Assignment 10: CCS

ETH Zurich

1 Labelled Transition Systems

1. Consider the following defining CCS equations:

$$\begin{aligned} \mathrm{CM} &\stackrel{\mathsf{def}}{=} coin.\overline{coffee}.\mathrm{CM} \\ \mathrm{CS} &\stackrel{\mathsf{def}}{=} \overline{pub}.\overline{coin}.coffee.\mathrm{CS} \\ \mathrm{UNI} &\stackrel{\mathsf{def}}{=} (\mathrm{CM} \,|\, \mathrm{CS}) \setminus \{coin, coffee\} \end{aligned}$$

   Use the rules of the SOS semantics for CCS to derive the labelled transitions system for the process UNI defined above. The proofs can be ommitted and a drawing of the LTS is enough.

2. Consider the CCS processes P_0 and Q_0 defined by the following equations:

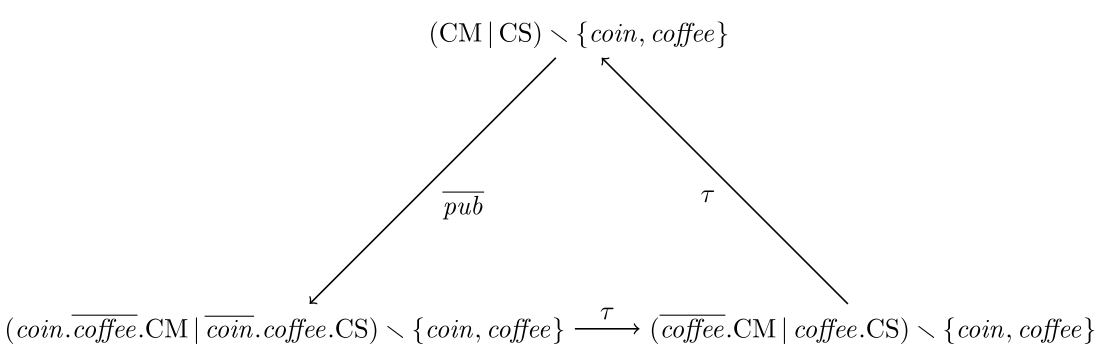
$$\begin{aligned} \mathrm{P}_0 &\stackrel{\mathsf{def}}{=} a.\mathrm{P}_1 + a.\mathrm{P}_2 \\ \mathrm{P}_1 &\stackrel{\mathsf{def}}{=} b.\mathrm{P}_0 + a.\mathrm{P}_2 \\ \mathrm{P}_2 &\stackrel{\mathsf{def}}{=} a.\mathrm{P}_2 + b.\mathrm{P}_0 \end{aligned} \tag{1}$$

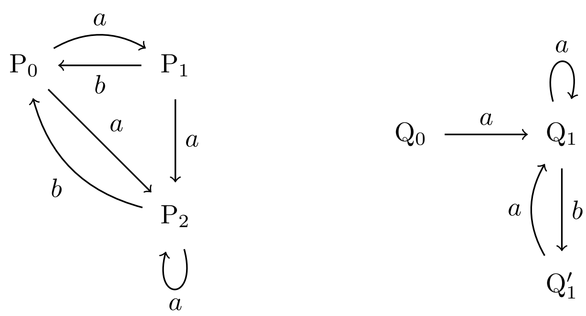
$$\begin{aligned} \mathrm{Q}_0 &\stackrel{\mathsf{def}}{=} a.\mathrm{Q}_1 \\ \mathrm{Q}_1 &\stackrel{\mathsf{def}}{=} a.\mathrm{Q}_1 + b.a.\mathrm{Q}_1 \end{aligned} \tag{2}$$

   For each of the processes P_0 and Q_0, draw a labeled transition system that describes its behavior.

1.1 Solution

1.



2. 

2 Derivations

By using SOS rules for CCS prove the existence of the following transitions where you assume that $\mathrm{A} \stackrel{\mathsf{def}}{=} b.a.\mathrm{B}$:

1. $(\mathrm{A} \mid \overline{b}.0) \setminus \{b\} \xrightarrow{\tau} (a.\mathrm{B} \mid 0) \setminus \{b\}$
2. $(\mathrm{A} \mid \overline{b}.a.\mathrm{B}) + (\overline{b}.\mathrm{A}) \xrightarrow{\overline{b}} (\mathrm{A} \mid a.\mathrm{B})$

2.1 Solution

1.

$$\text{RES}\,\dfrac{\text{COM3}\,\dfrac{\text{CON}\,\dfrac{\text{ACT}\,\dfrac{}{b.a.\mathrm{B} \xrightarrow{b} a.\mathrm{B}}}{\mathrm{A} \xrightarrow{b} a.\mathrm{B}} \quad \text{ACT}\,\dfrac{}{\overline{b}.0 \xrightarrow{\overline{b}} 0}}{(\mathrm{A} \mid \overline{b}.0) \xrightarrow{\tau} (a.\mathrm{B} \mid 0)}}{(\mathrm{A} \mid \overline{b}.0) \setminus \{b\} \xrightarrow{\tau} (a.\mathrm{B} \mid 0) \setminus \{b\}}$$

2.

$$\text{SUM}_1\,\dfrac{\text{COM2}\,\dfrac{\text{ACT}\,\dfrac{}{\overline{b}.a.\mathrm{B} \xrightarrow{\overline{b}} a.\mathrm{B}}}{(\mathrm{A} \mid \overline{b}.a.\mathrm{B}) \xrightarrow{\overline{b}} (\mathrm{A} \mid a.\mathrm{B})}}{(\mathrm{A} \mid \overline{b}.a.\mathrm{B}) + (\overline{b}.\mathrm{A}) \xrightarrow{\overline{b}} (\mathrm{A} \mid a.\mathrm{B})}$$