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Internal Assessment Test 1 - Nov 2024

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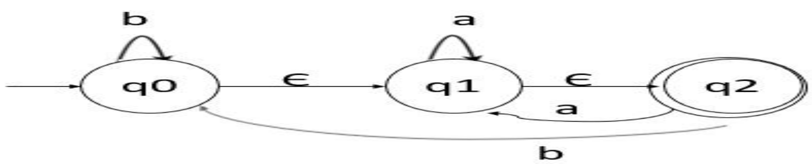
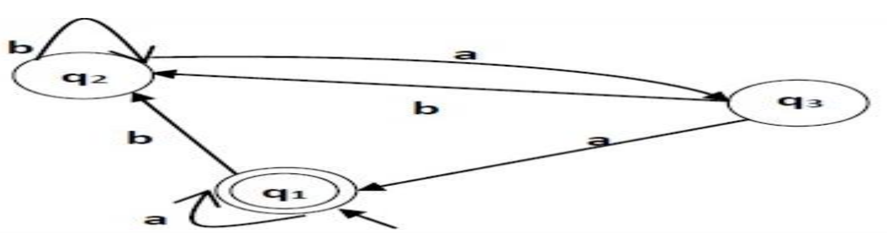
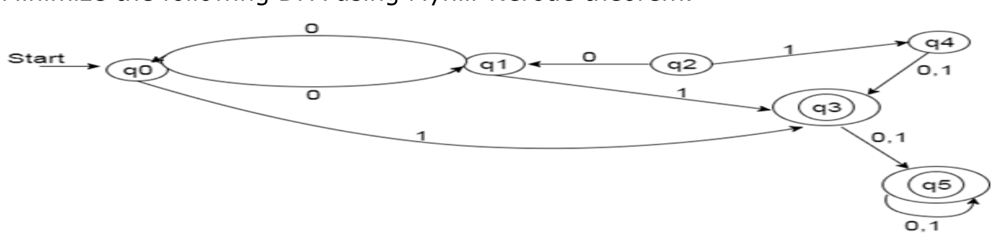
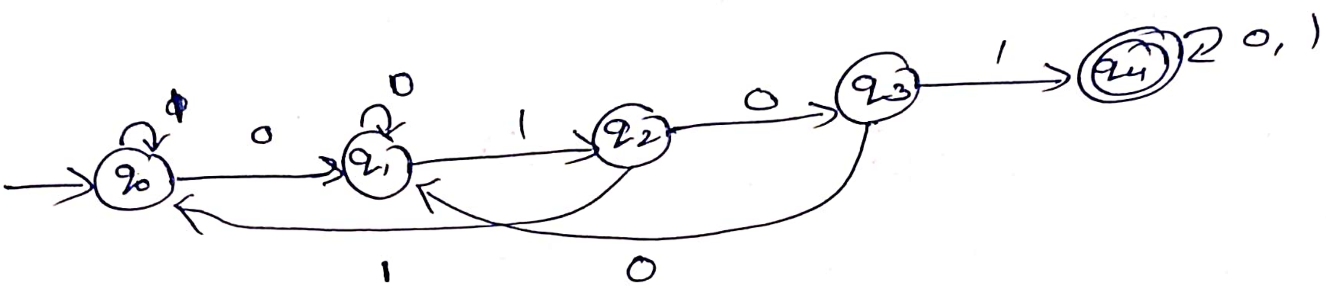
|---|---|---|---|---|---|---|---|
| Sub: | Theory Of Computation | | | Sub Code: | BCS503 | Branch: | **AIDS & CSE(DS)** |
| Date: | **08/11/2024** | Duration: | **90 minutes** | Max Marks: **50** | Sem/Sec: | **V -A, B & C** | **OBE** |

| **Answer any FIVE FULL Questions** | | | **MARKS** | **CO** | **RBT** |
|---|---|---|---|---|---|
| 1 | **a** | Design DFA which accepts set of all strings contains 0101 as substring over an alphabet {0,1} and process the string 10101101 | 5 | CO1 | L2 |
| | **b** | Prove "If the language L is recognized by a NFA then there exist a language L' which is recognized by a DFA". | 5 | CO1 | L3 |
| **2** | **a** | Design a NFA that accepts set of all strings containing even no. of 1's and even no. of 0's. over an alphabet {0,1}. | 5 | CO1 | L2 |
| | **b** | Construct DFA for the language over {a,b} that does not contain substring baba. | 5 | CO1 | L2 |
| **3** | | Find the equivalent NFA for the NFA-ε given below.<br> | 10 | CO1 | L3 |
| **4** | | Convert the following Regular Expression into Finite Automata<br>i) (00+11) * 110<br>ii) ((ab+bb)*aba)* | 10 | CO2 | L3 |
| **5** | | Find the regular expression for the automata given below using State elimination Method.<br> | 10 | CO2 | L3 |
| **6** | | Minimize the following DFA using Myhill-Nerode theorem.<br> | 10 | CO2 | L3 |

**CI** **CCI** **HoD**

# Internal Assesment - I

1. a) contains 0101 as substring




process : 10101101

$\delta(q_0, 10101101) = \delta(q_0, 0101101)$
$= \delta(q_1, 101101)$
$= \delta(q_2, 01101)$
$= \delta(q_3, 1101)$
$= \delta(q_4, 101)$
$= \delta(q_4, 01)$
$= \delta(q_4, 1) = q_4 \in F$

1. b) Let L be a set accepted by NFA, then there exist a DFA which accepts i.e $L(M) = L(M')$

**proof**: Let $M' = (Q, \Sigma, \delta, q_0, F)$ be an NFA accepting L, we construct DFA $M'$ as follows

$M' = (Q', \Sigma, \delta', q_0', F')$

(i) $Q' = 2^Q$

(ii) $q_0' = q_0$

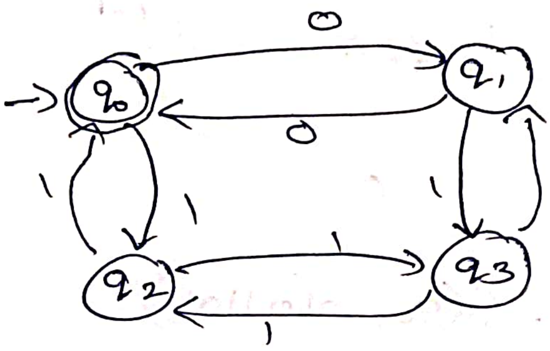
(iii) F is set of all subsets of Q containing an elements of F.

(iv) $\delta'([q_1, q_2, q_j], a) = \delta(q_1, a) \cup \delta(q_2, a) \ldots$

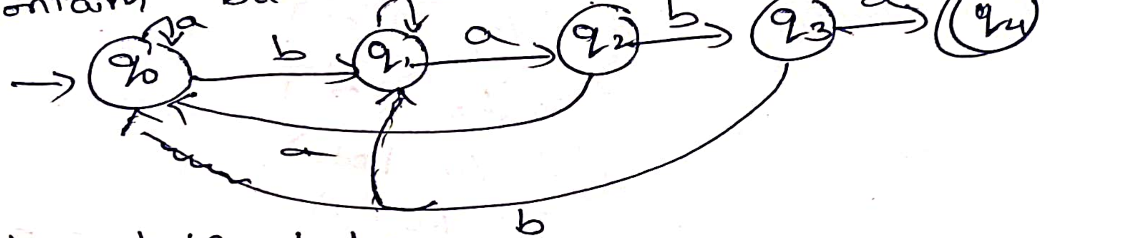
equivalently $\delta'([q_1 q_2, \ldots q_j], a) = [P_1 \ldots P_j]$

iff $\delta(\{q_1 \ldots q_j\}, a) = [P_1, P_2 \ldots P_j]$

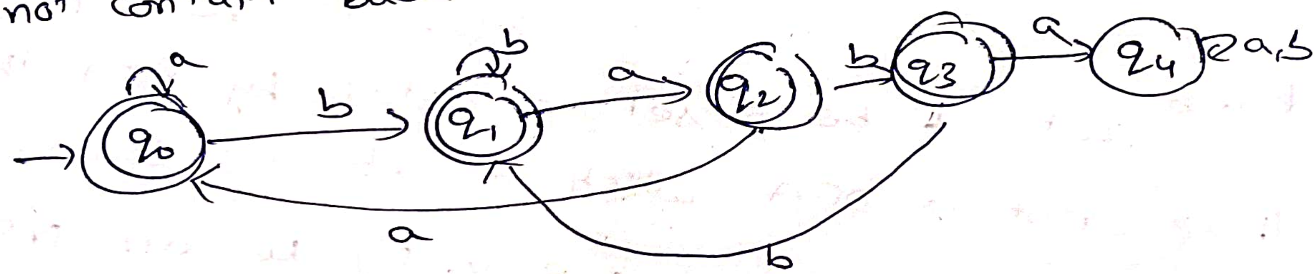
2. a.



2. b. contains baba



does not contain baba



3. a) NFA-$\epsilon$ to NFA

$\epsilon$-closure $(q_0) = \{q_0, q_1, q_2\}$

" $(q_1) = \{q_1, q_2\}$

" $(q_2) = \{q_2\}$

$\hat{\delta}(q_0, a) = \epsilon\text{-cl}(\delta(\hat{\delta}(q_0, \epsilon), a))$

$= \epsilon\text{-clos}(\delta(q_0, q_1, q_2), a)$

$= \epsilon\text{-cl}\{q_1\} = \{q_1, q_2\}$

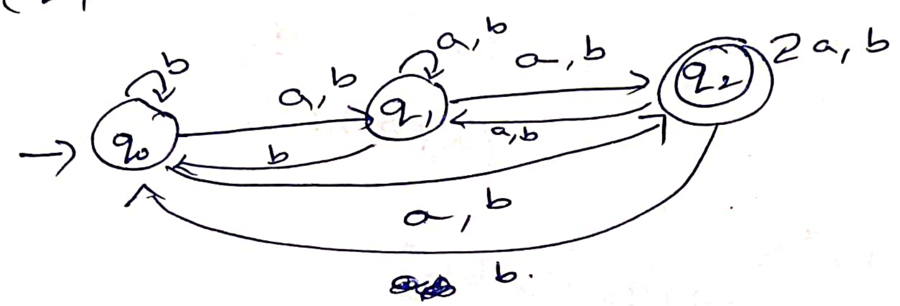
$$\hat{\delta}(q_0, b) = \epsilon\text{-clos}(q_0) = \{q_0, q_1, q_2\}$$

$$\hat{\delta}(q_1, a) = \epsilon\text{-clos}(\delta(\hat{\delta}(q_1, \epsilon), a))$$
$$= \epsilon\text{-clos}(\delta(q_1, q_2), a))$$
$$= \{q_1, q_2\}$$

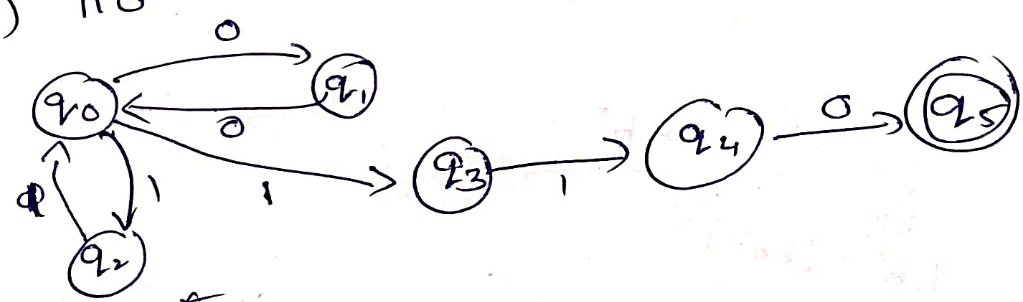
$$\hat{\delta}(q_1, b) = \{q_0, q_1, q_2\}$$

$$\hat{\delta}(q_2, a) = \{q_1, q_2\}$$

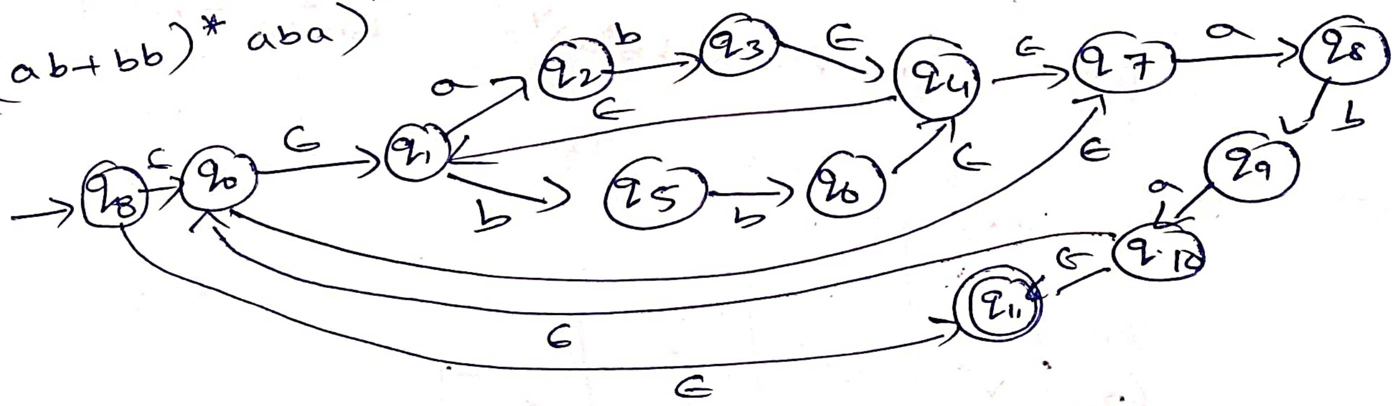
$$\hat{\delta}(q_2, b) = \{q_0, q_1, q_2\}$$



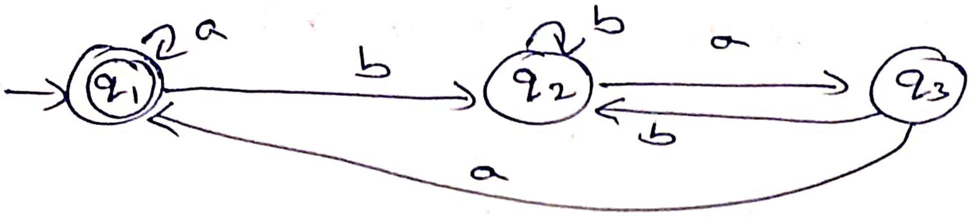

4) $(00+11)^* 110$




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

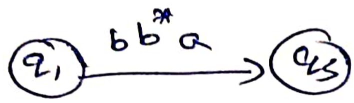


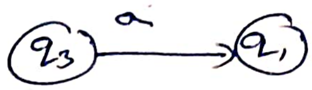
(5)



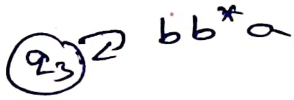

Eliminate $q_2$.

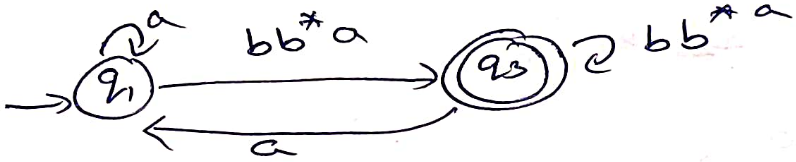
$q_1 - q_2 - q_3$ $\qquad$ $q_3 - q_2 - q_1$

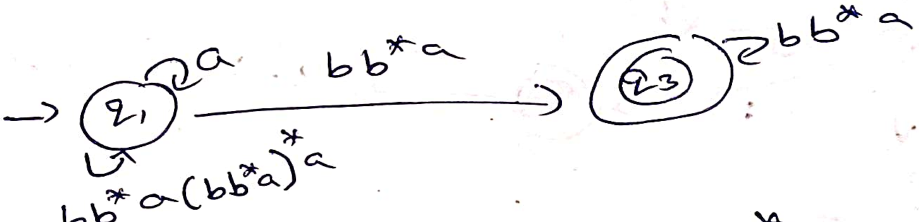
R.E 


$q_1 - q_2 - q_1$ $\qquad$ $q_3$ $\qquad$ $q_3$


R.E : $[a + bb^*a(bb^*a)^*a]^* \; bb^*a(bb^*a)^*$

(6)

| | $q_0$ | $q_1$ | $q_2$ | $q_3$ | $q_4$ | $q_5$ |
|---|---|---|---|---|---|---|
| $q_0$ | ✗ | | | | | |
| $q_1$ | | ✗ | | | | |
| $q_2$ | ✓ | ✓ | ✗ | | | |
| $q_3$ | ✓ | ✓ | ✓ | ✗ | | |
| $q_4$ | ✓ | ✓ | ✓ | ✓ | ✗ | |
| $q_5$ | ✓ | ✓ | ✓ | . | ✓ | ✗ |

$q_3$ $q$

$(q_0, q_1)$

$\delta(q_0, 0) = q_1$ $\quad$ $\delta(q_0, 1) = q_3$

$\delta(q_1, 0) = q_0$ $\quad$ $\delta(q_1, 1)$ $q_3$

$(q_2, q_0)$

$\delta(q_0, 0) = q_1$ $\quad$ $\delta(q_0, 1) = q_3$

$\delta(q_2, 0) = q_1$ $\quad$ $\delta(q_2, 1) = q_4$

$(q_2, q_1)$

$\delta(q_2, 0) = q_4$ $\quad$ $\delta(q_2, 1) = q_4$

$\delta(q_1, 0) = q_0$ $\quad$ $\delta(q_1, 1) = q_3$

$(q_3, q_2)$

$\delta(q_3, 0) = q_5$

$\delta(q_2, 0) = q_1$

$(q_4, q_0)$

$\delta(q_4, 0) = q_3$

$\delta(q_0, 0) = q_1$

$(q_4, q_1)$

$(q_4, 0) = q_3$

$(q_1, 0) = q_0$

$(q_4, q_2)$

$(q_4, 0) = q_3$

$(q_2, 0) = q_1$

$(q_5, q_3)$

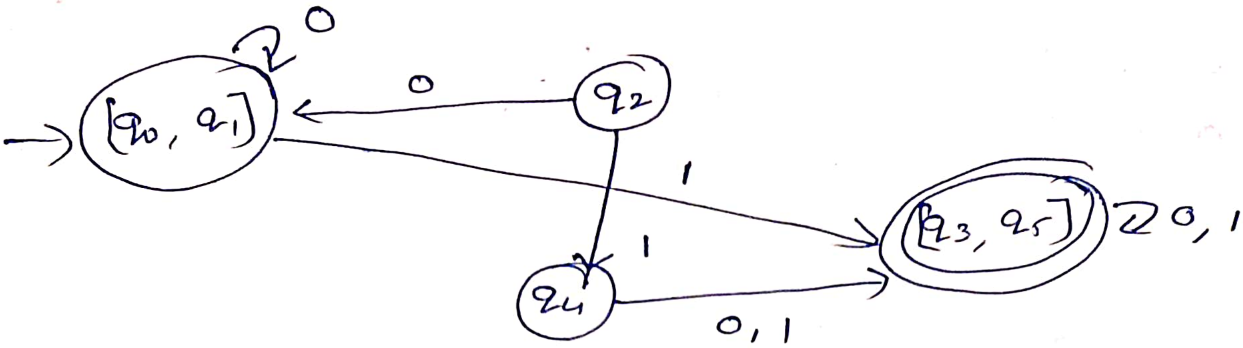
$(q_5, 0) = q_5$

$(q_3, 0) = q_5$

$(q_5, 1) = q_5$

$(q_3, 1) = q_5$

| $\delta \backslash \Sigma$ | 0 | 1 |
|---|---|---|
| $[q_0, q_1]$ | $[q_1, q_0]$ | $[q_3, q_5]$ |
| $q_2$ | $[q_0, q_1]$ | $[q_4]$ |
| $[q_5, q_3]$ | $[q_5, q_3]$ | $[q_5, q_3]$ |
| $[q_4]$ | $[q_3, q_5]$ | $[q_3, q_5]$ |



[q0, q1]
0
q2
0
1
1
[q3, q5]
0, 1
q4
0, 1