* TOC Assignment *

19DCS048

Ans-(1) The given transition table:-

State\Σ	a	b
p	{p, q}	p
q	r	r
r	s	ϕ
s	s	s

Final state: s
Initial state: p

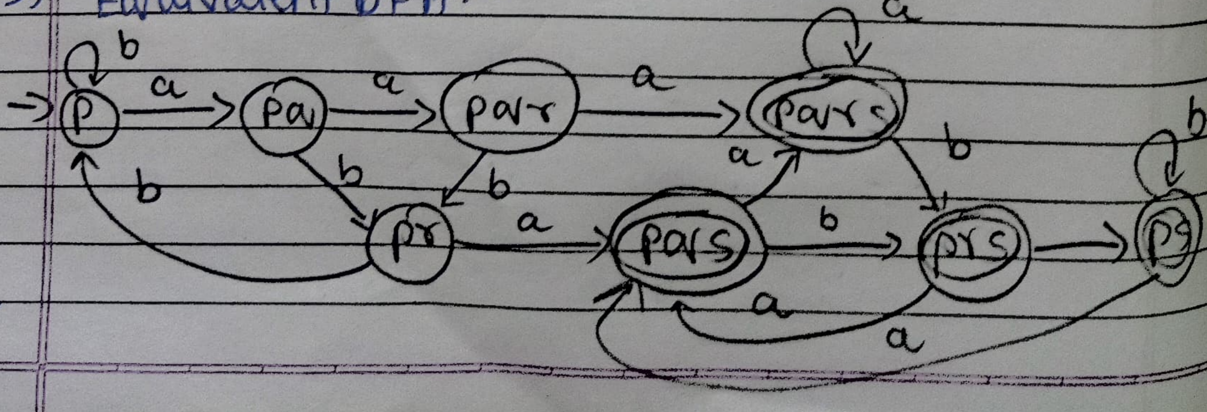
=) This is clearly NFA. So, we need to make transition table for DFA with the help of above transition.

=) Initial state: p.

∴

State\Σ	a	b
→ p	[pq]	p
[pq]	[pqr]	[pr]
[pqr]	[pqrs]	[pr]
[pr]	[pqs]	p
*[pqs]	[pqrs]	[prs]
*[pqrs]	[pqrs]	[prs]
*[prs]	[pqs]	[ps]
*[ps]	[pqs]	[ps]

=) Equivalent DFA:-



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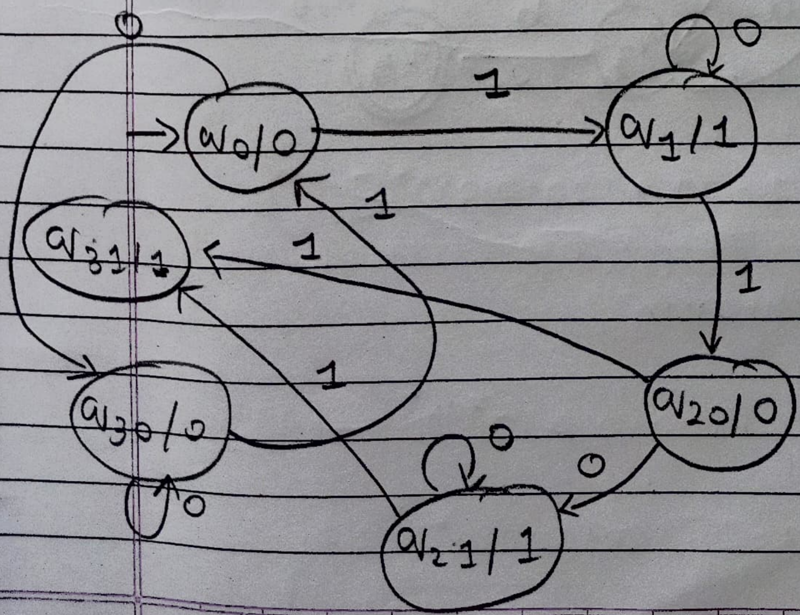
Ans-(2) * Convert mealy to moore.

=> From the given transition table, we will construct transition table for moore machine.

Present State	Next State ~~O/P=~~		Output
	$a=0$	$a=1$	
$\rightarrow q_0$	q_{30}	q_1	0
q_1	q_1	q_{20}	1
q_{20}	q_{21}	q_{31}	0
q_{21}	q_{21}	q_{31}	1
q_{30}	q_{30}	q_0	0
q_{31}	q_{30}	q_0	1

* Moore machine transition Diagram:-



Ans-(3) From the given DFA table, we will minize it by writing the equivalence form of it.

$\pi_0 = \{q_0, q_1, q_2, q_3, q_5, \cancel{q_4}\}\ \{q_5\}$

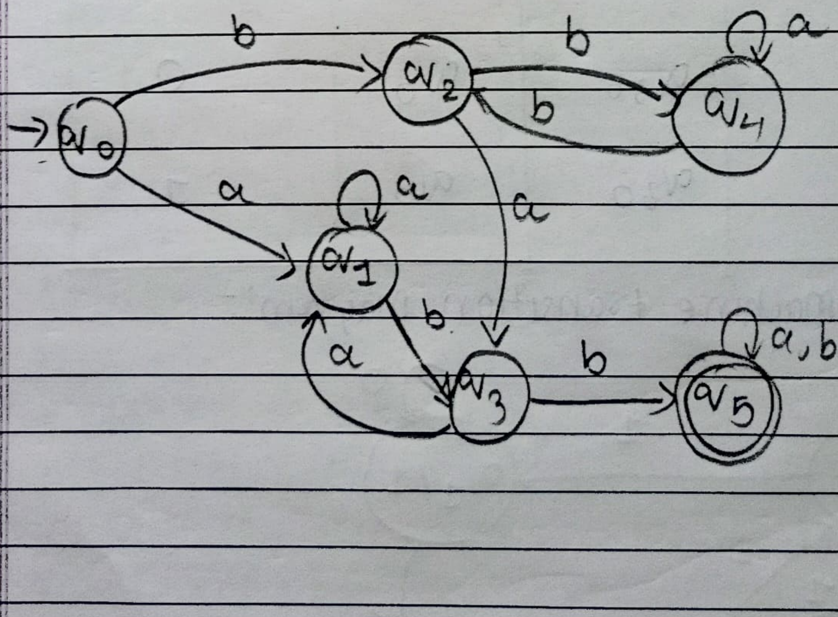
$\Rightarrow \pi_1 = \{q_0, q_1, q_2, q_4\}\ \{q_3\}\ \{q_5\}$

$\Rightarrow \pi_2 = \{q_0, q_1, q_4\}, \{q_2\}, \{q_3\}, \{q_5\}$

$\Rightarrow \pi_3 = \{q_0, q_4\}, \{q_1\}, \{q_2\}, \{q_3\}, \{q_5\}$

$\Rightarrow \pi_4 = \{q_0\}, \{q_1\}, \{q_2\}, \{q_3\}, \{q_4\}, \{q_5\}$

$\Rightarrow$ Transition diagram of minimized DFA:-



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Ans-(4) $q_1 = \varepsilon + q_1 0 + q_4 0 + q_3 0$ — (1)

$q_2 = q_2 1 + q_4 1 + q_1 1$ — (2)

$q_3 = q_2 0$ — (3)

$q_4 = q_3 1$ — (4)

=> By (3) & (4); $q_4 = q_2 01$ — (5)

=> In eqn — (1);

$q_1 = \varepsilon + q_2 00 + q_1 0 + q_2 010$

$q_1 = \underbrace{\varepsilon + q_2 (00 + 010)}_{Q} + \underbrace{q_1 0}_{R\ P}$

=> By applying Arden's theorem;

$q_1 = (\varepsilon + q_2 (00 + 010)) 0^*$ — (6)

=> In eqn (2);

$q_2 = q_2 1 + q_2 01 + [\varepsilon + q_2 (00 + 010)] 0^*$

$q_2 = q_2 1 + q_2 01 + \varepsilon 0^* + q_2 (00 + 010) 0^*$

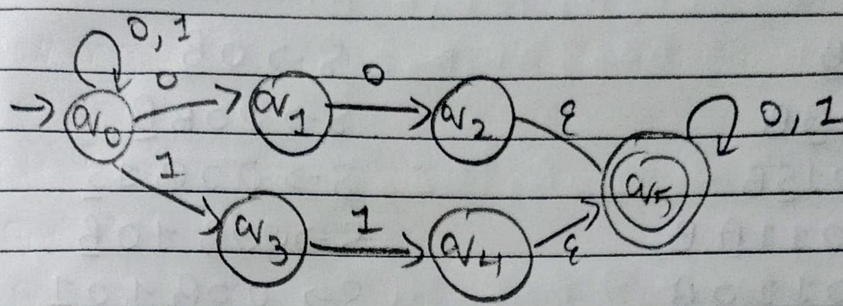
$q_2 = 0^* + q_2 [1 + 01 + (00 + 010) 0^*]$

-> from Arden's theorem;

$q_2 = 0^* (1 + 01 + (00 + 010) 0^*)^*$ — (7)

$\therefore$ RE $= 0^* (1 + 01 + (00 + 010) 0^*)^* 01$

Ans-(5) Given RE: $(0+1)^*(00+11)(0+1)^*$



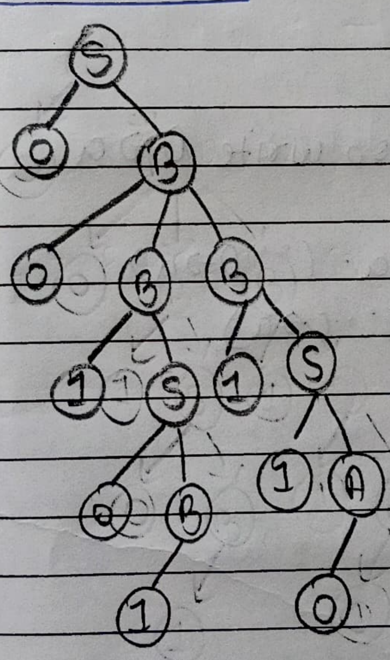
Ans-(6)

S → 0B | 1A

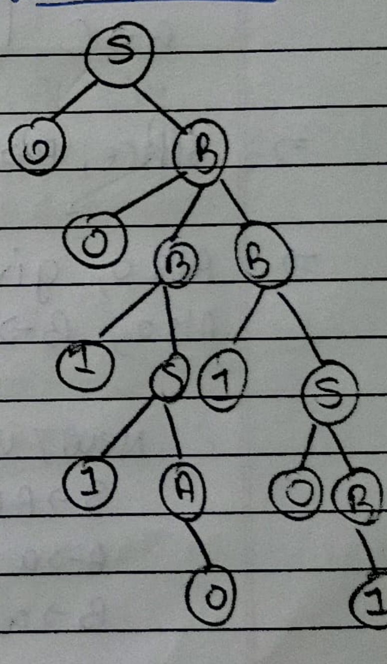
A → 0 | 0S | 1AA

B → 1 | 1S | 0BB

Left Derivation



Right Derivation



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Leftmost	Right most
$S \to 0B$	$S \to 0B$
$S \to 00BB$	$S \to 00BB$
$S \to 001SB$	$S \to 00B1S$
$S \to 0011AB$	$S \to 00B10B$
$S \to 00110B$	$S \to 00B101$
$S \to 001101S$	$S \to 001S101$
$S \to 0011010B$	$S \to 001A101$
$S \to 00110101$	$S \to 0010101$

Ans-(8)

$S \to AB$	$C \to D$
$A \to a$	$D \to E$
$B \to C$	$E \to a$

⇒ since, $E \to a$ ∴ we can also write $D \to a$

⇒ Also; given $C \to D$ ∴ $C \to a$ (∵ $D \to a$)
Also, $B \to C$ ∴ $B \to a$ (∵ $C \to a$)

∴ New/Updated Rules:

$S \to AB$	$C \to a$
$A \to a$	$D \to a$
$B \to a$	$E \to a$

⇒ As; $S \to AB$; ∴ C, D, E are useless symbol

$S \to AB$
$A \to a$
$B \to a$

Ans-(9)

$S \to aAD$ | $B \to b$
$A \to aB \mid bAB$ | $D \to d$

→ Taking $X_1 \to aA$; $X_2 \to bA$; $X_3 \to a$

$\therefore S \to X_1 D$
$A \to X_3 B \mid X_2 B$ ($\because$ CNF Form)
$B \to b$
$D \to d$ | $X_2 \to bA$
$X_1 \to aA$ | $X_3 \to a$

Ans-(10) $S \to AA \mid a$
$A \to SS \mid b$

⇒ Replace S with A_1 | $A_1 \to A_2 A_2 \mid a$
Replace A with A_2 | $A_2 \to A_1 A_1 \mid b$

A_2 can be written as:
$A_2 \to A_2 A_2 A_1 \mid b \mid a A_1$ ($\because A_1 \to A_2 A_2$)

→ Here, the first production having left recursion
→ We will remove left Recursion

$A_2 \to A_2 A_2 A_1$

$\therefore$ let $Z_2 \to A_2 A_1 \mid A_2 A_1 Z_2$

$A_2 \to b \mid a A_1$ are in GNF

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Now, $A_2 \to A_2 A_2 A_1$

$A_2 \to bA_2A_1 \mid aA_1A_2A_1$

$A_2 \to bZ_2 \mid aA_1\cancel{A_2}Z_2$

$\therefore A_2 \to \cancel{bA}\, b \mid aA_1 \mid bZ_2 \mid aA_1Z_2$

Now, for $A_1 \to A_2A_2 \mid a$

$\Rightarrow A_1 \to bA_2 \mid aA_1A_2 \mid bZ_2A_2 \mid aA_1A_2Z_2$

Final production list:→

$\cancel{A}.\ A_1 \to bA_2 \mid aA_1A_2 \mid bZ_2A_2 \mid aA_1Z_2A_2 \mid a$

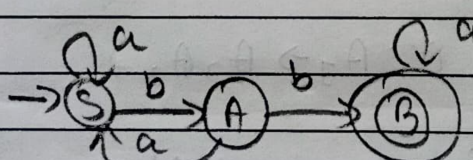
$A_2 \to b \mid aA_1 \mid bZ_2 \mid aA_1Z_2$

$Z_2 \to bA_1 \mid aA_1A_1 \mid bZ_2A_1 \mid aA_1Z_2A_1 \mid bA_2A_1Z_2 \mid aA_1A_1Z_2 \mid bZ_2A_1Z_2 \mid aA_1A_1Z_2Z_2$

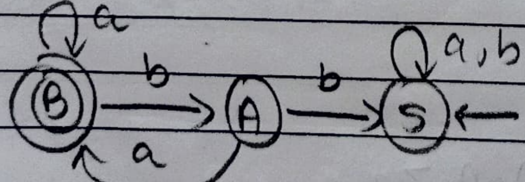
Ans-(ii) $S \to aS \mid bA$ | $B \to aB \mid bB \mid \varepsilon$

$A \to aS \mid bB$

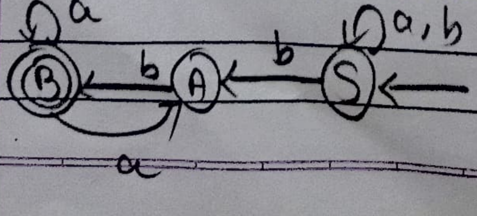
S1:



S2: Interchange initial & final state



S3: Reverse Directions



2) Final left linear grammer:-

$S \to aS \mid bS \mid bA$
$A \to bB$
$B \to aB \mid aA \mid \varepsilon$

Ans-1(2)

$S \to (L) \mid x$
$L \to LS \mid S$

One production has left recursion.

$L \to \underbrace{L}_{A}\underbrace{S}_{\alpha} \mid \underbrace{S}_{\beta}$

$L \to SA'$
$A' \to SA' \mid \varepsilon$

(∵ for form $A \to A\alpha \mid \beta$
$A \to \beta A'$
$A' \to \alpha A' \mid \varepsilon$)

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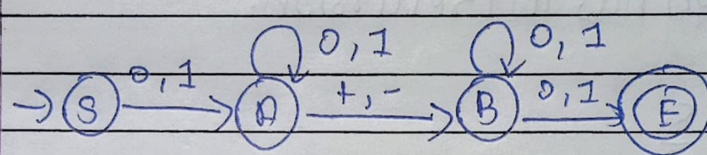
Ans ⇒ $S \to iEtS \mid iEtSeS \mid a, \; E \to b$

$S \to iEtSS' \mid a$
$S' \to \varepsilon \mid eS$
$E \to b$

Ans ⇒ $S \to 0A \mid 1A$
$A \to 0A \mid 1A \mid +B \mid -B$
$B \to 0B \mid 1B \mid 0 \mid 1$

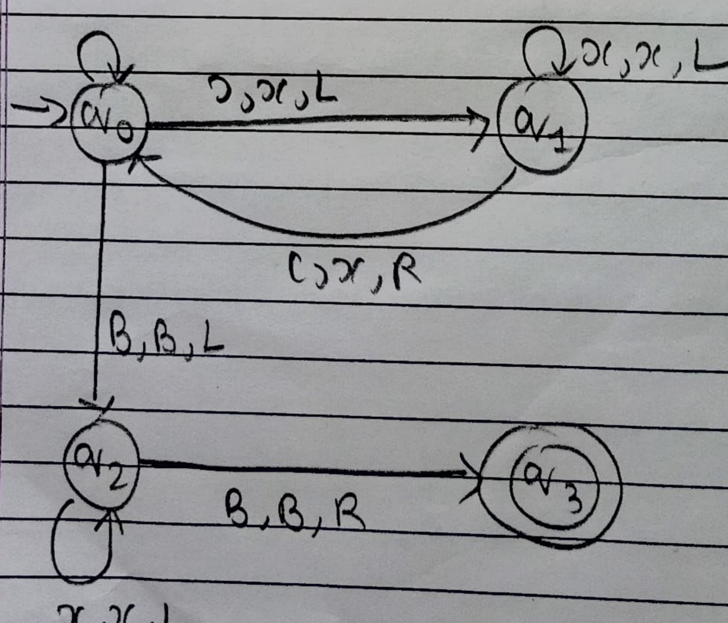


Ans ⇒

....	B	C	C	⊃	C	⊃	⊃	C	⊃	B	....

$\uparrow q_0$

⇒ Turing machine :-



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$\Rightarrow$ $\delta(q_0, () = (q_0, (, R)$
$\delta(q_0,)) = (q_1, X, L)$
$\delta(q_1, () = (q_0, X, R)$
$\delta(q_0, X) = (q_1, X, R)$
$\delta(q_1, X) = (q_1, X, L)$
$\delta(q_0, \cancel{B}) = (q_2, \cancel{B}, L)$
$\delta(q_2, X) = (q_2, X, L)$
$\delta(q_2, \cancel{B}) = (q_2, Y, H)$
$\delta(q_2, () = (q_2, N, H)$
$\delta(q_1, \cancel{B}) = (q_1, N, H)$

Ans $\Rightarrow$ Constructing turing machine oddpalindrome over {a, b}

... B	B	a	b	a	b	a	B	B ...

$\underbrace{ab}_{w}\ a\ \underbrace{ba}_{w^R}$

... B	B	a	b	b	b	a	B	B ...

$\underbrace{ab}_{w}\ \bar{b}\ \underbrace{ba}_{w^R}$