Mini Exercise for Mandatory Assignment 1

Mikkel Bundgaard

February 24, 2005

Mini Exercise 1
Given the expression $(\neg b)(a.b.0 \mid' b.0)$ answer the following three questions

I. Draw the LTS
Draw a LTS representing the behaviour of this process $(\neg b)(a.b.0 \mid' b.0)$

Derive transitions
If we want to derive the possible transitions of the process $(\neg b)(a.b.0 \mid' b.0)$ 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.

\[ \text{RES} \quad \frac{a.b.0 \mid' b.0}{(\neg b)(a.b.0 \mid' b.0) \xrightarrow{\alpha} (\neg b)P'} (\alpha, \overline{\alpha} \notin \{b\}) \]

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 $P' = a.b.0 \mid Q''$)

\[ \text{COM2} \quad \frac{\neg b.0 \xrightarrow{\alpha} Q''}{a.b.0 \mid' b.0 \xrightarrow{\alpha} a.b.0|Q''} \]

and finishing with the ACT rule

\[ \text{ACT} \quad \frac{\neg b.0 \xrightarrow{\neg b} 0}{a.b.0 \xrightarrow{\alpha} 0} \]

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

\[ \text{COM1} \quad \frac{a.b.0 \xrightarrow{\alpha} P''}{a.b.0 \mid' b.0 \xrightarrow{\alpha} P'' \mid' b.0} \]

again finishing with the ACT rule

\[ \text{ACT} \quad \frac{a.b.0 \xrightarrow{a} b.0}{a.b.0 \xrightarrow{a} b.0} \]
giving us that \( \alpha = a \), \( P'' = b.0 \), and hence \( P' = b.0 \mid b.0 \). So the entire derivation looks like this

\[
\begin{array}{c}
\text{ACT} \\
\text{Com} \quad a.b.0 \xrightarrow{a} b.0 \\
\text{Res} \\
(\neg b)(a.b.0 \mid b.0) \xrightarrow{a} (\neg b)(b.0 \mid b.0) \\
(a, \pi \not\in \{b\})
\end{array}
\]

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 \( (\neg b)(b.0 \mid b.0) \)