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Concurrency Theory WS 2015/2016

— Series 6 —

Hand in until December 14th before the exercise class.

Exercise 1 (Structural Congruence) (3 Points)

Prove that $P \to Q$ implies that there exists a derivation of this reduction in which the (Struct) rule (see Definition 9.6) is applied, if at all, only as the last rule.

Exercise 2 (Reaction Relation) (4 Points)

Let

$$\begin{aligned} S \;=\; & \mathsf{new}\, x(\\ & (x(u) \,.\, u(y) \,.\, u(z) \,.\, \bar{y}\langle z\rangle \,.\, \mathsf{nil} \\ & \;\|\; x(t) \,.\, t(w) \,.\, t(v) \,.\, \bar{v}\langle w\rangle \,.\, \mathsf{nil}) \\ & \;\|\; !\mathsf{new}\, s(\bar{x}\langle s\rangle \,.\, \bar{s}\langle a\rangle \,.\, \bar{s}\langle b\rangle \,.\, \mathsf{nil}) \\ &). \end{aligned}$$

Show that

$$S \longrightarrow^{\leq 12} (\bar{a}\langle b\rangle \,.\, \mathsf{nil} \;\|\; \bar{b}\langle a\rangle \,.\, \mathsf{nil}) \;\|\; \mathsf{new}\, x(!\mathsf{new}\, s(\bar{x}\langle s\rangle \,.\, \bar{s}\langle a\rangle \,.\, \bar{s}\langle b\rangle \,.\, \mathsf{nil}))$$

where $\longrightarrow^{\leq 12}$ denotes at most 12 applications of the reaction relation.

Exercise 3 (Polyadic π-Calculus) (3 Points)

Consider the following process definition in polyadic π-calculus:

$$x(y_1, y_2) \,.\, P \;\|\; \bar{x}\langle z_1, z_2\rangle \,.\, Q \;\|\; \bar{x}\langle z_1', z_2'\rangle \,.\, Q'.$$

Provide the corresponding encoding in monadic π-calculus. Furthermore, do at least two reduction sequences to the resulting process definition in order to convince yourself of the correctness of your translation.