

# Mini Exercise for Mandatory Assignment 1

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## Mini Exercise 1

Given the expression  $(\hat{b})(a.b.0 \mid b.0)$  answer the following three questions

**I. Draw the LTS** Draw a LTS representing the behaviour of this process  $(\hat{b})(a.b.0 \mid b.0)$

### Derive transitions

If we want to derive the possible transitions of the process  $(\hat{b})(a.b.0 \mid b.0)$  we proceed in the following manner. We look at the process and see that the outermost process constructor is a restriction, hence the last rule used must be RES.

$$\text{RES} \frac{a.b.0 \mid b.0 \xrightarrow{\alpha} P'}{(\hat{b})(a.b.0 \mid b.0) \xrightarrow{\alpha} (\hat{b})P'} \quad (\alpha, \bar{\alpha} \notin \{b\})$$

So now we need to find the possible transitions of the process  $a.b.0 \mid b.0$ . Since this is a parallel composition we can try 3 different rules COM1, COM2, and SYNC. First we try COM2 (taking  $P' = a.b.0 \mid Q''$ )

$$\text{COM2} \frac{'b.0 \xrightarrow{\alpha} Q''}{a.b.0 \mid b.0 \xrightarrow{\alpha} a.b.0 \mid Q''}$$

and finishing with the ACT rule

$$\text{ACT} \frac{}{'b.0 \xrightarrow{b} 0}$$

giving us that  $\alpha = 'b$  and  $Q'' = 0$ , but this breaks with the side-condition of RES, since we had  $\alpha, \bar{\alpha} \notin \{b\}$ . So we cannot use the rule COM2. If we instead use the rule COM1 we proceed as follows (taking  $P' = P'' \mid b.0$ )

$$\text{COM1} \frac{a.b.0 \xrightarrow{\alpha} P''}{a.b.0 \mid b.0 \xrightarrow{\alpha} P'' \mid b.0}$$

again finishing with the ACT rule

$$\text{ACT} \frac{}{a.b.0 \xrightarrow{a} b.0}$$

giving us that  $\alpha = a$ ,  $P'' = b.0$ , and hence  $P' = b.0 \mid b.0$ . So the entire derivation looks like this

$$\text{RES} \frac{\text{COM1} \frac{\text{ACT} \frac{}{a.b.0 \xrightarrow{a} b.0}}{a.b.0 \mid b.0 \xrightarrow{a} b.0 \mid b.0}}{(\hat{b})(a.b.0 \mid b.0) \xrightarrow{a} (\hat{b})(b.0 \mid b.0)} \quad (a, \bar{a} \notin \{b\})$$

**II. (Briefly) Why is not possible to use the rule Sync to derive a transition for  $a.b.0 \mid b.0$**

**III. Derive the possible transitions of  $(\hat{b})(b.0 \mid b.0)$**