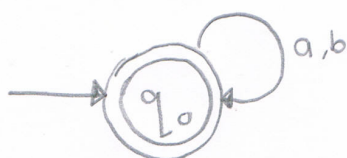


Tutorial 4

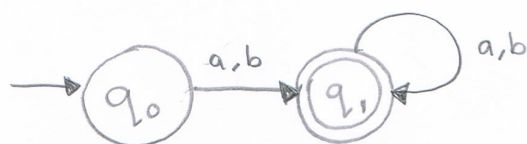
Muhammad Aminul Fahmi b.
Noor Anim
BIQEC0018

1. Draw finite automata for alphabet $\{a,b\}$

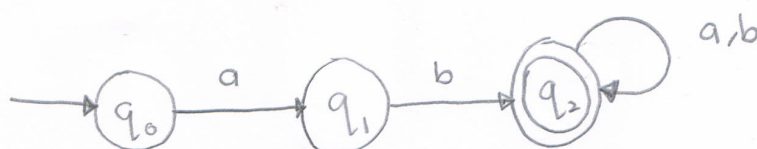
(a) $L_1 = \text{All strings} = (a+b)^*$



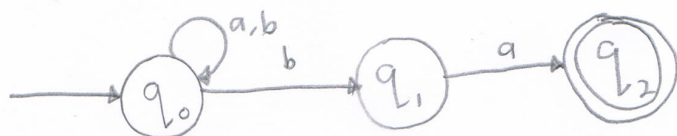
(b) $L_2 = \text{All strings except empty strings} = (a+b)^+$



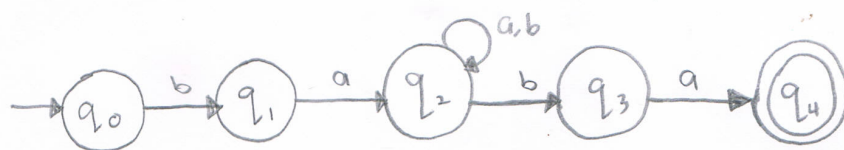
(c) $L_3 = \text{All strings starting with ba} = ba(a+b)^*$



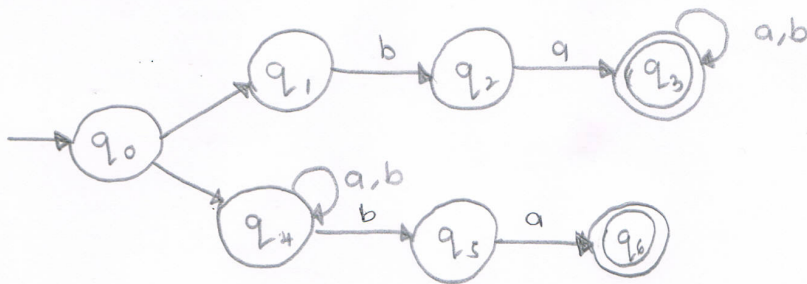
(d) $L_4 = \text{All strings ending with ba} = (a+b)^*ba$



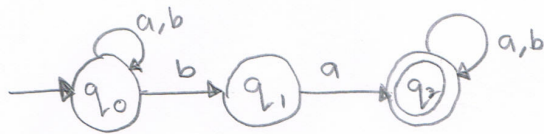
(e) $L_5 = \text{All strings that begin AND end with ba} = ba(a+b)^*ba$



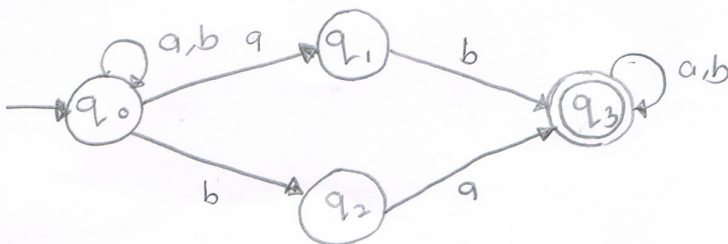
(f) L_6 = All strings that begin OR end with ba = $ba(a+b)^* + (a+b)^*ba$



(g) All strings that contain the substring ab = $(a+b)^*ba(a+b)^*$



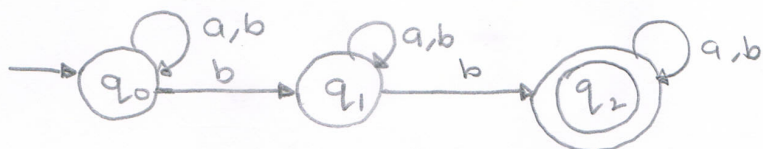
(h) L_9 = All strings that contain the substring ab or ba = $(a+b)^*(ab+ba)(a+b)^*$



(i) L_{10} = All strings containing exactly two b 's = $a^*ba^*ba^*$



(j) L_{11} = All strings containing at least two b 's = $(a+b)^*b(a+b)^*b(a+b)^*$



2. Let M be a finite automaton defined by

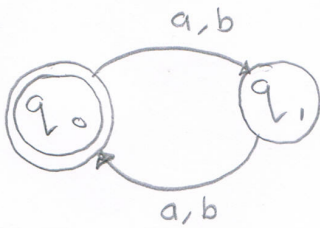
$$Q = \{q_0, q_1\};$$

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

$$q_0 = q_0; F = \{q_0\}$$

δ	a	b
q_0	q_1	q_1
q_1	q_0	q_0

(a) Give a state ~~dig~~ diagram (FA) for this state table.



(b) Trace the computations that process the strings, abbb, baa and baba.

$$\begin{aligned}
 [q_0, abbb] &\vdash [q_1, bbb] \\
 &\vdash [q_0, bb] \\
 &\vdash [q_1, b] \\
 &\vdash [q_0, \lambda]
 \end{aligned}$$

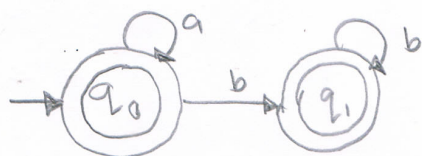
$$\begin{aligned}
 [q_0, baa] &\vdash [q_1, aa] \\
 &\vdash [q_0, a] \\
 &\vdash [q_1, \lambda]
 \end{aligned}$$

$$\begin{aligned}
 [q_0, baba] &\vdash [q_1, aba] \\
 &\vdash [q_0, ba] \\
 &\vdash [q_1, a] \\
 &\vdash [q_0, \lambda]
 \end{aligned}$$

(c) Give regular expressions for the language accepted by M .

$$(a+b)^*$$

3. Let M be the FA with state diagram.



(a) Construct the transition table of M .

δ	a	b
q_0	q_0	q_1
q_1	-	q_1

(b) Which of the strings abb , aab , $abab$, $aaaab$ are accepted by M ?

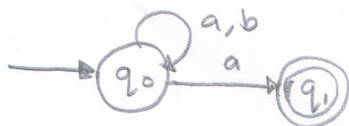
abb , aab and $aaaab$ are accepted by M .

(c) Give a regular expression for $L(M)$

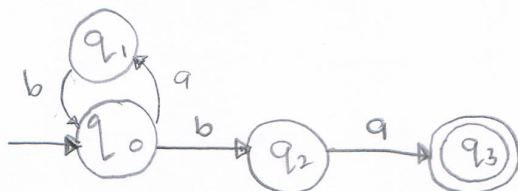
a^*b^*

4. For each of the following languages, draw a FA accepting it.

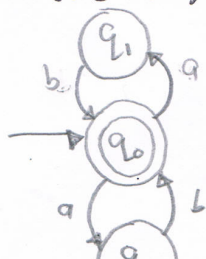
(a) $(a+b)^*a$



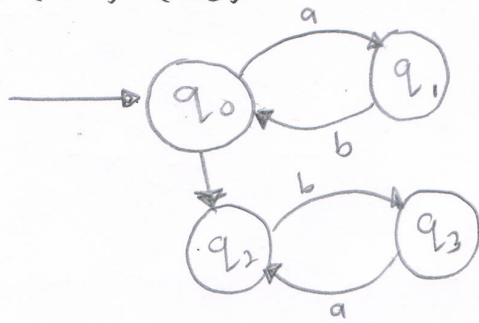
(b) $(ab)^*ba$



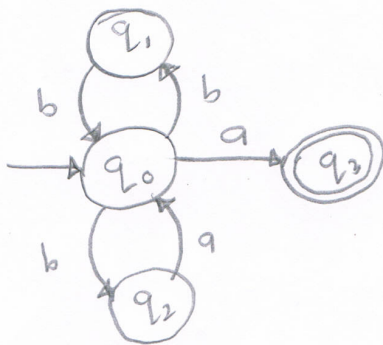
(c) $(ab+ba)^*$



(d) $(ab)^*(ba)^*$



(e) $(bb+ba)^*a$



(f) $(bb+ba)a$

