Concurrency Theory (WS 2010/11) Out: Wed, Jan 12 Due: Mon, Jan 17

Exercise Sheet 10

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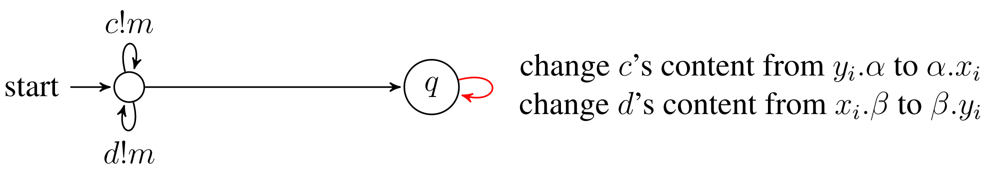
Problem 1: Rotation Construction

Remember the lcs sketched in class for proving RSP's undecidability:

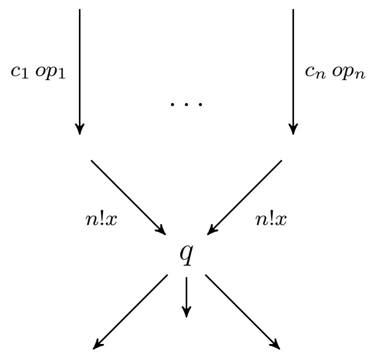


Provide a formal description/depiction of the red transition.

Problem 2: Reasoning about Infinity

Recall the construction given for outlining the non-computability of

$$W(q,c) := \{w \quad | \quad \gamma_0 \rightarrow^* (q, W) \text{ with } W(c) = w\}.$$



Prove that $W(q,n)$ is infinite if and only if there is a transition sequence in the original lcs visiting q infinitely often. Implication $\Rightarrow$ is not obvious and requires a tree representation of certain transition sequences.

Problem 3: Lemma on Reachability of Upward-closed Sets

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

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

Problem 4: Underapproximation

Consider a wsts $TS = (\Gamma, \gamma_0, \rightarrow)$ and let $\Gamma' \subseteq \Gamma$ with $\gamma_0 \in \Gamma'$. The Γ'-*exact partial transition system* of TS is $TS' = (\Gamma', \gamma_0, \rightarrow')$ with $\rightarrow' := \rightarrow \cap (\Gamma' \times \Gamma')$.

- Compute the Γ'-exact partial transition system of the alternating bit protocol with

  $$\Gamma' := \text{ All configurations with at most one symbol in channel } N \text{ and no symbol in } A.$$

- Let $I \subseteq \Gamma$ be an upward-closed set such that $R(\gamma_0) \cap I \neq \emptyset$ in TS. Prove that there exists $\Gamma' \subseteq \Gamma$ finite with $\gamma_0 \in \Gamma'$ such that $R(\gamma_0) \cap I \neq \emptyset$ in TS' as described above.