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Concurrency Theory WS 2015/2016

— Series 8 —

Hand in until January 18th before the exercise class.

Exercise 1 (Game Characterization of Bisimulation) (3 Points)

Prove Theorem [Stirling 1995, Thomas 1993] on Slide 10 in Lecture 13.

Exercise 2 (Monotonicity of $\mathcal{F}$) (1 Points)

Recall the definition of $\mathcal{F}\colon : \mathcal{P}(\mathit{Prc} \times \mathit{Prc}) \to \mathcal{P}(\mathit{Prc} \times \mathit{Prc})$, $\mathcal{R} \mapsto \mathcal{R}'$, where $P\ \mathcal{R}'\ Q$ if and only if

1. if $P \xrightarrow{\alpha} P'$ then there exists $Q' \in \mathit{Prc}$, such that $Q \xrightarrow{\alpha} Q'$ and $P'\ \mathcal{R}\ Q'$, and
2. if $Q \xrightarrow{\alpha} Q'$ then there exists $P' \in \mathit{Prc}$, such that $P \xrightarrow{\alpha} P'$ and $P'\ \mathcal{R}\ Q'$.

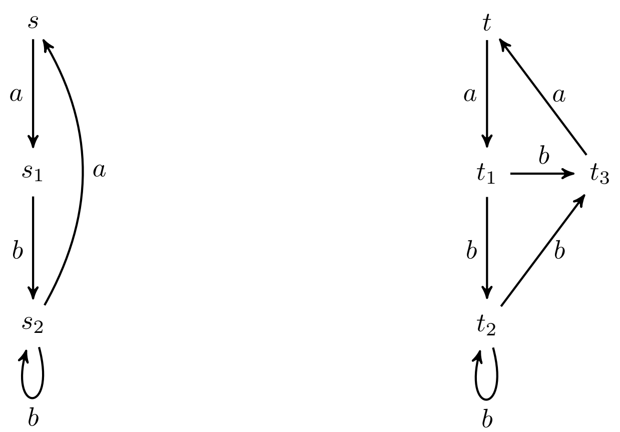
Prove that $\mathcal{F}$ is monotonic on $(\mathcal{P}(\mathit{Prc} \times \mathit{Prc}), \supseteq)$!

Exercise 3 (Greatest Fixed Point Characterization of $\sim$) (2 Points)

Prove that the greatest fixed point of $\mathcal{F}$ is equal to $\sim$.

Exercise 4 (Strong Bisimilarity as a Game) (2 Points)

Decide whether $s \sim t$ in the following LTS. For that, either give a universal wining strategy for the attacker (i.e., $s \not\sim t$) or for the defender (i.e., $s \sim t$). If $s \sim t$, define a strong bisimulation relating the pair of processes.



Exercise 5 (Ready Simulation and Bisimulation) (3 Points)

Prove or disprove: $P \sqsubseteq_{\mathrm{rs}} Q$ and $Q \sqsubseteq_{\mathrm{rs}} P$ implies $P \sim Q$.