Concurrency Theory WS 2017/2018
Chair for Software Modeling and Verification
RWTH Aachen University

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— Series 5 —

Hand in until November 17 before the exercise class.

Exercise 1 (Value Passing Process Definitions) (2+2 Points)

(a) Complete the value passing process definition below such that the process 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.

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

(b) Give a value passing process definition for a process Squarer such that the process $\mathsf{Squares} = (\mathsf{Counter} \| \mathsf{Squarer}) \setminus \{\mathsf{sync}\}$ 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 2 (HML formulae) (4 Points)

For this exercise, assume the LTS contains actions a, b.

1. Explain in your own words the meaning of the following formula:

$$X \overset{\max}{=} [b]X \wedge Y$$
$$Y \overset{\min}{=} [a]Y \wedge X$$

2. Give (recursive) HML formulae for the following expressions.
   - A process can eventually do an a.
   - Each sequence consisting of only a and b ends in an infinite sequence of a's.
   - Among states visited by a sequence of b's, there are only finitely many where an a is possible.

Exercise 3 (π-calculus and standard form) (2 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.