CS334-B

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Problem Set 1

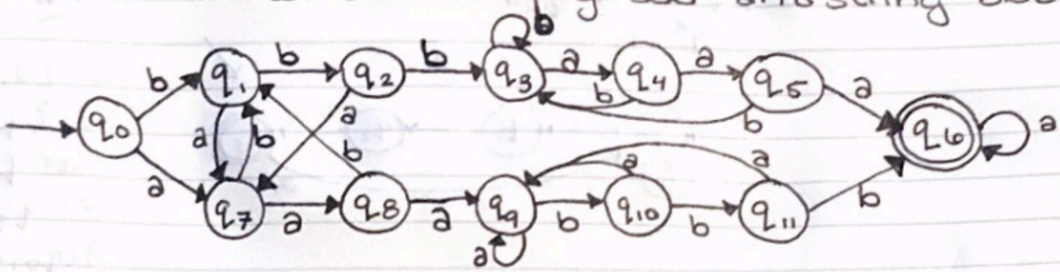
"I pledge my honor that I have abided by the Stevens Honor System" J Nelson

Problem 1

$\Sigma = \{a,b\}$

1\.

$L_1 = \{w : w$ contains the string aaa and string bbb$\}$



$\Sigma = \{a,b\}$

$Q = \{q_0, q_1, q_2, q_3, q_4, q_5, q_6, q_7, q_8, q_9, q_{10}, q_{11}, \}$

Start State: q_0

$F = q_6$

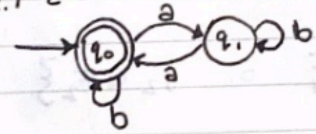
Transitions:

$\delta(q_0,a) = q_7$
$\delta(q_0,b) = q_1$
$\delta(q_1,a) = q_7$
$\delta(q_1,b) = q_2$
$\delta(q_2,a) = q_7$
$\delta(q_2,b) = q_3$
$\delta(q_3,a) = q_4$
$\delta(q_3,b) = q_3$
$\delta(q_4,a) = q_5$
$\delta(q_4,b) = q_3$
$\delta(q_5,a) = q_6$
$\delta(q_5,b) = q_3$
$\delta(q_6,a) = q_6$
$\delta(q_6,b) = q_6$
$\delta(q_7,a) = q_8$
$\delta(q_7,b) = q_1$
$\delta(q_8,a) = q_9$
$\delta(q_8,b) = q_1$
$\delta(q_9,a) = q_9$
$\delta(q_9,b) = q_{10}$
$\delta(q_{10},a) = q_9$
$\delta(q_{10},b) = q_{11}$
$\delta(q_{11},a) = q_9$
$\delta(q_{11},b) = q_6$

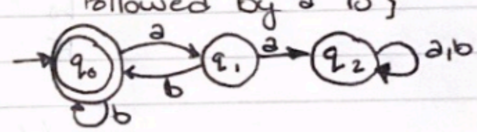
2\.

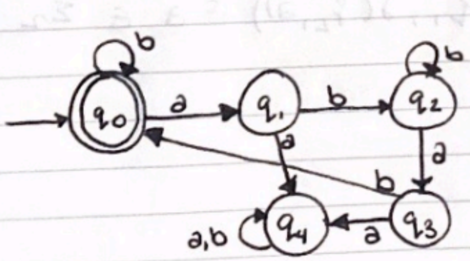
$L_2 = \{w : w$ contains an even # of a's and each a is followed immediately by atleast 1 b$\}$

$L_{2.1} = \{w : w$ contains even # a's$\}$



$L_{2.2} = \{w :$ each a is immediately followed by a "b"$\}$





$\Sigma = \{a,b\}$

$Q = \{q_0, q_1, q_2, q_3, q_4\}$

Start State: q_0

$F = q_0$

Transitions

$\delta(q_0,a) = q_1$
$\delta(q_0,b) = q_0$
$\delta(q_1,a) = q_4$
$\delta(q_1,b) = q_2$
$\delta(q_2,a) = q_3$
$\delta(q_2,b) = q_2$
$\delta(q_3,a) = q_4$
$\delta(q_3,b) = q_0$
$\delta(q_4,a) = q_4$
$\delta(q_4,b) = q_4$

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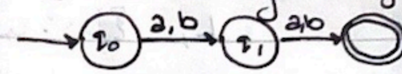
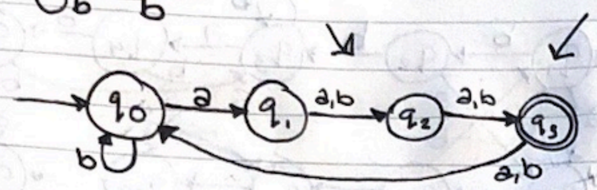
3. $L_3 = \{w :$ the 3^{rd} last symbol in w is $a\}$

$L_{3.1} = \{w :$ last symbol is $a\}$

$L_{3.2} = \{w :$ exactly 2 symbol$\}$





$\Sigma = \{a, b\}$
$Q = \{q_0, q_1, q_2, q_3\}$
Start: q_0
$F = q_3$
$\delta(q_0, a) = q_1$ $\quad \delta(q_3, a) = q_0$
$\delta(q_0, b) = q_0$ $\quad \delta(q_3, b) = q_0$
$\delta(q_1, a) = q_2$
$\delta(q_1, b) = q_2$
$\delta(q_2, a) = q_3$
$\delta(q_2, b) = q_3$

Problem 2

Modify proof of Theorem 1.25.

Proof: Let A_1, A_2 be regular languages ~~over~~ respectfully Σ_1 and Σ_2 recognized by FSA M_1 and M_2

M_1 recognized A_1, where $M_1 = (Q_1, \Sigma_1, \delta_1, q_1, F_1)$
M_2 recognize A_2, where $M_2 = (Q_2, \Sigma_2, \delta_2, q_2, F_2)$

Define a new FSA $M = (Q, \Sigma, \delta, q_0, F)$:

$Q = Q_1 \times Q_2$
$\Sigma = \Sigma_1 \cup \Sigma_2$
$q_0 = (q_1, q_2)$
$F = \{(\delta_1, \delta_2) \mid \delta_1 \in F_1$ or $\delta_2 \in F_2\}$

$\delta((\delta_1, \delta_2), a) = (\delta(\delta_1, a), q_2)$ if $a \in \Sigma_1$
$\quad = (q_1, \delta(\delta_2, a))$ if $a \in \Sigma_2$