CS 4124
Solutions to Homework Assignment 5

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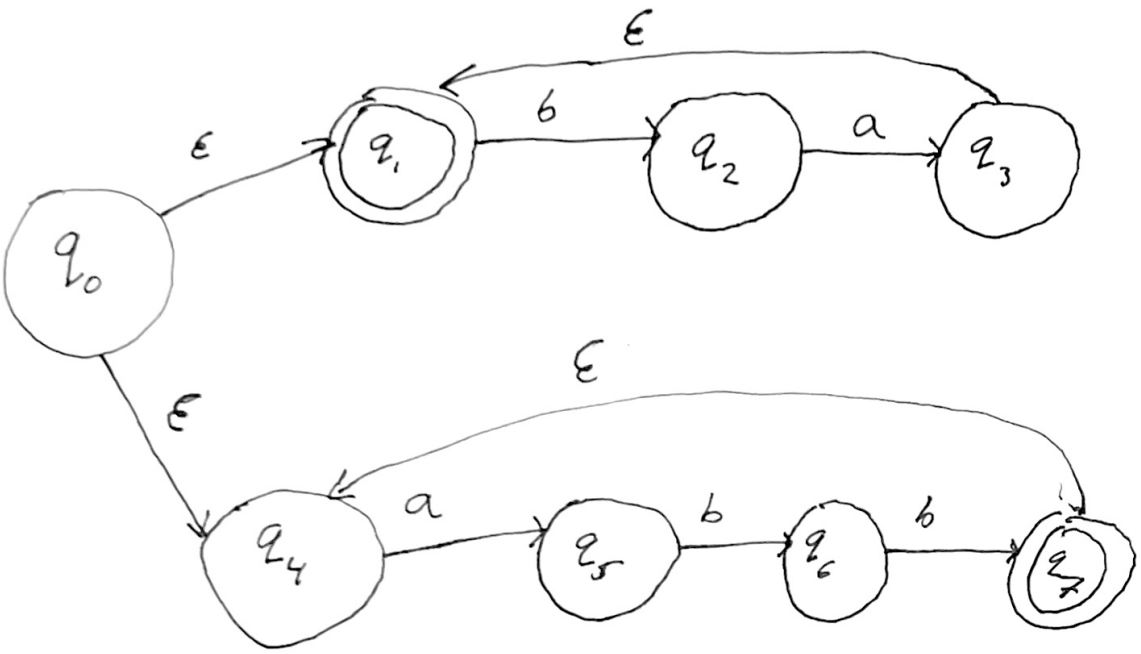
[50] 1. Let $\mathcal{R}_1$ be the (simplified) regular expression $(ba)^\star + (abb)(abb)^\star$.

Construct an ε-NFA N_1 that accepts the language denoted by $\mathcal{R}_1$. You should employ the construction given in class or in the textbook for inspiration, but you do not have to follow the construction precisely. Use reason to construct your N_1 and justify your reasoning. Give N_1 as a labeled directed graph or state diagram. Please draw it neatly!

This was constructed by first creating two $\varepsilon-$NFA the first one located at the top recognizes $(ba)^\star$ this is seen as it accepts the empty string and if it does receive a string in order for it to accept it must take the path $q_1 \longrightarrow q_2 \longrightarrow q_3 \longrightarrow q_1$ which can only be traversed by the string $ba\varepsilon$. The epsilon ensures that $(ba)^\star$ will be recognized.

The second $\varepsilon-$NFA is located at the bottom and recognizes $(abb)(abb)^\star$ this is seen as it first must traverse $q_4 \longrightarrow q_5 \longrightarrow q_6 \longrightarrow q_7$ to reach an accepting state. This can only be done by the string abb after it is in state q_7 there is an epsilon transition back to q_4 which ensures that $(abb)(abb)^\star$ will also be recognized. Both these $\varepsilon-$NFA are combined with the initial state q_0 and a ε transition to their initial states.


ε
ε
b
a
q_0
q_1
q_2
q_3
ε
ε
a
b
b
q_4
q_5
q_6
q_7

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[50] 2. Let N_2 be the ε-NFA in Figure **??**.

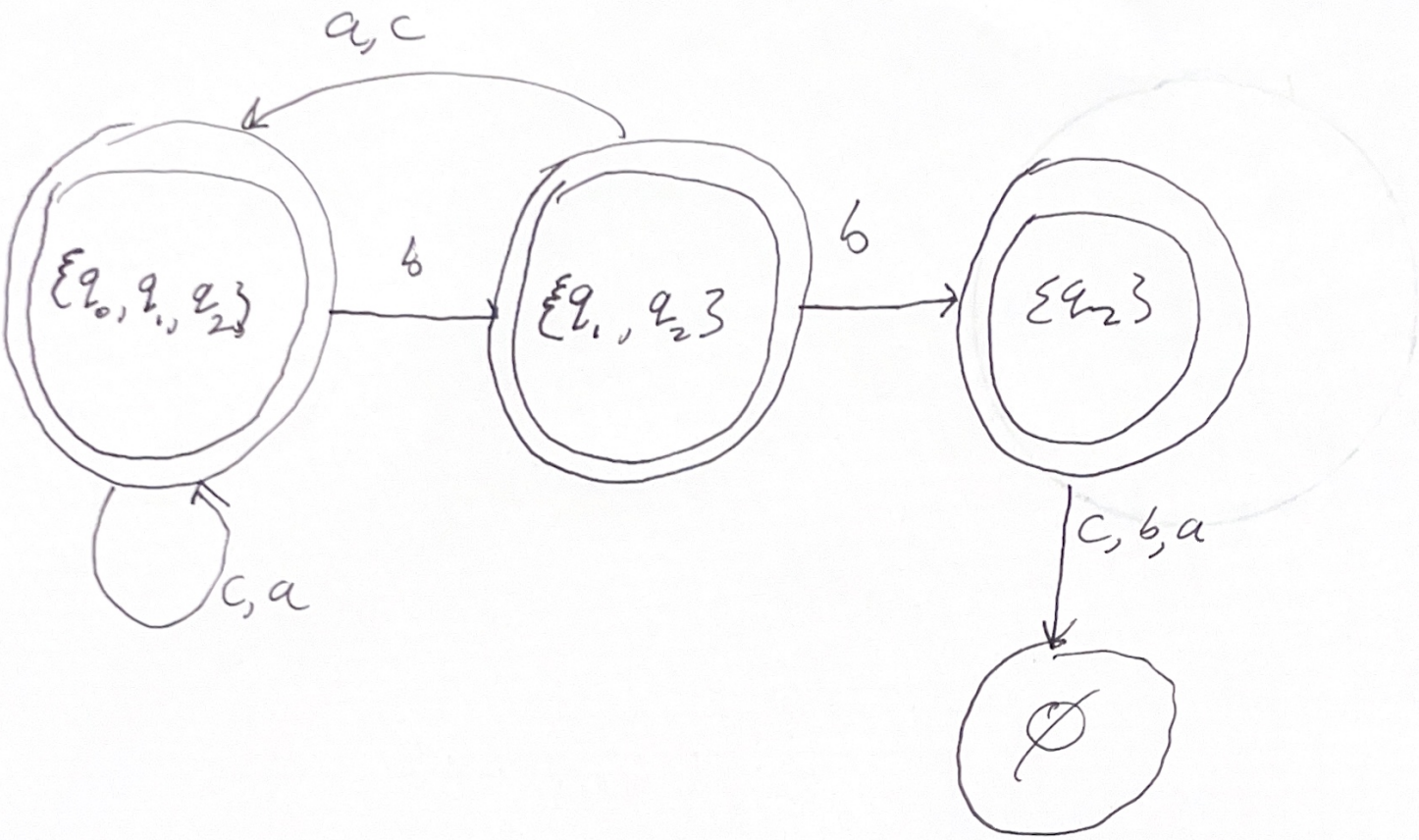
A. Compute the ε-reachability set $E(q)$ of each state q of N_2.

$$E(q_0) = \{q_0, q_1, q_2\}$$
$$E(q_1) = \{q_1\}$$
$$E(q_2) = \{q_2\}$$

B.

bb	$q_0 \xrightarrow{b} q_1 \xrightarrow{b} q_2$
cb	$q_0 \xrightarrow{\varepsilon} q_1 \xrightarrow{c} q_1 \xrightarrow{b} q_2$
ε	$q_0 \xrightarrow{\varepsilon} q_2$
c	$q_0 \xrightarrow{c} q_2$
b	$q_0 \xrightarrow{\varepsilon} q_1 \xrightarrow{b} q_2$
ab	$q_0 \xrightarrow{\varepsilon} q_1 \xrightarrow{a} q_0 \xrightarrow{\varepsilon} q_1 \xrightarrow{b} q_2$
cc	$q_0 \xrightarrow{\varepsilon} q_1 \xrightarrow{c} q_0 \xrightarrow{c} q_2$
ac	$q_0 \xrightarrow{\varepsilon} q_1 \xrightarrow{a} q_0 \xrightarrow{c} q_2$
ca	$q_0 \xrightarrow{\varepsilon} q_1 \xrightarrow{c} q_1 \xrightarrow{a} q_0 \xrightarrow{\varepsilon} q_2$
ba	$q_0 \xrightarrow{b} q_1 \xrightarrow{a} q_0 \xrightarrow{\varepsilon} q_2$
a	$q_0 \xrightarrow{\varepsilon} q_1 \xrightarrow{a} q_0 \xrightarrow{\varepsilon} q_2$

C. Use the power set construction to obtain a DFA M_2 equivalent to N_2. Give M_2 as a labeled directed graph or state diagram. Please draw it neatly!


a, c
{q0, q1, q2}
b
{q1, q2}
b
{q2}
c, a
c, b, a
∅