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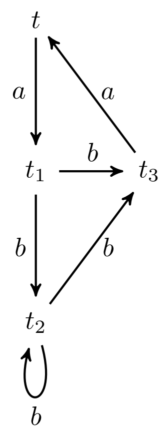
Concurrency Theory WS 2017/2018

— Series 9 —

Hand in until January 12 before the exercise class.

Exercise 1 (Characteristic HML Formula) (2 Points)

Consider the LTS provided below. Provide an HML formula F for each pair of states $s \neq s'$ such that $s \models F$ and $s' \not\models F$.



Exercise 2 (k–Boundedness and Marking Graphs) (2 Points)

An elementary net N is k–bounded iff for each reachable marking M and place p of N holds

$$M(p) \;\leq\; k\;.$$

Prove or disprove:

a) If N is k–bounded, then N has a finite marking graph.

b) If N has a finite marking graph, then N is k–bounded.

Exercise 3 (Regularity of Petri Net Languages) (2 Points)

Let $N = (P, T, F, M_0)$ be an elementary net and let $\mathsf{Lab}\colon T \to \Sigma$, where Σ is a finite alphabet, be a labelling of the transitions. The language of N is defined as

$$\mathcal{L}(N, \mathsf{Lab}) \;=\; \{w \in \Sigma^* \mid w = \mathsf{Lab}(t_1)\cdots\mathsf{Lab}(t_k),\, \sigma = t_1\cdots t_k,\, M_0 \xrightarrow{\sigma} M\}$$

A language L is called petri–net–acceptable iff there exist an elementary net N with labelling Lab such that $L = \mathcal{L}(N, \mathsf{Lab})$. Prove or disprove:

a) If L is regular, then L is petri–net–acceptable.

b) If L is petri–net–acceptable, then L is regular.

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Exercise 4 (Dining Philosophers Revisited) (2 + 2 Points)

The philosophical society employs two philosophers, Phil_1 and Phil_2. Both spend their time either thinking or eating at a table with a large spaghetti bowl, one Spoon and one Fork. Each philosopher usually keeps thinking, but at any point in time, he may decide to eat. When philosopher Phil_1 decides to eat, he picks up the fork, then picks up the spoon, then eats, then releases the fork and then releases the spoon. When philosopher Phil_2 decides to eat, he picks up the spoon, then picks up the fork, then eats, then releases the spoon and then releases the fork.

a) Remodel this scenario as an elementary net. Your net's transition set shall contain at least the set

$$\{\mathsf{pickUpFork}, \mathsf{pickUpSpoon}, \mathsf{releaseFork}, \mathsf{releaseSpoon}, \mathsf{releaseFork}, \mathsf{eat}_1, \mathsf{eat}_2\}\ .$$

b) Draw the marking graph induced by your net. Argue whether your net exhibits a deadlock situation.