

(1)

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Name: Danyl Fernandes

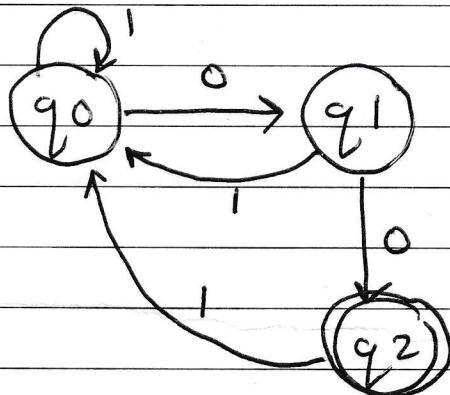
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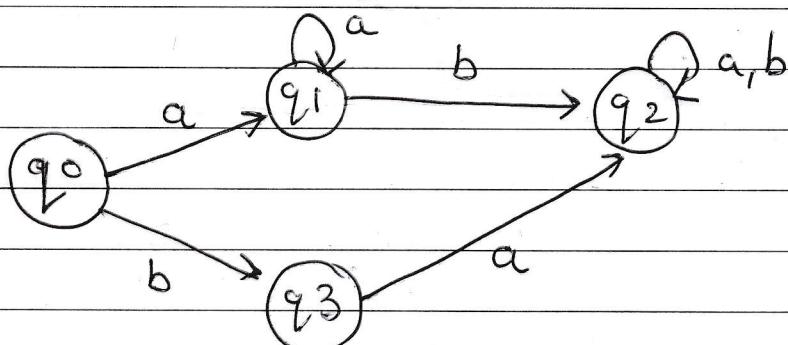
(Q2)

1) b) $\Sigma = \{0, 1\}$

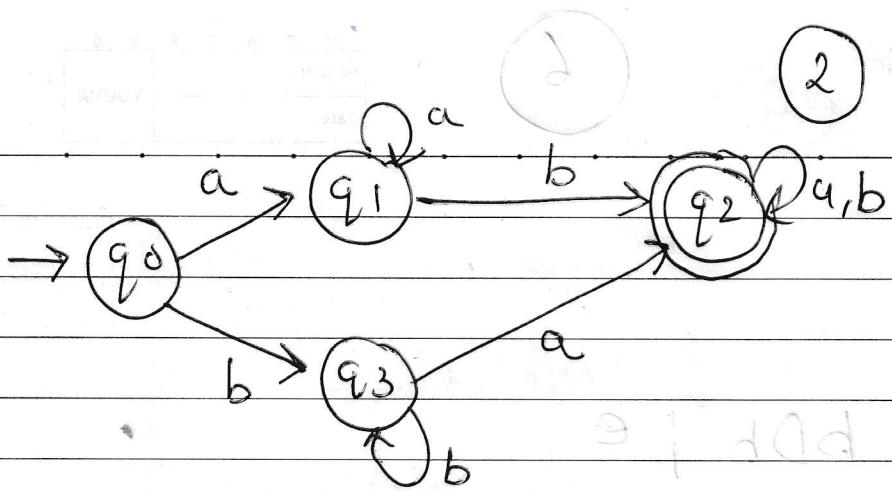
 $L = \{w \mid w \text{ ending with } 00\}$ 

Q \ Σ	0	1
q0	q1	q0
q1	q0	q2
q2	q2	q0

a) $L = \{w \mid w \text{ contains neither substring ab nor ba}\}$
 $\Sigma = \{a, b\}$



Step 1: Creating DFA for ab & ba



Step 2: Interchanging final & non-final states

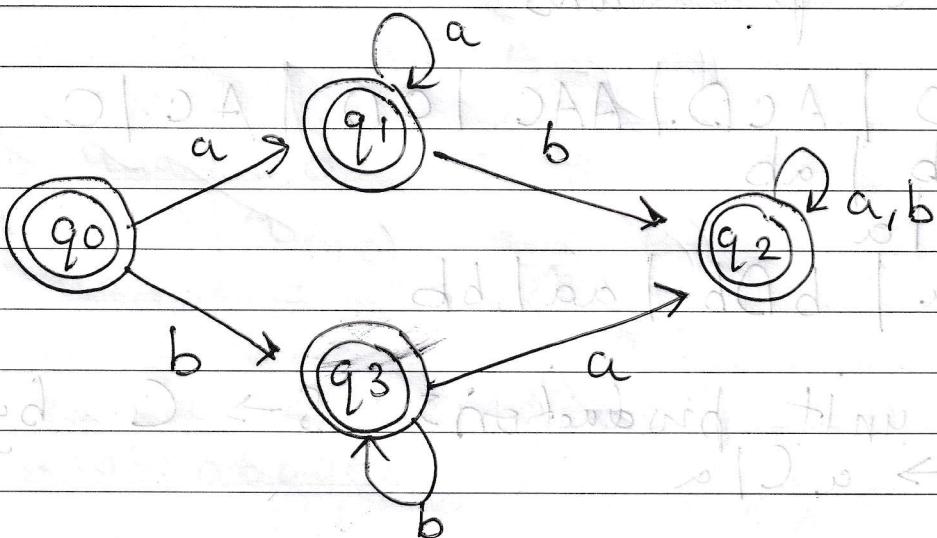
$$Q = \{q_0, q_1, q_2, q_3\}$$

$$F = \{q_0, q_1, q_3\}$$

$$\delta = \sum \times Q$$

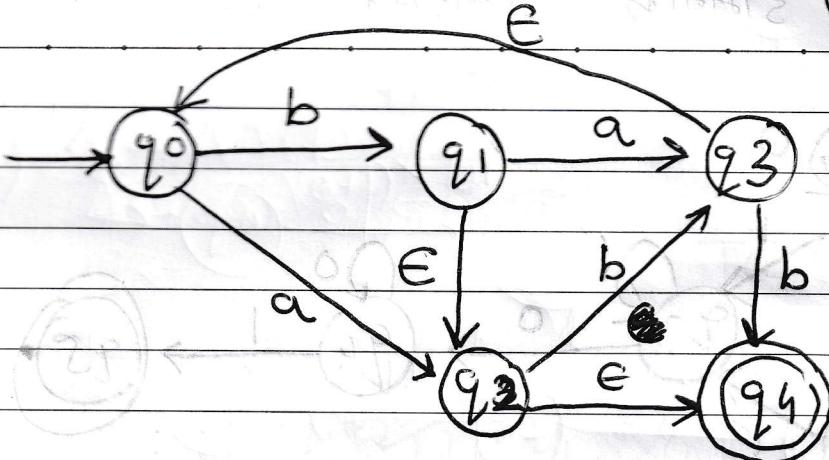
$$\Sigma = \{a, b\}$$

$$q_0 = q^0$$



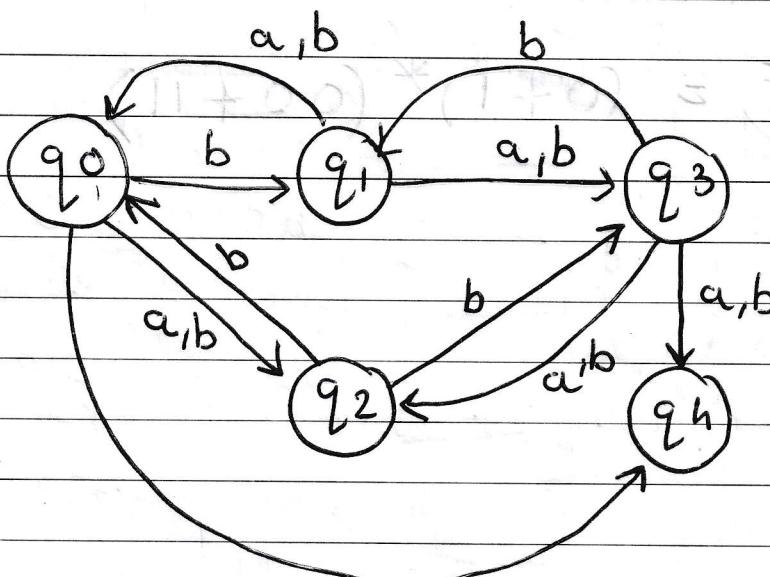
Q/Σ	a	b
q_0	q_1	q_3
q_1	q_1	q_2
q_2	q_2	q_3
q_3	q_2	q_3

2)

~~Q*~~

Q	E^*	$\delta(x_1, a)$	$\delta(x_2, b)$	$E(x_1)$	$E(x_2)$
q_0	$\{q_0\}$	$\{q_2\}$	$\{q_1\}$	$\{q_2, q_4\}$	$\{q_1, q_2, q_4\}$
q_1	$\{q_1, q_2, q_4\}$	$\{q_3\}$	$\{q_3, q_4\}$	$\{q_3, q_0\}$	$\{q_3, q_0, q_1\}$
q_2	$\{q_2, q_4\}$	-	$\{q_3, q_4\}$	-	$\{q_3, q_0, q_1\}$
q_3	$\{q_3, q_0\}$	$\{q_2\}$	$\{q_4, q_1\}$	$\{q_2, q_4\}$	$\{q_3, q_0, q_1\}$
q_4	$\{q_4\}$	-	-	-	$\{q_4, q_1, q_2\}$

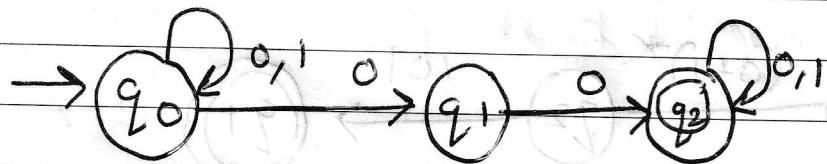
Q	E
q_0	$\{q_1\}$
q_1	$\{q_2\}$
q_2	$\{q_3\}$
q_3	$\{q_4\}$
q_4	$\{q_1\}$



Q E	a	b	a, b
q_0	$\{q_2, q_4\}$	$\{q_1, q_2, q_4\}$	
q_1	$\{q_0, q_3\}$		$\{q_0, q_3\}$
q_2	x		$\{q_0, q_3\}$
q_3	$\{q_2, q_4\}$		$\{q_1, q_2, q_3\}$
q_4	x		$\{q_1, q_2, q_3\}$

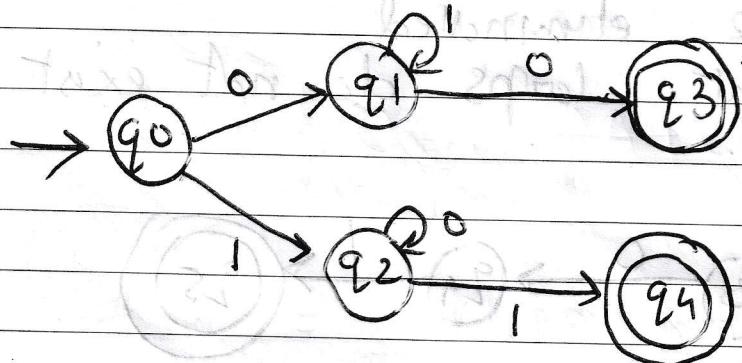
Q3)

2) i) set of all 0's & 1's with at least two consecutive 0's



$$R.E = (0+1)^* 00 (0+1)^*$$

ii) all strings over $\{0, 1\}$ last symbols are same

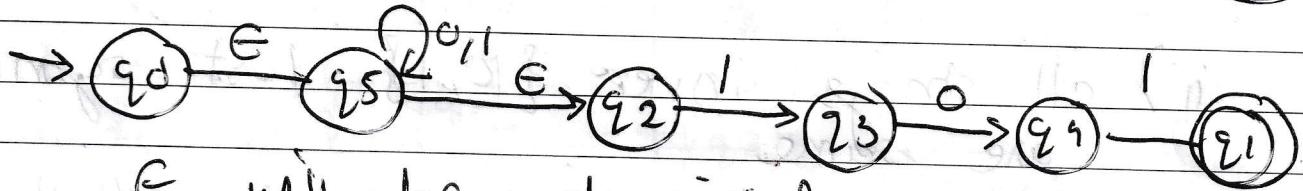
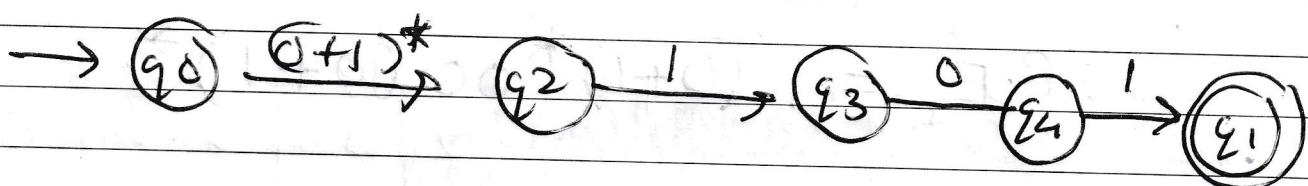
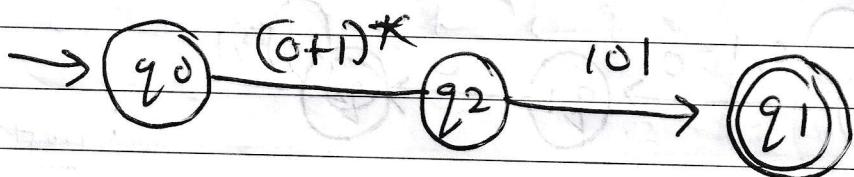
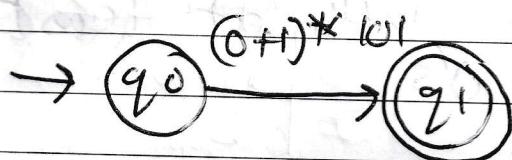


$$R.E = (0+1)^* (00 + 11)$$

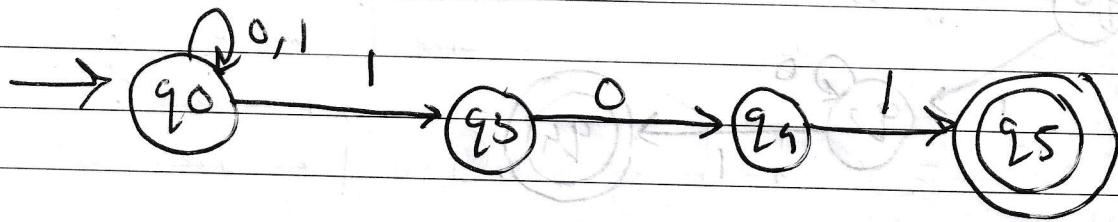
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Q3) i) NFA $(0+1)^* 101$ & convert to DRA



ϵ will be eliminated
since adjacent loops do not exist



$$Q \setminus \{E\} \cup \{0\} \cup (0+1)^* \cup (1+0)^* = E$$

q_0	q_0	$\{q_0, q_3\}$
$\{q_0, q_3\}$	$\{q_0, q_4\}$	$\{q_0\}$
$\{q_0, q_3\}$	$\{q_0, q_4\}$	$\{q_0, q_5, q_3\}$
$\{q_0, q_5\}$	$\{q_0\}$	$\{q_0, q_3, q_5\}$

Q4)

$$3) S \rightarrow AACD$$

$$A = aAb | \epsilon$$

$$C = aC | a$$

$$D \rightarrow aDa | bDb | \epsilon$$

Solution:

$$S \rightarrow AACD | ACD | AAC | CD | AC | CaC | a$$

$$A \rightarrow aAb | ab | \epsilon$$

$$C \rightarrow aC | a$$

$$D \rightarrow aDa | bDb | aa | bb | \epsilon$$

Eliminate ϵ productions

$$S \rightarrow AACD | ACD | AAC | CD | AC | C$$

$$A \rightarrow aAb | ab$$

$$C \rightarrow aC | a$$

$$D \rightarrow aDa | bDb | aa | bb$$

Removing unit productions $S \rightarrow C$ by
 $S \rightarrow aC | a$

$$S \rightarrow AACD | ACD | AAC | CD | AC | x_cCa$$

$$A \rightarrow x_aAx_b | x_a x_b$$

$$C \rightarrow x_aC | a$$

$$D \rightarrow x_aDx_a | x_bDx_b | x_a x_a | x_b x_b$$

$$x_a \rightarrow a$$

$$x_b \rightarrow b$$

(8)

(7)

Finally:

$$\begin{aligned}
 S &\rightarrow AT_1 | AU_1 | AV_1 | CD | AC | X_a C | a \\
 T_1 &\rightarrow AT_2 \\
 T_2 &\rightarrow CD \\
 U_1 &\rightarrow CD
 \end{aligned}$$

Q4)

2) $S \rightarrow aB | ba$

$A \rightarrow aS | bAA | a$

$B \rightarrow bS | aBB | b$

String: $aabbabba$

1) $S \rightarrow aB$

$\rightarrow aaB$

$\rightarrow aaaBB$

$\rightarrow aaa bSB$

$\rightarrow aaabbAB$

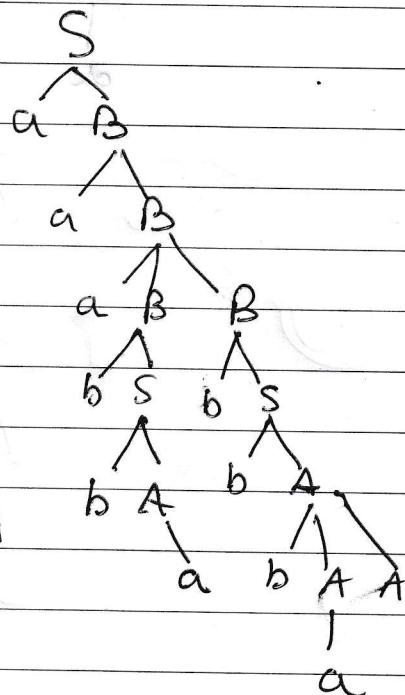
$\rightarrow aaabb aB$

$\rightarrow aaabbabS$

$\rightarrow aaabbabbA$

$\rightarrow aaabbabbAA$

$\rightarrow aaa bbaabbba$



2) RMD

$S \rightarrow aB$
 $\rightarrow aaB$
 $\rightarrow aaaBB$
 $\rightarrow aaaBbS$
 $\rightarrow aaaBbbA$
 $\rightarrow aaaBbbbA$
 $\rightarrow aaaBbbbbA$
 $\rightarrow aabbSbbbA$
 $\rightarrow aabbAbbbA$
 $\rightarrow aabbabbbA$

