Concurrency Theory (WS 2011/12) Out: Tue, Dec 13 Due: Mon, Dec 19

Exercise Sheet 9

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Problem 1: Reachability of Upward-Closed Sets

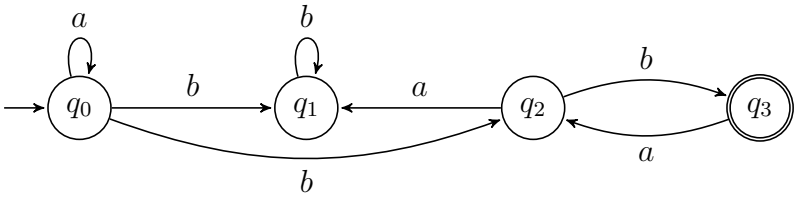
Consider wsts $(\Gamma, \to, \gamma_0, \leq)$. Let $pre^j(I) := \overbrace{pre(\ldots pre}^{j \text{ times}}(I)\ldots)$ for upward closed set $I \subseteq \Gamma$.

(a) Show that $I_j = \bigcup_{l=0}^{j} pre^l(I)$ with I_j as it has been defined in the lecture.

(b) Prove that I is reachable from γ in $\leq n$ steps if and only if $\gamma \in I_n$.

Problem 2: Downward Closure of Automata Languages

Compute $\mathcal{L}(A)\downarrow$ for the following automata A:



Give a general procedure which given an arbitrary automaton A computes $\mathcal{L}(A)\downarrow$.

Problem 3: SRE Inclusion

Use the algorithm given in the lecture to check whether the following SRE inclusions hold:

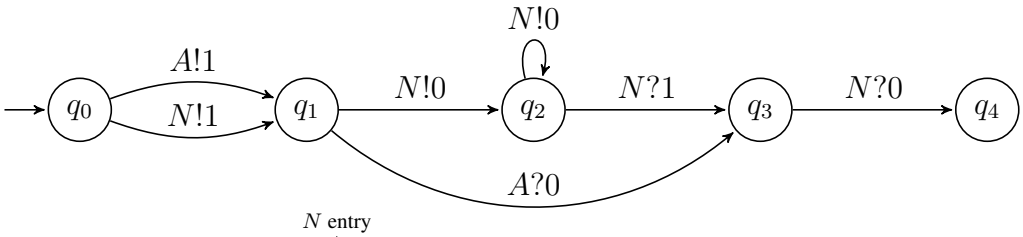
(a) $(a+n+s)^*(t+a+n)^* \subseteq (s+a+n+t+a)^*$

(b) $(r+\epsilon)(p+\epsilon)(n+t)^* \subseteq p^*(r+\epsilon)(s+\epsilon)(n+t)^* + (p+\epsilon)r^*(n+e+t)^*$

(b) $(r+\epsilon)(p+\epsilon)(n+t)^* \subseteq (p+r+e)^*(s+\epsilon)(n+t)^*$

Problem 4: Coverability for Lossy Channel Systems

Consider the lcs depicted in the figure below.



Determine if configurations $(q_4, \begin{bmatrix} 0 \\ \varepsilon \end{bmatrix})$ and $(q_4, \begin{bmatrix} \varepsilon \\ 1 \end{bmatrix})$ are coverable using the known procedure.

N entry ↓

↑ A entry