

Assignment 1

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Question 12

- a. Show $P_2 \approx P_3$, i.e., P_2 and P_3 are *bisimilar*.

Clearly, $p_0 \approx s_0$ as only a and b come out of both p_0 and s_0 . After trace a , in P_2 , p_0 goes to state p_1 ; in P_3 , s_0 goes to state s_1 . $p_1 \approx s_1$ since only a comes out of both p_1 and s_1 . $p_2 \approx s_2$ since a, b and c can be executed from both states. $p_3 \approx s_3$ since only a and c can come out of both p_3 and s_3 . $p_4 \approx s_4$ since only a and b come out of both p_4 and s_4 . $p_5 \approx s_5$ since only c can be executed from both states and both lead back to the starting states. $p_5 \approx s_6$ since only c can be executed from both states and both lead back to the starting states as well. Hence $P_2 \approx P_3$.

- b. Show that $P_1 \not\approx P_2$, i.e., P_1 and P_2 are not *bisimilar*.

Clearly, $q_0 \approx p_0$ since only transition a can be executed from both q_0 and p_0 . Then $q_1 \approx p_1$ since only a comes out of both p_1 and q_1 . After this trace a , in P_1 , q_1 goes to either q_2 or q_3 while p_1 goes to p_2 in P_2 . However, $q_2 \not\approx p_2$ since at state p_2 , a , b , and c can be executed but from state q_2 , only a and c can be executed. $q_3 \not\approx p_2$ either since only a and b can be executed from q_3 . Therefore, $P_1 \not\approx P_2$.

- c. Show that $P_1 \not\approx P_3$, i.e., P_1 and P_3 are not *bisimilar*.

Clearly, $q_0 \approx s_0$ since only transition a can be executed from both states. After trace a , in P_1 , q_0 goes to state q_1 while in P_3 , s_0 goes to state s_1 . $q_1 \approx s_1$ since only transition a can be executed in both cases. After this trace a , in P_1 , q_1 goes to either q_2 or q_3 while in P_3 , s_1 goes to state s_2 . However, $s_2 \not\approx q_2$ and $s_2 \not\approx q_3$. At s_2 , a , b and c can be executed while at q_2 , only a and c can be executed; while at q_3 , only a and b can be executed. Hence, $P_1 \not\approx P_3$.

- d. $\text{Traces}(P_1) = \text{Traces}(P_2) = \text{Traces}(P_3) = \text{Pref}((aa(c^*a \cup b^*a)c)^*)$