SS 2018 14.06.2018

Exercises to the lecture
Algorithmic Automata Theory
Sheet 7

Dr. Prakash Saivasan
Peter Chini

Delivery until 19.06.2018 at 09:00

Exercise 7.1 (Marking Equation)

Let $N = (S, T, W)$ be a Petri net with connectivity matrix $\mathbb{C}$. Let $M_1, M_2 \in \mathbb{N}^{|S|}$ be any two markings, and $\sigma \in T^*$ be a sequence of transitions such that $M_1 \xrightarrow{\sigma} M_2$. Prove by induction on the length of σ that $M_2 = M_1 + \mathbb{C} \cdot \Psi(\sigma)$.

Exercise 7.2 (Communication-free Petri Nets of Context-free Languages)

Compute the communication-free Petri nets of the following context-free grammars and find any X for which (a) and (b) in Esparza's theorem from class hold:

a) $S \to aSbS' \mid \varepsilon$, $S' \to SbS'a \mid \varepsilon$

b) $S \to S' \mid \varepsilon$, $S' \to aSb \mid bSc$

In the above CFGs, S is the start symbol.

Hint: $N \to \varepsilon$ productions are encoded by transitions with no outgoing arcs.

Exercise 7.3 (Existential Presburger Formulas for Context-free Languages)

Use the method from class to compute existential Presburger formulas φ_G such that

a) $Sol(\varphi_G) = \Psi(L(G))$ for grammar G described by the productions in 6.2.(a), and

b) $Sol(\varphi_G) = \Psi(L(G))$ for grammar G described by the productions in 6.2.(b).

Hint: use the Petri nets you built in 6.2 and clearly name your variables.

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