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Concurrency Theory WS 2017/2018

— Series 6 —

Hand in until November 24th 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 8.8) is applied, if at all, only at the root of the derivation tree.

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 (Recursive Definitions) (3 Points)

Consider again the buffer from Example 9.3, split into two processes:

$$B(l, r) = l(x) \,.\, C\langle x, l, r\rangle$$
$$C(x, l, r) = \bar{r}\langle x\rangle \,.\, B\langle l, r\rangle$$

Let the right hand sides be Q_B and Q_C, respectively. Follow the definitions in lecture 9, section *Adding recursive process calls* and write down $\widehat{Q}_B$ and $\widehat{Q}_C$. Let

$$P = \bar{l}\langle x_1\rangle \,.\, \bar{l}\langle x_2\rangle \,.\, \bar{l}\langle x_3\rangle \;\|\; B_2 \;\|\; r(y_1) \,.\, r(y_2) \,.\, r(y_3)$$

where B_2 is a two-place buffer defined by

$$B_2 = \mathsf{new}\, m(B\langle l, m\rangle \;\|\; B\langle m, r\rangle).$$

Following part (3) of the definition in “Recursive Process Calls II”, write down P' and draw the corresponding LTS.