Concurrency Theory (WS 2010/11) Out: Thu, Dec 16 Due: Mon, Dec 20

Exercise Sheet 8

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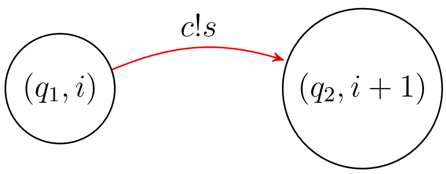
Problem 1: Reachability of Upward-Closed Sets

Consider wsts $(\Gamma, \rightarrow, \gamma_0, \leq)$. Let $pre^j(I) := \underbrace{pre(\ldots pre}_{j \text{ times}}(I)\ldots)$ 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 $\gamma \in I_n$.

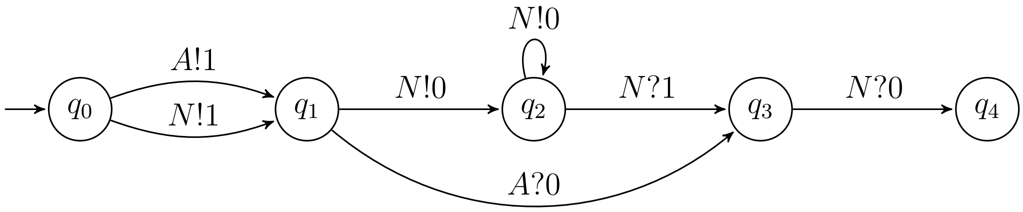
Problem 2+3: Generalized Lossy Channel Systems

Consider the following variation of a lcs: assume one of the symbols $s \in M$ can not be lost during send/receive by any channel but that a channel can contain at most $k \in \mathbb{N}$ symbols s. A transition that wants to send the $k+1$st symbol s is blocked. Such a generalized lcs can be represented by a standard lcs using as states the Cartesian product $Q \times \{0, \ldots, k\}$ where Q is the set of states of the original system. The resulting lcs transitions are schematically represented below (for $0 \leq i < k$).



You are asked to give an implementation of $(q_1, i) \xrightarrow{c!s} (q_2, i+1)$ by several lossy transitions. Your model should check that precisely i symbols s are present in the channel c before appending the extra s. Hint 1: Take $M \cup \{\#\}$ as the alphabet of the resulting lcs. Hint 2: What happens if you use $c?m$ and afterwards $c!m$ for $m \in M \cup \{\#\}$. The solution needs a notion of *round*.

Problem 4: Coverability for Lossy Channel Systems



Determine if the configurations $(q_4, \begin{pmatrix} 0 \\ \varepsilon \end{pmatrix})$ and $(q_4, \begin{pmatrix} \varepsilon \\ 1 \end{pmatrix})$ (where the upper channel entry is for N and the lower for A) are coverable by specifying the minimal predecessors created by the backward coverability procedure discussed in class.