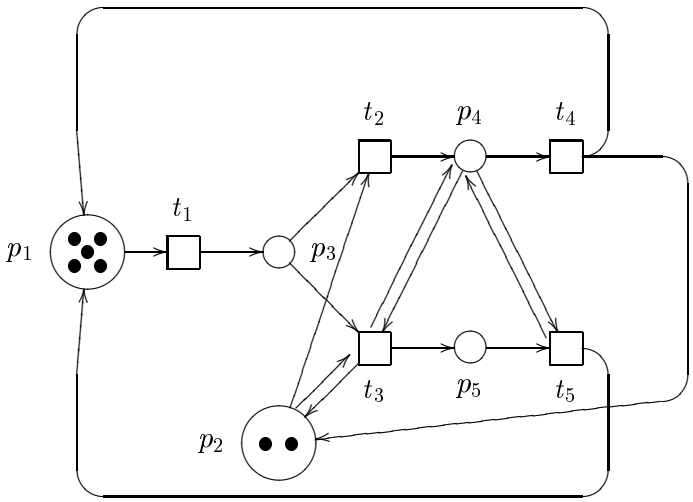
Original Keijo Heljanko, translated by Esa Kettunen

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 PROD net description language. Cf. Lecture 5, page 20-21.

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

   - 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 1 is in the critical section, it will eventually leave the critical section.

(b) Add explicit process scheduling to your PROD model. (Cf. Lecture 5, page 25). 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?

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

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