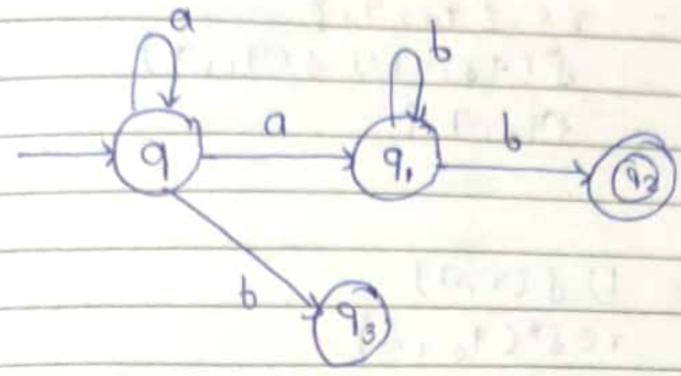
Tutorial no 5

Q1 For Following NFA



Find $\delta^*(q_0 aab)$

→ transition table

$M = (Q, \Sigma, q_0, A, \delta)$
$Q = \{q_0, q_1, q_2, q_3\}$
$\Sigma = \{a, b\}$
$q_0 = \{q_0\}$
$A = \{q_2\}$
$\delta = Q \times \Sigma : 2^Q$

Transition table

states	a	b
q_0	$\{q_0, q_1\}$	q_3
q_1	ϕ	$\{q_1, q_2\}$
q_2	ϕ	ϕ
q_3	ϕ	ϕ

$\delta^*(q_0, aab) = \bigcup_{r \in \delta^*(q_0, aa)} \delta(r, b)$
$= r \in \{q_0, q_1\}$
$= (\delta(q_0, b) \cup \delta(q_1, b))$
$= q_3, q_1, q_2$

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$$\delta^*(q_0, aa) = \bigcup_{r \in \delta^*(q_0, a)} \delta(r, a)$$

$= r \in \{q_0, q_1\}$

$= \delta(q_0, a) \cup \delta(q_1, a)$

$= \{q_0, q_1\}$

$$\delta^*(q_0, a) = \bigcup_{r \in \delta^*(q_0, \Lambda)} \delta(r, a)$$

$r \in \{q_0\}$

$\delta(q_0, a)$

$= \{q_0, q_1\}$

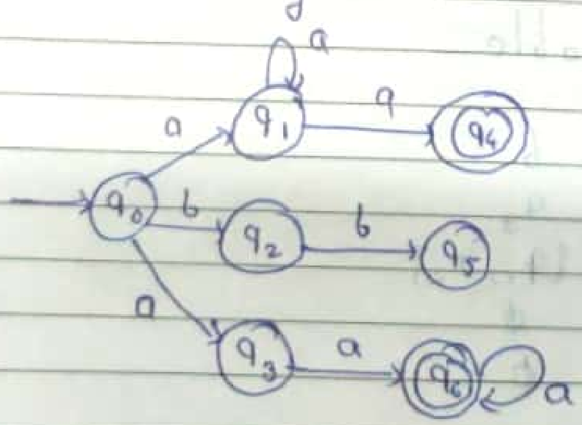
$\delta^*(q_0, \Lambda) = \{q_0\}$

$\delta^*(q_0, aab) = \{q_1, q_2, q_3\}$

q_2 is acceptated state

aab is accepted

Q2 For following NFA



$Q = \{q_0, q_1, q_2, q_3, q_4, q_5, q_6\}$

$\Sigma = (a, b)$

$A = \{q_4, q_6\}$

$q_0 = \{q_0\}$

$\delta = Q \times \Sigma = 2^Q$

state	a	b
q_0	$\{q_1, q_3\}$	q_2
q_1	$\{q_1, q_4\}$	ϕ
q_2	$\cancel{q_5}$ ϕ	q_5
q_3	q_6	ϕ
q_4	ϕ	ϕ
q_5	ϕ	ϕ
q_6	q_6	ϕ

Find $\delta^*(q_0, aaa)$

$$\delta^*(q_0, aaa) = \bigcup_{r \in \delta^*(q_0, aa)} \delta(r, a)$$

$$r \in \{q_1, q_4, q_6\}$$

$$= \delta(q_1, a) \cup \delta(q_4, a) \cup \delta(q_6, a)$$

$$= \{q_1, q_4, q_6\}$$

$$\delta^*(q_0, aa) = \bigcup_{r \in \delta^*(q_0, a)} \delta(r, a)$$

$$= r \in \{q_1, q_3\}$$

$$= \delta(q_1, a) \cup \delta(q_3, a)$$

$$= \{q_1, q_4, q_6\}$$

$$\delta^*(q_0, a) = \bigcup_{r \in \delta^*(q_0, \Lambda)} \delta(r, a)$$

$$= r \in \cancel{\delta^*}\{q_0\}$$

$$= \delta(q_0, a)$$

$$= \{q_1, q_3\}$$

$$\delta^*(q_0, \Lambda) = \{q_0\}$$

$$\delta^*(q_0, aaa) = \{q_1, q_4, q_6\}$$

q_4 & q_6 is acceptace state

$\therefore$ aaa is accepted

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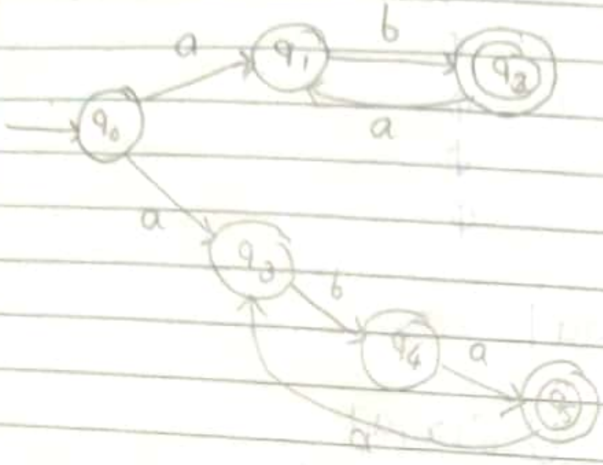
abab abaa

ababa

Q 3 Draw NFA and convert it into DFA

a) $(ab)^* + (aba)^*$



$Q = \{q_0, q_1, q_2, q_3, q_4, q_5\}$
$\Sigma = \{a, b\}$
$q_0 = \{q_0\}$
$A = \{q_2, q_5\}$
$\delta = Q \times \Sigma = 2^Q$

$\delta^*(q_0 a) = \bigcup (\delta(r, a))$
$r \in \delta^* \{q_0, \Lambda)$
$r \in \{q_0\}$
$\delta(q_0, a)$
$= \{q_1, q_3\}$
$\delta(q_0, \Lambda) = \{q_1\}$

$\delta^*(q_1, a) = \bigcup (\delta(r, a)$
$r \in \delta^*(q_0, \Lambda)$
$= r \in \{q_1\}$
$\delta(q_1, a)$
$= \phi\ q_1$

$\delta^*(q_1 \Lambda) = \{q_1\}$

$\delta^*(q_1, b) = \bigcup_{r \in \delta^*(q_1, \Lambda)} (\delta(r, b))$

$= r \in \{q_1\}$

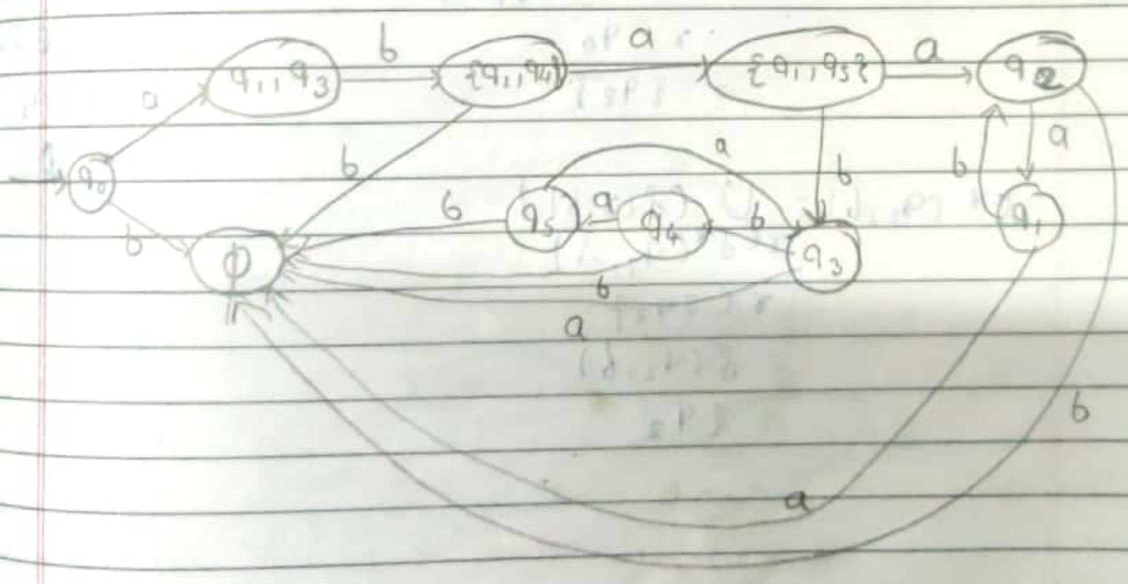
$\delta^*(q_1, b)$

$= \{q_2\}$

$\delta^*(q_1, \Lambda) = \{q_1\}$

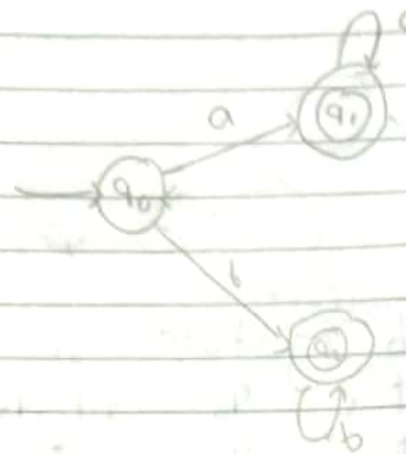
state	a	b
q_0	$\{q_1, q_3\}$	ϕ
q_1	$\{q_1\}$	ϕ
q_2	ϕ	$\{q_4\}$
q_3	q_5	ϕ
q_4	q_3	ϕ
q_5		

state	a	b
q_0	$\{q_1, q_3\}$	ϕ
q_1	ϕ	q_2
q_2	q_1	ϕ
q_3	ϕ	q_4
q_4	q_5	ϕ
q_5	q_3	ϕ



ab

b) $aa^* + bb^*$



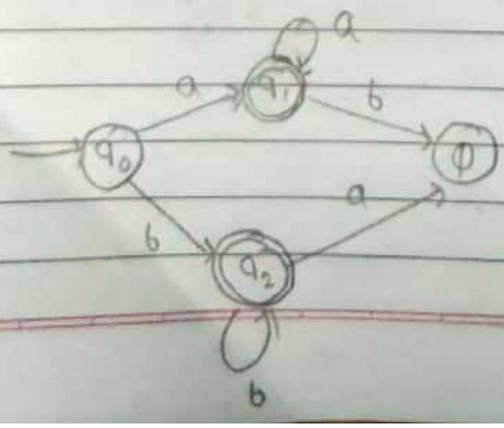
$\delta^*(q_0, a) = \bigcup_{r \in \delta^*(q_0, \Lambda)} \delta(r, a)$
$= r \in \{q_0\}$
$= \delta(q_0, a)$
$= \{q_1\}$

$\delta^*(q_1, a) = \bigcup_{r \in \delta^*(q_1, \Lambda)} \delta(r, a)$
$= r \in \{q_1\}$
$= \delta(q_1, a)$
$= \{q_1\}$

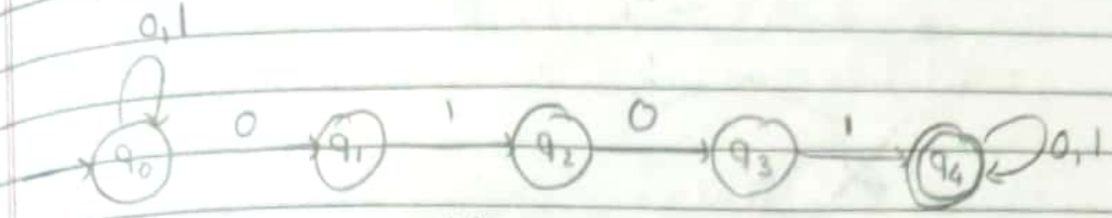
$\delta^*(q_0, b) = \bigcup_{r \in \delta^*(q_0, \Lambda)} (\delta(r, b))$
$r \in q_0$
$= \{q_2\}$

$\delta^*(q_1, b) = \bigcup_{r \in \delta^*(q_1, \Lambda)} \delta(r, b)$
$r \in \{q_1\}$
$\delta(q_1, b)$
$= \Phi$

$\delta^*(q_2, b) = \bigcup_{r \in \delta^*(q_2, \Lambda)} (\delta(r, b))$
$r \in \{q_2\}$
$= \delta(q_2, b)$
$= \{q_2$



c) $(0+1)^*(0101)(0+1)^*$

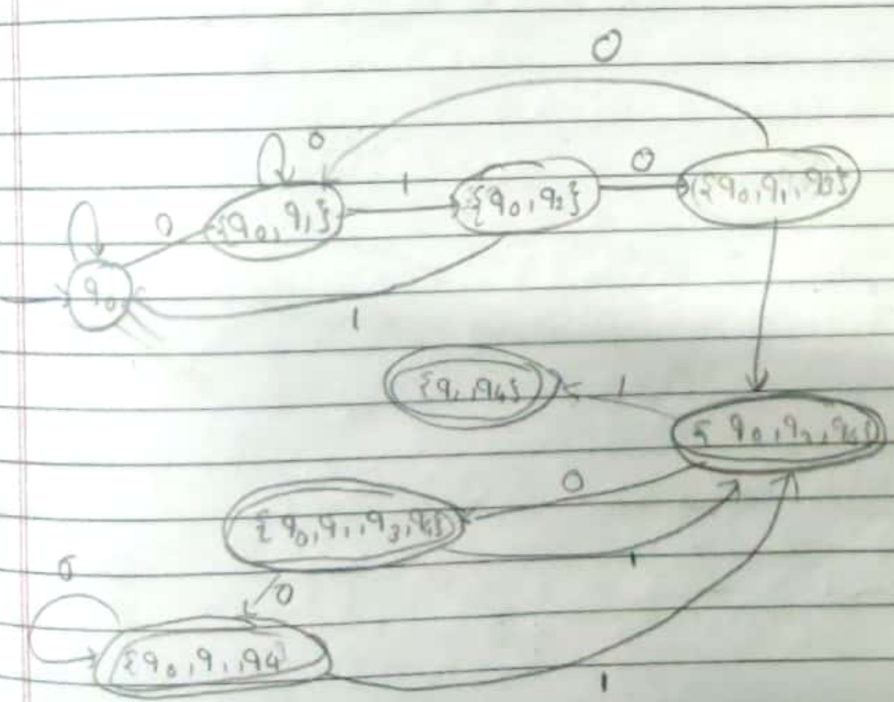


$\delta^*(q_0,0) = \bigcup(\delta(r,0))$
$r \in \delta^*(q_0,\Lambda)$
$r \in \{q_0\}$
$\delta(q_0,0)$
$\{q_0,q_1\}$

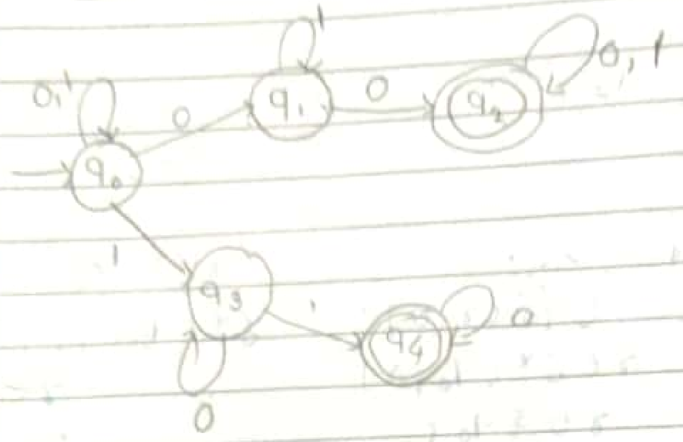
$\delta^*(q_0,1) = \bigcup(\delta(r,1))$
$r \in \delta^*(q_0,\Lambda)$
$r \in \{q_1\}$
$\delta(q_0,0)$
$= q_0$

$\delta^*(q_1,0) = \bigcup(\delta(r,0))$
$r \in \delta^*(q_1,\Lambda)$
$= r \in \{q_1\}$
$= \delta(q_1,0)$
$= \phi$

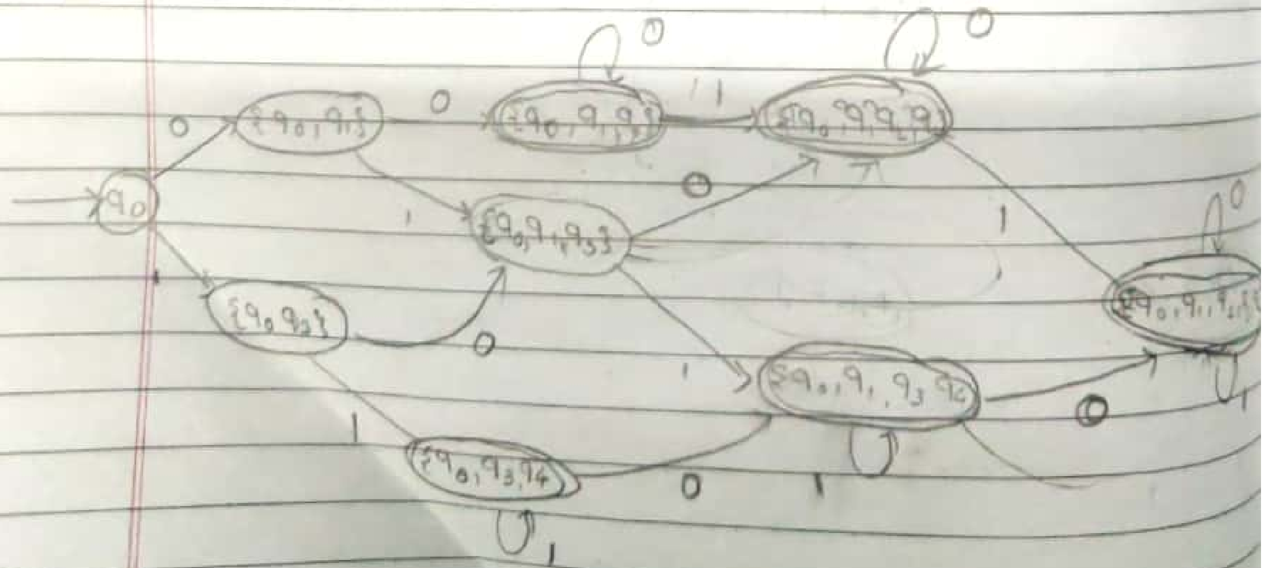
$\delta^*(q_1,1) = \bigcup(\delta(r,1))$
$r \in \delta^*(q_1,\Lambda)$
$r \in \{q_1\}$
$\cancel{r \in} \delta(q_1,1)$
q_2



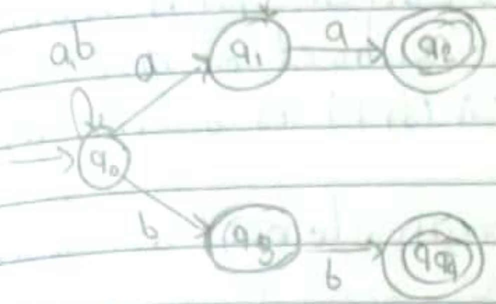
d) $0^*(0+1)^*01^*0(0+1)^* + 0^*10^*10^*$



state	0	1
q_0	$\{q_0, q_1\}$	$\{q_0, q_3\}$
q_1	$\{q_2\}$	$\{q_1\}$
q_2	$\{q_2\}$	$\{q_2\}$
q_3	$\{q_3\}$	$\{q_4\}$
q_4	$\{q_4\}$	ϕ



c) $(a+b)^*(aa+bb)$



state	a	b
q_0	$\{q_0, q_1\}$	$\{q_0, q_3\}$
q_1	$\{q_2\}$	ϕ
q_2	ϕ	ϕ
q_3	ϕ	q_4
q_4	ϕ	ϕ