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Concurrency Theory WS 2019/2020

— Exercise 7 —

Hand in until November 28th before the exercise class.

Exercise 1 (30 Points)

In this exercise, Act^∞ denotes the set of all *infinite* words over Act. Moreover, for $w' \in \mathrm{Act}^*$ and $w \in \mathrm{Act}^\infty$, we write $w' \sqsubseteq_{\mathrm{fin}} w$ iff w' is a *finite* prefix of w.

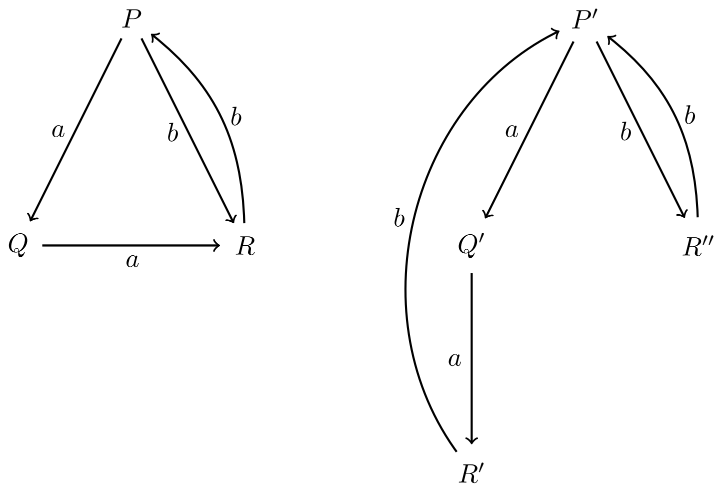
For every $P \in \mathrm{Prc}$, we define the set of *maximal traces* $\mathrm{MTr}(P)$ of P by

$$\mathrm{MTr}(P) \;=\; \left\{ w \in \mathrm{Act}^* \;\middle|\; \exists Q \colon P \xrightarrow{w} Q \;\wedge\; Q \not\rightarrow \right\} \cup \left\{ w \in \mathrm{Act}^\infty \;\middle|\; \forall w' \sqsubseteq_{\mathrm{fin}} w \colon \exists Q \colon P \xrightarrow{w'} Q \right\} .$$

Prove or disprove: Maximal trace equivalence is a congruence w.r.t. restriction.

Exercise 2 (20 Points)

Consider the following LTS:



1. Give the smallest strong bisimulation of the above LTS.
2. Give the smallest strong bisimulation $\mathcal{R}$, such that $P \mathrel{\mathcal{R}} P'$.
3. Prove or disprove: $\mathcal{R}$ is an equivalence relation.

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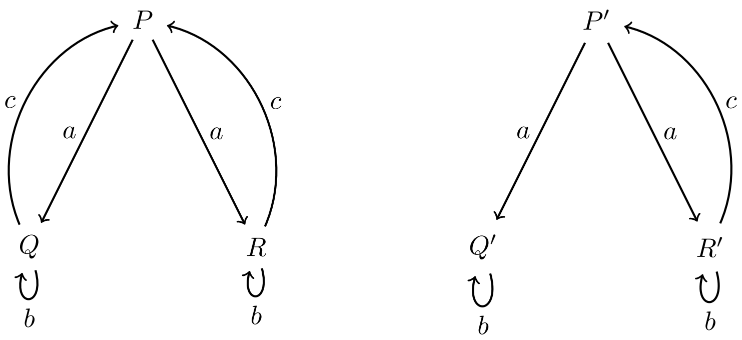
Exercise 3 (20 Points)

Consider the following LTS:



1. Show that $P' \equiv_{\mathrm{TR}} P$, where $\equiv_{\mathrm{TR}}$ denotes trace equivalence.
2. Give $\sim$. Does $P \sim P'$ hold?

Exercise 4 (30 Points)

Prove the theorem [Stirling 1995, Thomas 1993] on Slide 18 of Lecture 13.