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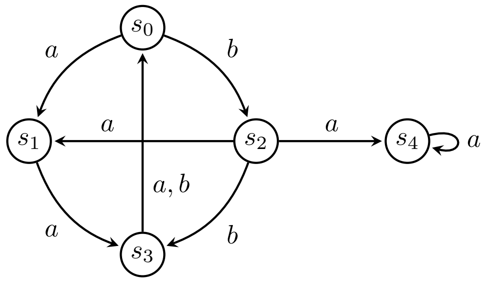
Concurrency Theory WS 2019/2020

— Exercise 4 —

Hand in until November 7th before the exercise class.

Exercise 1 (30 Points)

Consider the LTS



and the mutually recursive equation system

$$E = \left(\begin{array}{lcl} X_1 & \overset{\min}{=} & [a]X_1 \vee \langle b\rangle X_2 \\ X_2 & \overset{\max}{=} & [b]X_2 \wedge \langle b\rangle X_2 \end{array} \right).$$

Do the fixed–point iteration for $[\![E]\!]$.

Exercise 2 (30 Points)

(a) Complete the value passing process definition below such that the process $\mathsf{Counter}$ outputs the sequence of natural numbers, i.e. $\overline{\mathsf{out}}(0)$, $\overline{\mathsf{out}}(1)$, $\overline{\mathsf{out}}(2)$, $\overline{\mathsf{out}}(3)$, …, but where arbitrarily many τ's may occur between the outputs.

$$\begin{aligned} \mathsf{Counter} &= \ldots \\ \mathsf{Adder} &= \ldots \\ \mathsf{Adder}' &= \ldots \\ \mathsf{Buffer} &= \ldots \end{aligned}$$

(b) Give a value passing process definition for a process $\mathsf{Squarer}$ such that the process $\mathsf{Squares} = (\mathsf{Counter} \| \mathsf{Squarer}) \setminus \{\mathsf{out}\}$ outputs the sequence of *even* square numbers, i.e. $\overline{\mathsf{square}}(0)$, $\overline{\mathsf{square}}(4)$, $\overline{\mathsf{square}}(16)$, $\overline{\mathsf{square}}(36)$, …, but where arbitrarily many τ's may occur between the outputs.

Exercise 3 (20 Points)

Let $P \equiv x(u).\bar{u}\langle v\rangle \parallel new z((\bar{x}\langle y\rangle + z(w).\bar{w}\langle y\rangle) \parallel \bar{x}\langle z\rangle)$. Transform process P into standard form.

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Exercise 4 (20 Points)

Prove that $P \rightarrow Q$ implies that there exists a derivation of this reduction in which the (Struct) rule (see Definition 8.8) is applied, if at all, only at the root of the derivation tree.