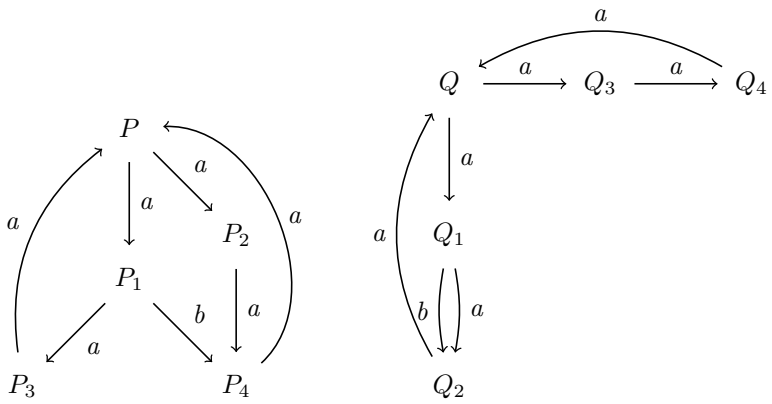
Assignment 12: CCS advanced concepts

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 $P \mathcal{R} Q$.

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

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

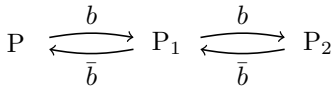
Your task is to

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.

3 In a nutshell

3.1 Background

Consider the labeled transition system describing the behavior of a process P:



Furthermore, consider the CCS process Q defined by the following equations:

$$\begin{aligned} \mathrm{Q} &\stackrel{\mathsf{def}}{=} (\mathrm{Q}_1 \mid \mathrm{Q}_2) \setminus \{a\} \\ \mathrm{Q}_1 &\stackrel{\mathsf{def}}{=} a.\bar{b}.\mathrm{Q}_1 \\ \mathrm{Q}_2 &\stackrel{\mathsf{def}}{=} b.\bar{a}.\mathrm{Q}_2 \end{aligned}$$

3.2 Tasks

1. Draw a labeled transition system that describes the behavior of process Q.
2. (a) Are the processes P and Q strongly bisimilar?

   (b) Are the processes P and Q weakly bisimilar?

   Justify your answers: if yes, give a strong (weak) bisimulation $\mathcal{R}$ such that $\mathrm{P}\,\mathcal{R}\,\mathrm{Q}$; if no, argue why not.