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Concurrency Theory WS 2019/2020

— Exercise 9 —

Hand in until December 12th before the exercise class.

Exercise 1 (30 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 2 (40 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.

Exercise 3 (30 Points)

Consider the following CCS process P_n for $n \geq 1$:

$$P_n \ = \ a_1.\text{nil} \ \ || \ldots || \ a_n.\text{nil}$$

a) Sketch LTS(P_n). How many states does LTS(P_n) have? Briefly justify your answer.

b) Recall the language $\mathcal{L}(N, \mathsf{Lab})$ of a Petri net N and a labeling of states Lab. Give a *minimal* (w.r.t. number of places) one-bounded elementary net N and a labeling of states Lab with $L(N, \mathsf{Lab}) =$ TR(P_n).