Concurrency Theory (WS 2011/12) Out: Tue, Jan 10 Due: Mon, Jan 16

Exercise Sheet 11

Jun.-Prof. Roland Meyer, Georgel Călin Technische Universität Kaiserslautern

Problem 1: Reachability of Upward-Closed Sets

Let $(\Gamma, \gamma_0, \to, \leq)$ be a well-structured transition system and $I \subseteq \Gamma$ an upward-closed set.

(a) Prove that $R(\gamma_0) \cap I = \emptyset$ if and only if $R(\gamma_0)\Downarrow \cap I = \emptyset$.

(b) Let $R(\gamma_0) \cap I \neq \emptyset$ in $(\Gamma, \gamma_0, \to)$. Prove that there exists $\Gamma' \subseteq \Gamma$ finite with $\gamma_0 \in \Gamma'$ such that $R(\gamma_0) \cap I \neq \emptyset$ in $(\Gamma', \gamma_0, \to \cap (\Gamma' \times \Gamma'))$.

Problem 2: Adequate Domain of Limits for LCSs

(a) Show that symbolic configurations (q, R) with $R\colon C \to SRE$ are an adl.

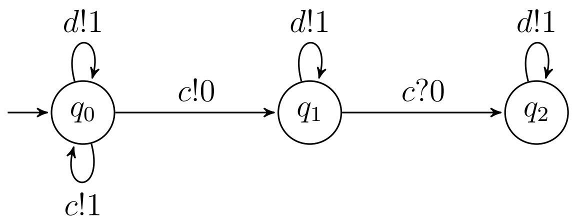
(b) Argue why the above adequate domain of limits (adl) is effective for LCSs.

Problem 3: And-Or Graphs and Execution Trees

Give four And-Or graphs with the following properties: the first one has infinitely many execution trees, the second one has more than one but finitely many execution trees, the third has a unique execution tree with infinitely many branches, and the last has a unique execution tree with finitely many branches.

Problem 4: Expand, Enlarge and Check

Consider the lossy channel system LCS:



together with $\Gamma = \{(q_0, \varepsilon), (q_1, \varepsilon), (q_2, \varepsilon)\}$ and limit domains

$$L_0 = \left\{\top, \left(q_0, \begin{pmatrix}1^*\\ \varepsilon\end{pmatrix}\right), \left(q_0, \begin{pmatrix}\varepsilon\\ 1^*\end{pmatrix}\right), \left(q_1, \begin{pmatrix}(0+1)^*\\ 0^*.1^*\end{pmatrix}\right), \left(q_1, \begin{pmatrix}(0+1)^*\\ 1^*.0^*\end{pmatrix}\right)\right\}$$

$$L_1 = L_0 \cup \left\{\left(q_0, \begin{pmatrix}1^*\\ 1^*\end{pmatrix}\right), \left(q_1, \begin{pmatrix}1^*.(0+\varepsilon)\\ 1^*\end{pmatrix}\right), \left(q_2, \begin{pmatrix}\varepsilon\\ 1^*\end{pmatrix}\right)\right\}.$$

(a) Compute $Over(LCS, \Gamma, L_0)$. Provide an execution tree.

(b) Compute $Over(LCS, \Gamma, L_1)$. Argue why configuration $\left(q_2, \begin{pmatrix}1\\ \varepsilon\end{pmatrix}\right)$ is not coverable.