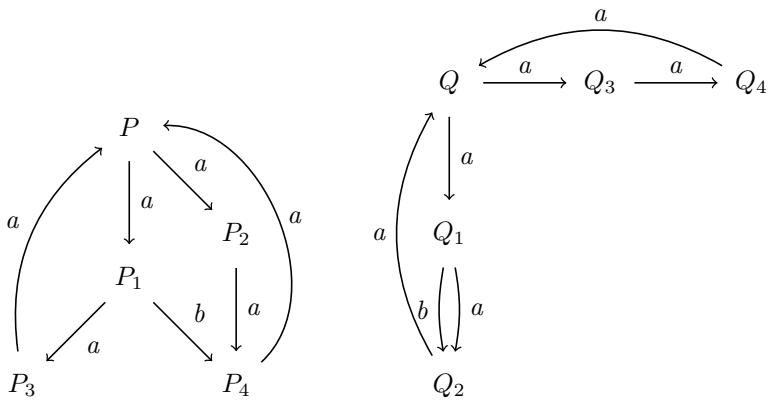
Assignment 8: CCS advanced concepts

ETH Zurich

1 Strong Bisimulation

Consider the following labelled transition system:



Show that $P \sim Q$ by finding a strong bisimulation $\mathcal{R}$ such that $P \mathcal{R} Q$.

1.1 Solution

A strong bisimulation $\mathcal{R}$ is given by the following relation:

$$\mathcal{R} = \{(P, Q), (P_1, Q_1), (P_3, Q_2), (P_4, Q_2), (P_2, Q_3), (P_4, Q_4)\}$$

2 Weak Bisimulation

Suppose we have the following definitions of processes

$$\begin{aligned} \mathrm{S} &\stackrel{\mathsf{def}}{=} a.\overline{b}.\mathrm{S} \\ \mathrm{T} &\stackrel{\mathsf{def}}{=} \overline{a}.e.b.\mathrm{T} \\ \mathrm{ST} &\stackrel{\mathsf{def}}{=} (\mathrm{S} \,|\, \mathrm{T}) \setminus \{a, b\} \end{aligned}$$

Further we have

$$\begin{aligned} \mathrm{U} &\stackrel{\mathsf{def}}{=} e.x.y.\mathrm{U} \\ \mathrm{V} &\stackrel{\mathsf{def}}{=} \overline{x}.\overline{y}.\mathrm{V} \\ \mathrm{UV} &\stackrel{\mathsf{def}}{=} (\mathrm{U} \,|\, \mathrm{V}) \setminus \{x, y\} \end{aligned}$$

Your task is to

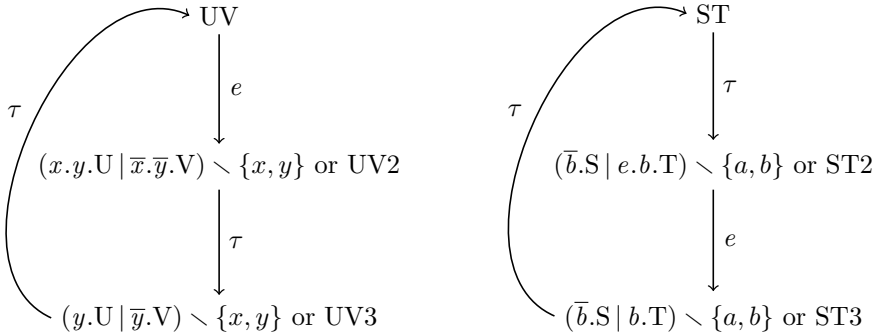
1. Represent ST and UV as LTSs.

2. Show that ST and UV are weakly bisimilar.

3. Suppose we further have $\mathrm{UV}' \stackrel{\mathsf{def}}{=} (\mathrm{U} \,|\, \mathrm{V}) \setminus \{y\}$. Show that ST and UV' are not weakly bisimilar.

2.1 Solution

1.



2. The weak bisimulation here is $\{ST, ST2, ST3\} \times \{UV, UV2, UV3\}$. An alternative weak bisimulation relation is $\{(UV, ST), (UV, ST2), (UV2, ST3), (UV3, ST3)\}$.

3. This is no longer a weak bisimulation. Due to the exposure of x, UV' can now make transitions that are impossible in ST.