

Student ID :
Name Surname :

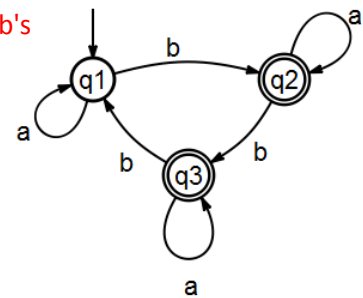
Automata Theory Course Quiz-1.b (2015-2016 Fall)
(Please use free space for draft and fit your answer to boxes.)

1. (50P) Express what DFA at the right does as a sentence. ($\Sigma=\{a,b\}$)

Briefly, it accepts binary $\{a,b\}$ words in which the number of its b's must be relatively prime with three.

But we can consider each state as an independent language

$$\begin{aligned} L_{q_1} &= a.L_{q_1} \cup b.L_{q_2} \\ L_{q_2} &= \varepsilon \cup a.L_{q_2} \cup b.L_{q_3} \\ L_{q_3} &= \varepsilon \cup a.L_{q_3} \cup b.L_{q_1} \end{aligned}$$



Because L_{q_2} depend on L_{q_3} , we should reduce L_{q_3}

$$L_{q_3} = \varepsilon \cup a.L_{q_3} \cup b.L_{q_1} = a^* \cup a^*b.L_{q_1}$$

Because L_{q_1} depend on L_{q_2} , we should reduce also L_{q_2}

$$L_{q_2} = \varepsilon \cup a.L_{q_2} \cup b.(a^* \cup a^*b.L_{q_1}) = a^*(\varepsilon \cup ba^* \cup ba^*b.L_{q_1})$$

We should organize L_{q_1} by placing L_{q_2}

$$\begin{aligned} L_{q_1} &= a.L_{q_1} \cup ba^*(\varepsilon \cup ba^* \cup ba^*b.L_{q_1}) = (a \cup ba^*ba^*b).L_{q_1} \cup ba^* \cup ba^*ba^* \\ L_{q_1} &= (a \cup ba^*ba^*b)^*(ba^* \cup ba^*ba^*) \end{aligned}$$

2. (50P) Design such a DFA that its regular expression is $(a \cup b)a^*b$. ($\Sigma=\{a,b\}$)

We should evaluate the given RegEx as a problem definition.

