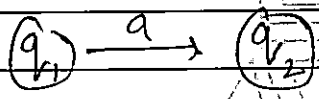
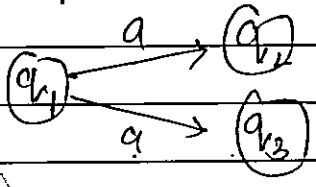
Ans:- 1(a)

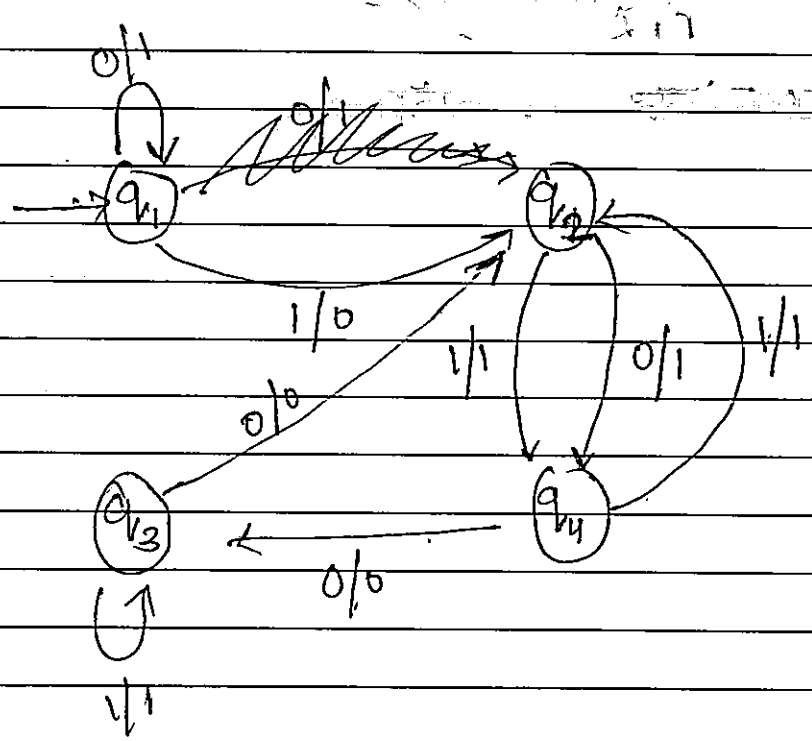
DFA	NDFA
(1) DFA stands as Deterministic finite Automata.	(1) NFA stands as Non-Deterministic finite automata.
(2) Their is only one transition for one input in a node 	(2) Their can be more than one transition of one input in a node. 
(3) Transition in DFA is : $\delta \Rightarrow Q \times \Sigma \rightarrow Q$	(3) Transition in NFA $\delta \Rightarrow Q \times \Sigma \rightarrow 2^Q$
(4) DFA is considered as one machine.	(4) NFA can be consider as large no. of small machine working simentaneously
(5) DFA takes less time for computation but more space.	(5) NFA takes more time for computation but less space
(6) Difficult to construct	(6) Easy to construct

Ans:- 1(b)

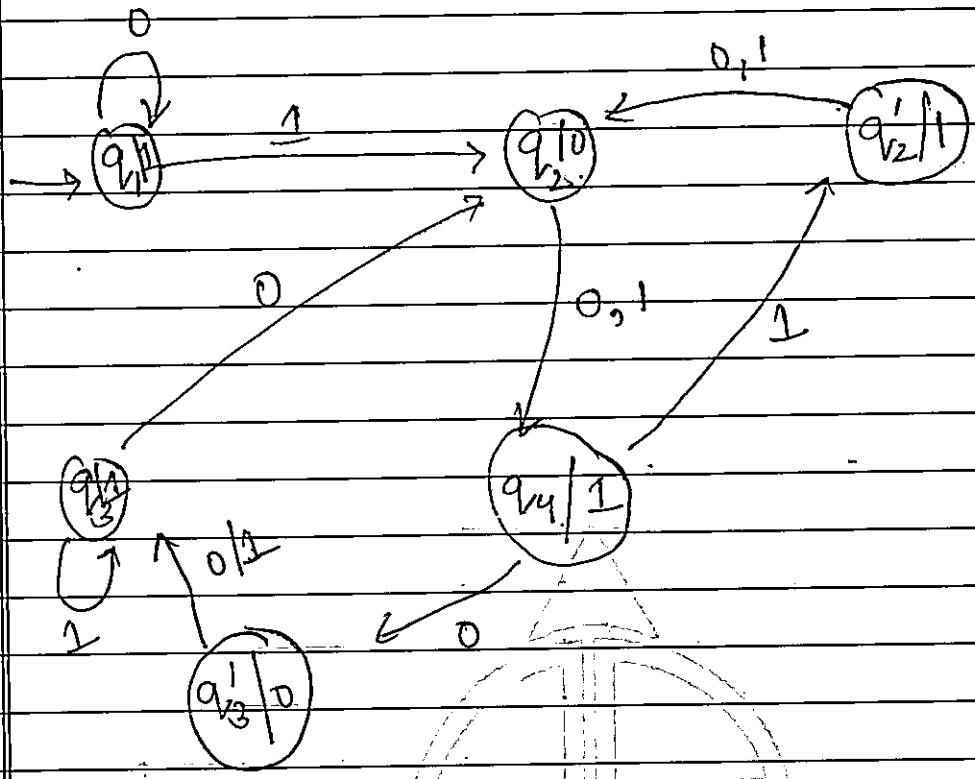
Given; transition table :-

Of Melay Machine

	$q=0$		$q=1$	
	State	Output	State	Output
q_{01}	q_1	1	q_2	0
q_2	q_4	1	q_4	1
q_3	q_2	0	q_3	1
q_4	q_3	0	q_{q_2}	1



Moore machine (Automata)



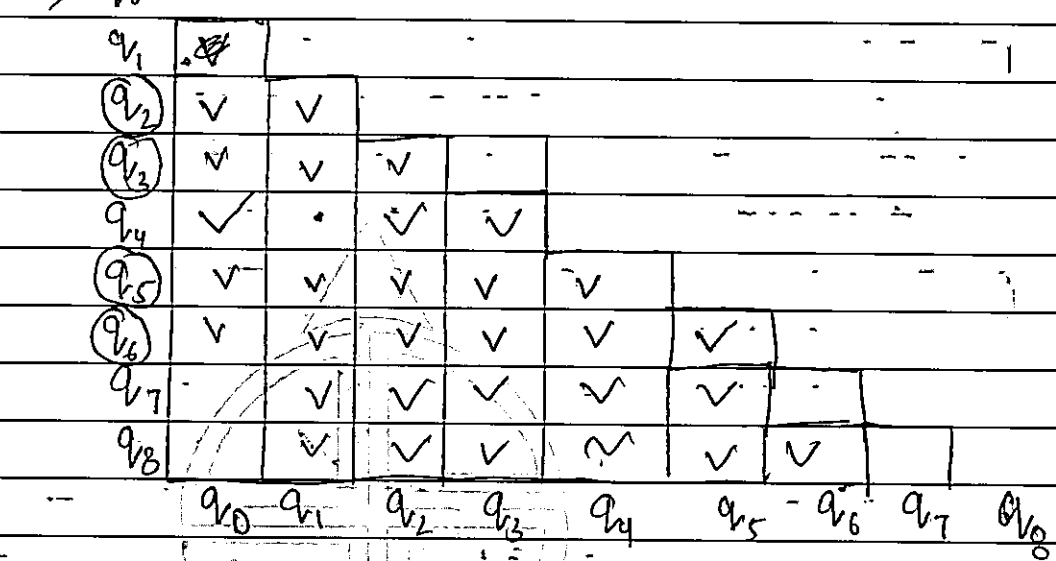
→ Their are two new states are formed q'_2, q'_3.

Transition table is :- (Moore machine)

States	0	1	output.
→ q_1	q_1	q_2	1
q_2	q_4	q_4	0
q'_2	q_2	q_2	1
q_3	q_2	q_3	1
q'_3	q_2	q_3	0
q_4	q'_3	q'_2	1

Ans:- 1 (c)

The table of my Hill nerode ..... is:-



Step-1

Mark all final states

Step-2

(q_1, q_0), (q_4, q_0) (q_4, q_1) (q_4, q_2) (q_4, q_3)

(q_7, q_0) (q_7, q_1) (q_7, q_2) (q_7, q_3) (q_7, q_4) (q_7, q_5)

(q_7, q_6)

(q_8, q_0) (q_8, q_1) (q_8, q_2) (q_8, q_3) (q_8, q_4) (q_8, q_5)

(q_8, q_6) (q_8, q_7)

step-3

find transition for unmarked state

$(q_1, q_0) \rightarrow (q_0, 0) = q_1 \quad (q_0, 1) = q_4$

$(q_1, 0) = q_2 \quad (q_1, 1) = q_3$

↳ different

↳ different marked

$(q_4, q_0) \rightarrow (q_4, 0) = q_5 \quad (q_4, 1) = q_6$

$(q_0, 0) = q_1 \quad (q_0, 1) = q_4$

marked

same

$(q_4, q_1) \rightarrow (q_4, 0) = q_5 \quad (q_4, 1) = q_6$

$(q_1, 0) = q_2 \quad (q_1, 1) = q_5$

$(q_4, q_2) \rightarrow (q_4, 0) = q_5 \quad (q_4, 1) = q_6$

$(q_2, 0) = q_7 \quad (q_2, 1) = q_8$

$(q_4, q_3) \rightarrow (q_4, 0) = q_5 \quad (q_4, 1) = q_6$

$(q_3, 0) = q_8 \quad (q_3, 1) = q_7$

$(q_7, q_0) \rightarrow (q_7, 0) = q_7 \quad (q_7, 1) = q_7$

$(q_0, 0) = q_2 \quad (q_0, 1) = q_3$

$(q_7, q_1) \rightarrow (q_7, 0) = q_7 \quad (q_7, 1) = q_7$

$(q_1, 0) = q_2 \quad (q_1, 1) = q_3$

Hy for all state we find transition.

Step-4

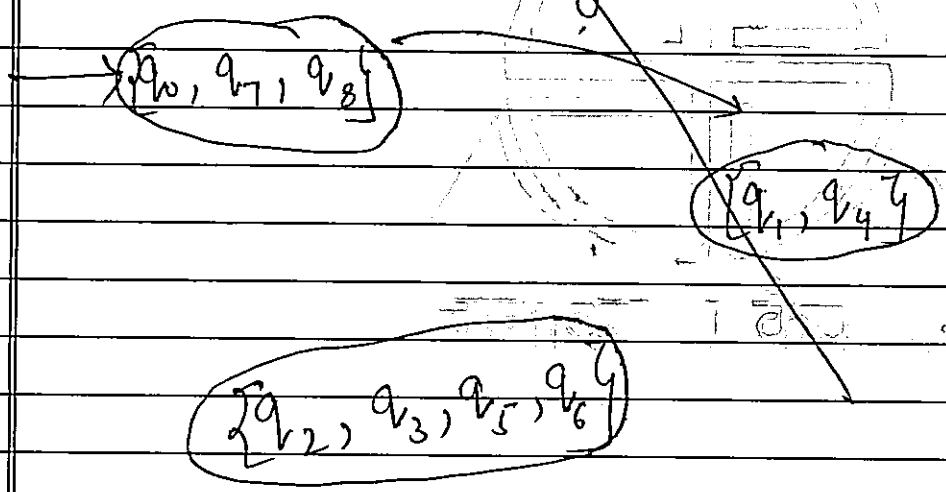
After marking all the states we get

(q_0, q_7, q_8)

(q_1, q_4)

(q_2, q_3, q_5, q_6)

So, Reduced DFA will be

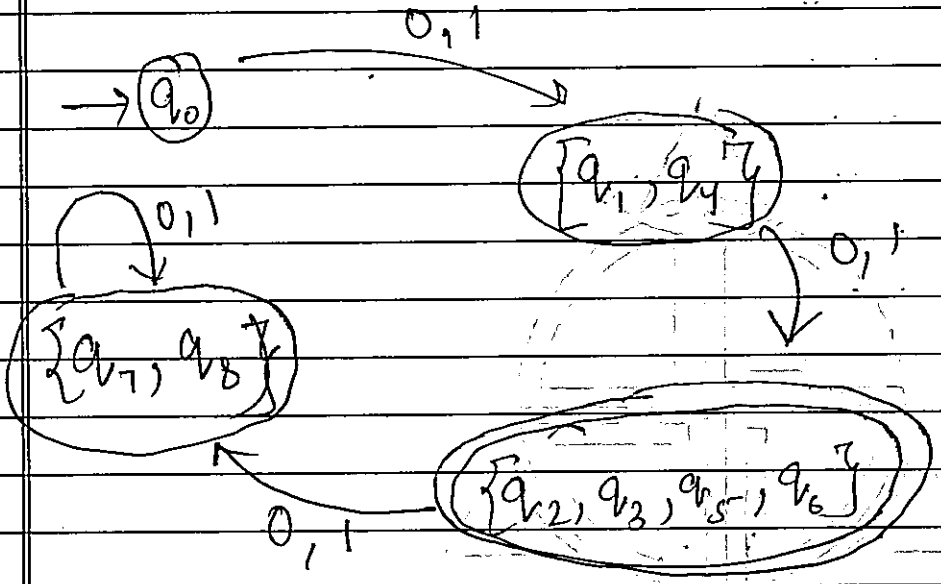


step- 4.

After marking all the states, we get,

$\{q_0\}, \{q_7, q_8\}, \{q_1, q_4\}, \{q_2, q_3, q_5, q_6\}$

So, reduced DFA will be ⇒

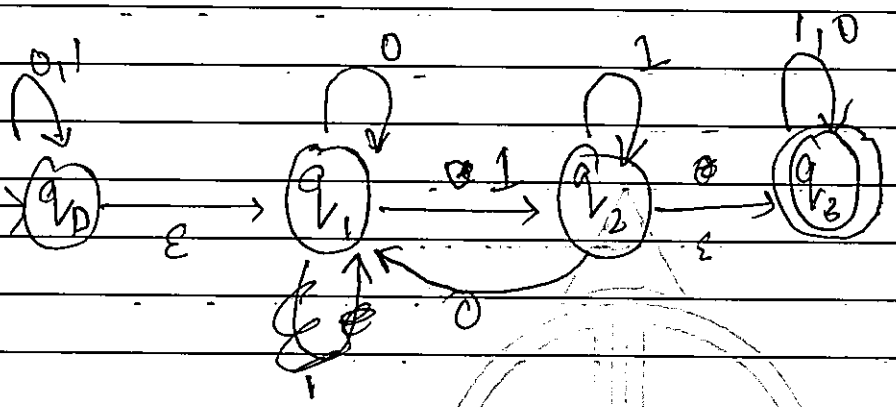


States \ input	0	1
→ q_0	$\{q_1, q_4\}$	$\{q_1, q_4\}$
$\{q_1, q_4\}$	$\{q_2, q_3, q_5, q_6\}$	$\{q_2, q_3, q_5, q_6\}$
$\{q_7, q_8\}$	$\{q_7, q_8\}$	$\{q_7, q_8\}$
* $\{q_2, q_3, q_5, q_6\}$	$\{q_7, q_8\}$	$\{q_7, q_8\}$

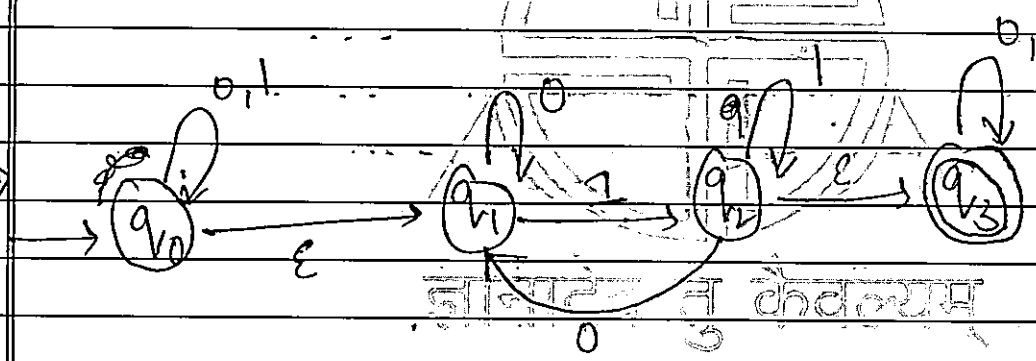
Ans: 2(b)

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

$$L = \{ 0011, 0\,0011\,1^*, 0101\,01 \cdots \}$$



Ans ⇒



Transition table :-

State \ i/p	0	1	ε
→ q_0	q_0	q_0	q_1
q_1	q_1	q_2	—
q_2	q_2	q_1	q_3
(q_3)	q_3	q_3	—

ε-closer $q_0 = q_0, q_1$

— " — $q_1 = q_1$

— " — $q_2 = q_2, q_3$

— " — $q_3 = q_3$

Ans:- 2(c)

→ To prove any language is non-regular we operate pumping lemma to it

According to pumping lemma:-

Any ~~lang~~ string belong to language it can be divided into three parts as xy^iz where $i \geq 0$ has some pumping lemma P it follows three rules are:-

(i) $xy^iz \in L \quad \forall \; i \geq 0 \quad n \geq 1$

(ii) $|y| \geq 1$

(iii) $|xy| \leq p$

Let $L = \{a^n b^n$ where $n \geq 1\}$

$L = \{ab, aabb, aaabbb \ldots\}$

⇒ Step-1

Let take $n = 3$

for:-

$n = 1$

ab

$x = a \qquad y = b \qquad z = \varepsilon$

$a b^i$

$i = 2$

$abb \notin L$

~~∴ It is not~~

→ for $n = 2$

$aabb$

$x = a$, $y = ab$, $z = b$

$a (ab)^i b$

$i = 2$

$a\ aabbb$

$i = 3$

$a\ aaabbbb$

⋮

~~for all~~ let take $i = 0$;

$x = a$, $y = a$, $z = bb$

$a (a)^0 bb$

$i = 2$

$aaabb \notin L$

→ for $n = 3$

$aaabbb$

$x = aa$ $y = abb$ $z = b$

$aa (abb)^i b$

$i = 2$

$aa\,aabbbbb \notin L$

Sol

Step-2 $i > 0$

(i) $i = 2$ (ii) $i = 2$ (iii) $i = 2$

Here $i \neq 0$

Step 3 $[x, y] \neq 0$

(i) $ab \neq 0$

(ii) $aab \neq 0$

(iii) $aaabb \neq 0$

Ans ∴ It is not a regular language

3(a) (2) ~~$(a+b)^*$~~ $(0+1)^*(00)^+$

(1) $(1) + (1)^*$ $(1) + (1)^*$

Ans:- 3 & (G)

Given;

$E \rightarrow E+T \mid T$ — (I)

$T \rightarrow T^*F \mid F$ — (II)

$F \rightarrow (E) \mid a$ — (III)

Step-1

Elemination of null propogation.

Step-2

Elemination of Unit Propogation

$E \rightarrow T$ & $T \rightarrow F$

&

$T \rightarrow T^*F \mid F$ and $F \rightarrow (E) \mid a$

T will be

$T \rightarrow T^*F \mid (E) \mid a$ — (IV)

~~$T \rightarrow T^*F \mid (E) \mid T^*F a$~~

for

$E \rightarrow T$

put (4) in (1)

$E \rightarrow E+T \mid T^*F \mid (E) \mid a$ ~~$\mid T^*F(E) \mid T^*Ea$~~

~~$E+T \rightarrow T^*F \mid (E+T)E$~~

(V)

Step-3 Convert it into CNF (partially).

$$E \rightarrow EC_1T \mid TC_2F \mid (EC_3 \mid a$$

$C_1 \rightarrow +$

$C_2 \rightarrow *$

$C_3 \rightarrow)$

Step-4

Rename

$E \rightarrow A_1$; $C_1 \rightarrow A_2$; $T \rightarrow A_3$; $C_2 \rightarrow A_4$; $F \rightarrow A_5$; $E \rightarrow A_6$
$C_3 \rightarrow A_7$

$$A_1 \rightarrow A_1A_2A_3 \mid A_3A_4A_5 \mid (A_6A_7 \mid a$$

Step-5

left Recursion

~~$X_i \rightarrow X_j$~~ $X_i \rightarrow X_j$; $i \geq j$

$$A_1 \rightarrow A_3A_4A_5 \mid (A_6A_7 \mid a \mid A_1A_2A_3$$

$$Z_1 \rightarrow A_2A_3Z_1 \mid A_2A_3$$

Then,

$$A_1 \rightarrow A_3A_4A_5 \mid (A_6A_7 \mid a \mid Z_1 \mid A_3A_4A_5Z_1 \mid (A_6A_7Z_1 \mid aZ_1$$

&

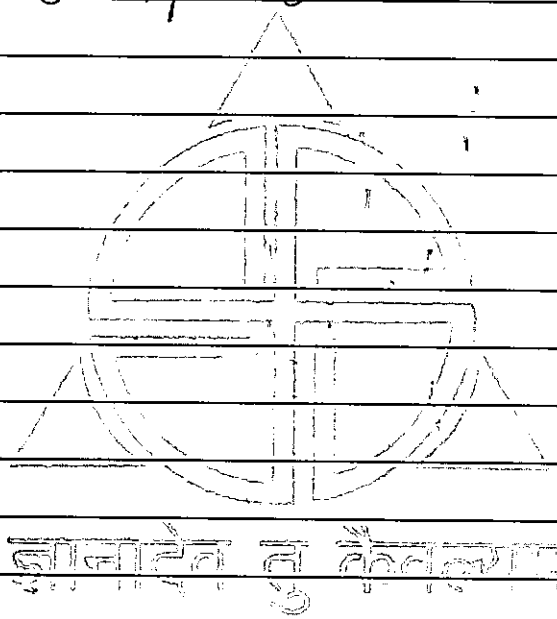
$Z_1 \rightarrow + A_3 Z_1 / + A_3$

So the @ GNF is correspond it given

are

$A_1 \rightarrow A_3 A_4 A_5 / (A_6 A_7 / a) / Z_1 / A_3 A_4 A_5 Z_1 / (A_6 A_7 Z_1 / a Z_1$

$Z_1 \rightarrow + A_3 \& Z_1 / + A_3$



Ans:- 3(d)

$S \rightarrow 0B \mid 1A$

$A \rightarrow 0 \mid 0S \mid 1AA$

$B \rightarrow 1 \mid 1S \mid 0BB$

→ LMD (left most Derivation)

$S \xrightarrow{LM} 0B$

$\xrightarrow{RLM} 0BB$

$\xrightarrow{LM} 00BBB$

$\xrightarrow{LM} 001SBB$

$\xrightarrow{LM} 001\,1ABB$

$\xrightarrow{LM} 0011\,0BB$

$\xrightarrow{LM} 00110\,1B$

$\xrightarrow{LM} 001101\,0$

$\xrightarrow{LM} 00110101$

→ RMD (Right most Derivation)

$S \xrightarrow{RM} 0B$

$\rightarrow 0BB$

$\rightarrow 0B1$

$\rightarrow 00BB1$

$\rightarrow 01S1$

$\rightarrow 011A1$

$\rightarrow 0110S1$

$\rightarrow 01101A1$

→ 0 1 0 1 0 1

S $\xrightarrow{RM}$ 0 B

→ ~~0 1 S~~

$\xrightarrow{RM}$ 0 0 B

$\xrightarrow{RM}$ 0 0 1 S

$\xrightarrow{RM}$ 0 0 1 1 A

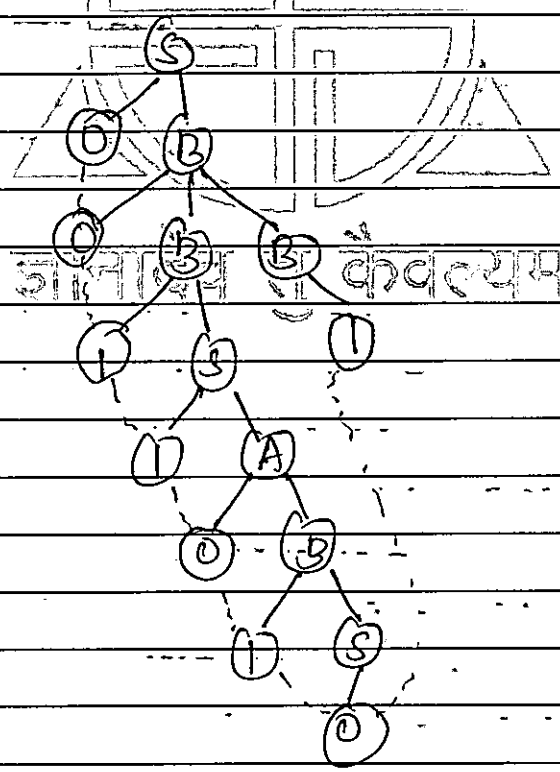
$\xrightarrow{RM}$ 0 0 1 1 0 S

$\xrightarrow{RM}$ 0 0 1 1 0 1 A

$\xrightarrow{RM}$ 0 0 1 1 0 1 0 B

$\xrightarrow{RM}$ 0 0 1 1 0 1 0 1

Derivation tree:-



सत्यमेव जयते

Ans:- (4) (b)

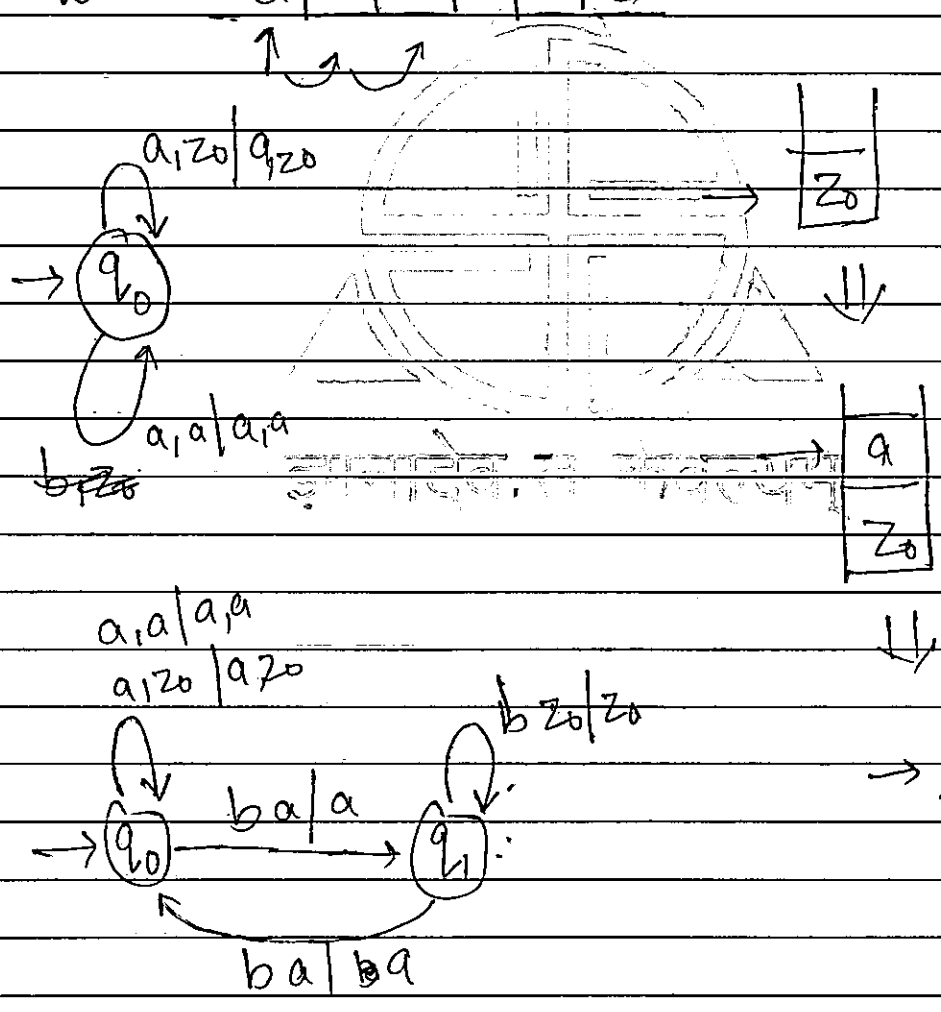
→ Push down Automata

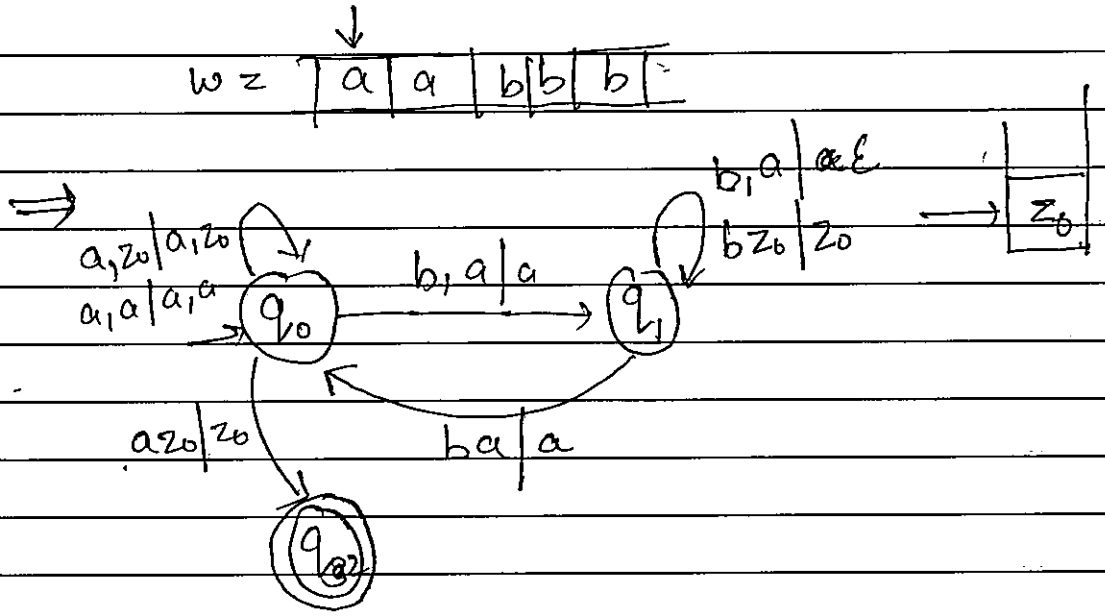
$L = \{a^n b^{2n}\}$ where $n \geq 1$

$L = \{abb, aabbbb \ldots\}$

Let $n = 2$

w = a | a | b | b | b | ε





सत्यमेव जयते

Ans- 4(c)

Turing Machine :-

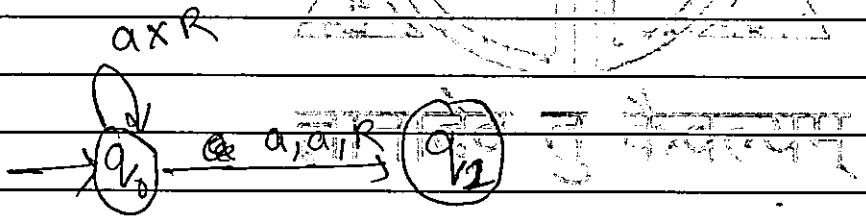
Given;

$L = \{a^n b^n c^n \gamma$ where $\gamma \neq 0\}$

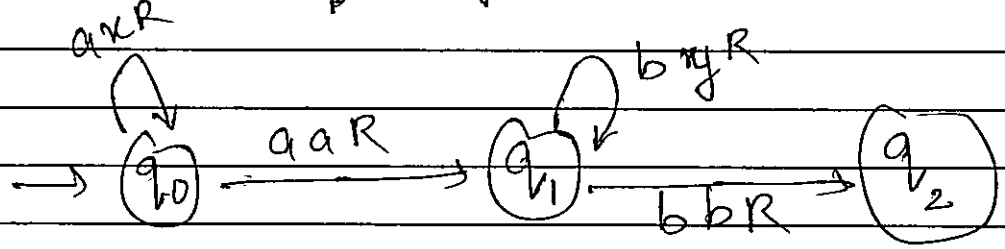
$L = \{abc, aabbcc, \ldots\}$

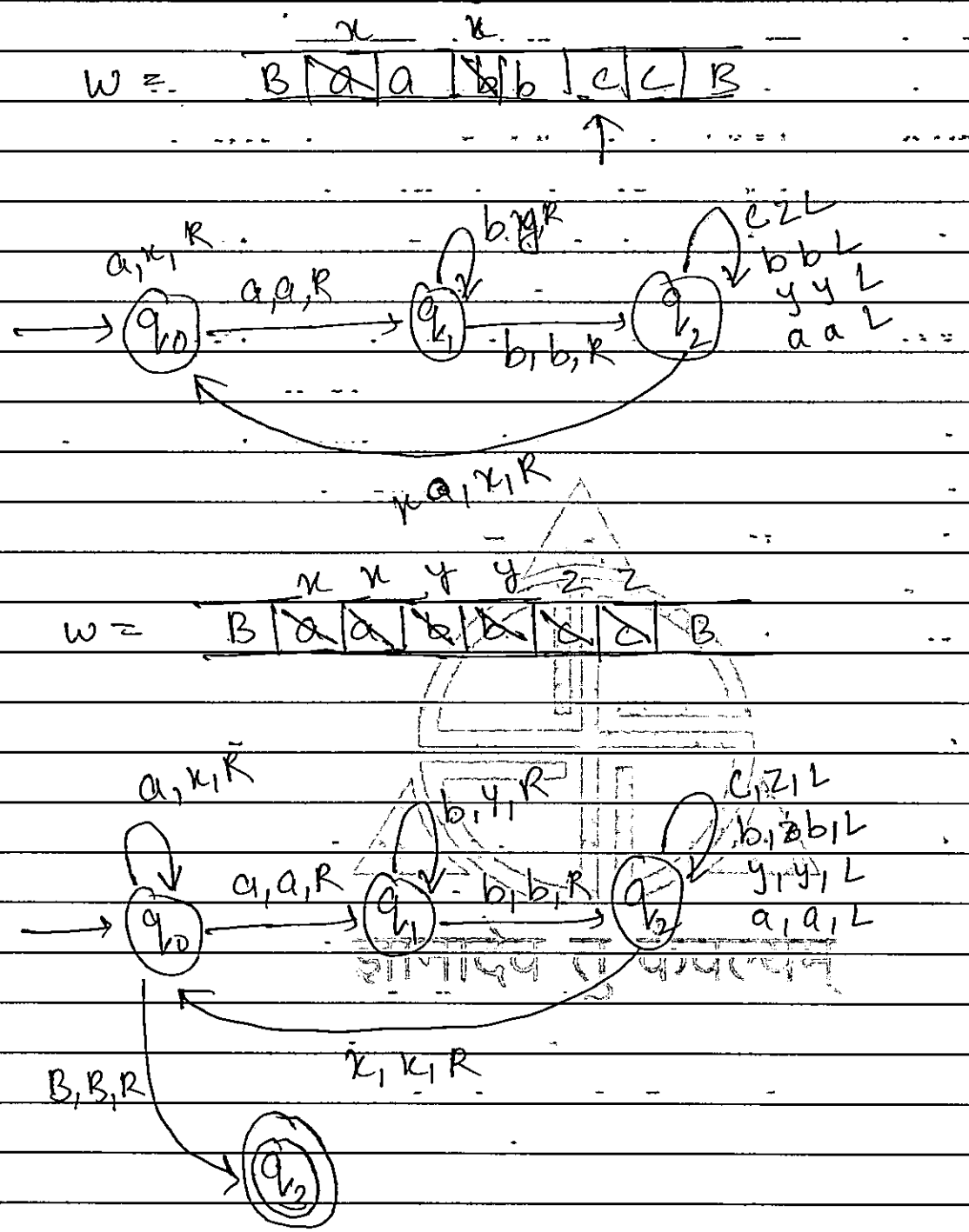
Let $n = 2$

$w =$ | B | a | a | b | b | c | c | B |



$w =$ | B | x | a | b | b | c | c | B |




W = B a a b b c c B
a, x, R
a, a, R
b, y, R
c, z, L
b, b, L
y, y, L
a, a, L
b, b, R
q0
q1
q2
W = B x x y y z z B
a, x, R
b, y, R
c, z, L
b, b, L
y, y, L
a, a, L
a, a, R
b, b, R
x, x, R
B, B, R
q0
q1
q2
q3

States	Read	write	Direction
q_0	a	x	R
q_0	a	a	R
q_1	b	y	R
q_1	b	b	R
q_2	c	z	L
q_2	b	b	L
q_2	y	y	L
q_2	a	a	L
q_2	x	x	L
q_1	B	B	R

And ~~Transform~~

~~$\delta(q, x, R) =$~~

Ans:- 5 (a)

PARTIAL FUNCTION :-

→ Partial function is a type of function in which every value of input there can be distinct output.
But for the same value of input there can't be same value of output.

INITIAL FUNCTION :-

There are three types of initial functions.

① Zero function :- Every value of input the output is always zero.

Eg:-
$z(6) = 0$; $z(5) = 0$ i.e., $z(n) = 0$
$z(6.14) = 0$

(2) Sussesive function :- for every value of x the output is sussive i.e., +1

$S(6) = 7$

& $S(9) = 7$; ie, $S(n) = n+1$

(3) Projection function :- In projection function value of i the output will be i.

$U_i^j (x_1 x_2 x_3 x_4)$

Here $j = 4$

$i = 2$

so,

$U_2^4 (x_1, x_2, x_3, x_4) \Rightarrow x_2$

ज्ञानार्थं न केवलम्

Eg :-

$U_2^3 (6, 4, 7) = 4$

Ans:- 5 (b)

(1) $f(x, y) = x * y$

step- 1

put $y = 0$.

$$f(x, 0) = x * 0 = 0 = G_1(x)$$

step - 2

put $y = y + 1$

$$f(x, y+1) = x * (y+1)$$
$$= x * y + x * 1$$
$$= x * y + x$$

step 3

$$f(x, y, f(x, y+1)) = x * y + x$$
$$= x * U_1^3 (f(x), f(y), f(x, y+1))$$
$$= U_1^3 (f(x), f(y), f(x, y+1)) +$$
$$U_1^3 (f(x, y+1))$$

∴ It is primitive recursive fxn.

⇒ (ii) $f(x,y) = x^y$

Step-1 Put $x=0$

$f(x,0) = x = G_1(y)$

Step-2 Put $y = y+1$

$f(x,y+1) = x^{y+1}$

$= x^y * x$

Step-3

$f(x, y, f(x,y+1)) = x^y * x$

$= U_i^3(x, y, f(x,y+1))$

$= U_i^3(x, y, f(x,y+1)) \rightarrow *$

$= U_i^3(x^y * z)$

∴ it is recursive fxn

⇒ Any function can be a premitive recursive function when it is one of the initial function i.e. zero function, sussesive function, projection function and we can obtain it by computation and rearranging.

Ans:- 5(c)

→ There are two types of complexity in Turing machine

→ Space complexity & Time complexity

⇒ SPACE COMPLEXITY:-

→ Space complexity is a space occupied in the system by Turing machine to do computation

→ The space or the values of no. of tape cell required to perform computation is space complexity of Turing machine

→ The space complexity is of tuning machine is

S(n) = n + 1

Here it is 4.

→ The space complexity is the ~~from~~ ~~computer~~. taken by Turing machine for computation.

⇒ TIME COMPLEXITY

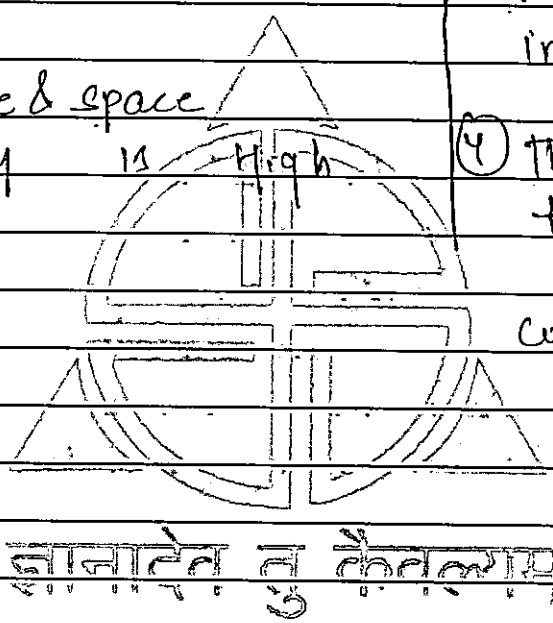
→ Time taken by the turing machine for computation is known as time complexity.

→ In Turing maching the no. of transition or steps of pointer is space complexity.

→ It is $T(0) = 0$

ज्ञानदीप ज्ञान केन्द्रालय

Q(a) NPDA	PDA
(1) Non Deterministic push down automata	(1) Deterministic push down automata.
(2) It is less strong as compared to PDA	(2) It is more strong.
(3) It is not common & for use	(3) The usess of PDA is high in industries
(4) Its time & space complexity is High	(4) The space & time complexity is low Compared to NPDA

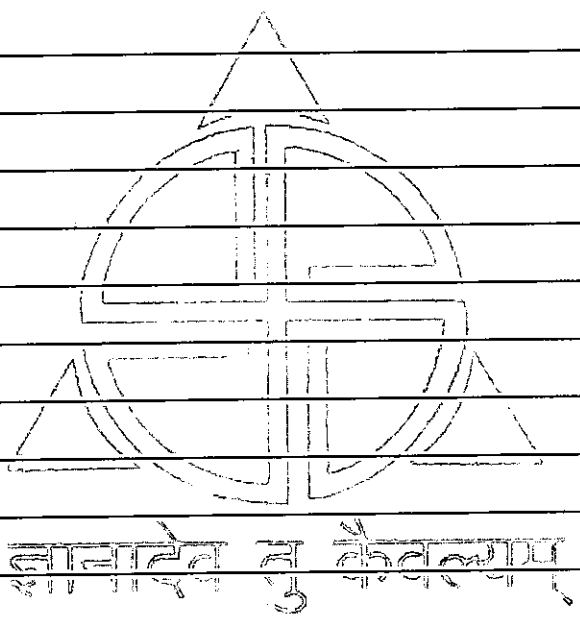


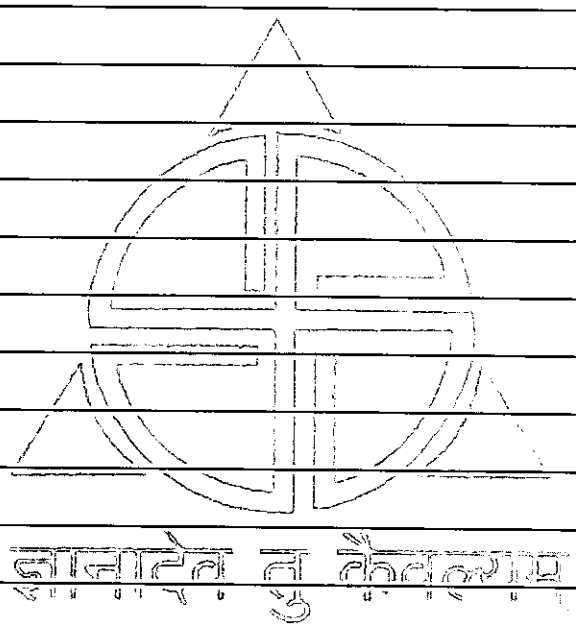
Ans — 2(a)

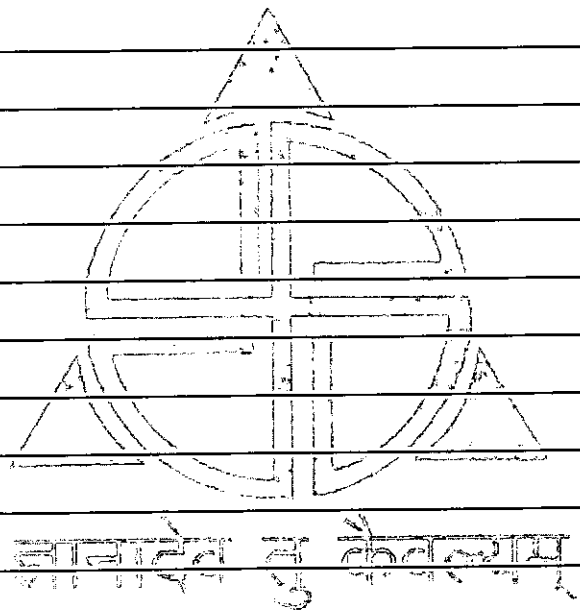
Property of regular grammer

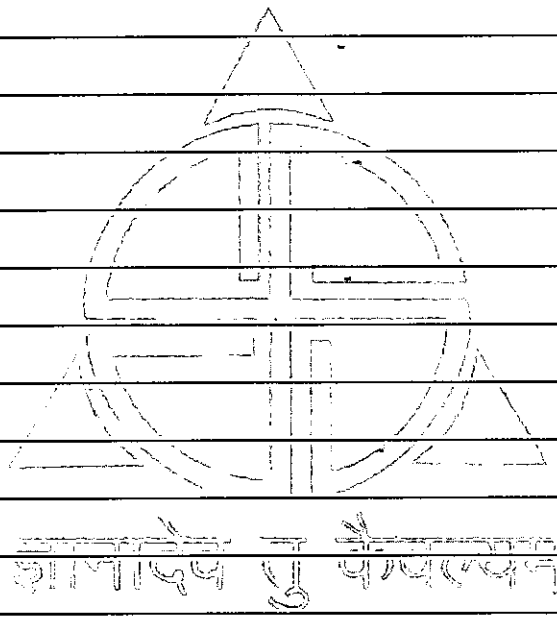
(1) A → Non-terminal to Non terminal can be done

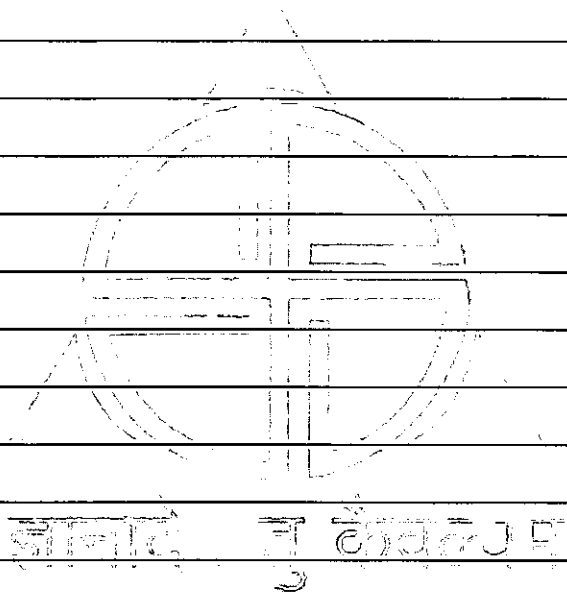
(2) There can be not any duplicate states.

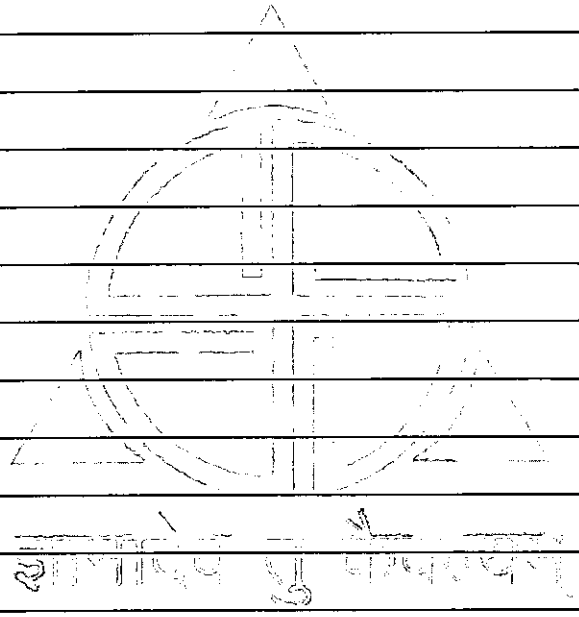


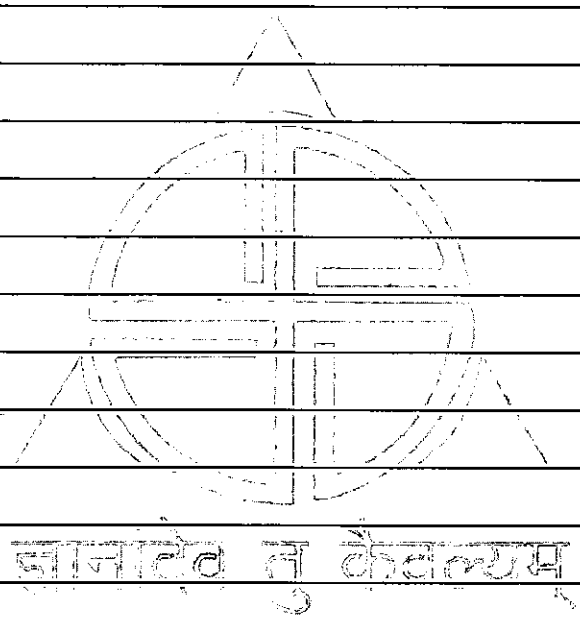


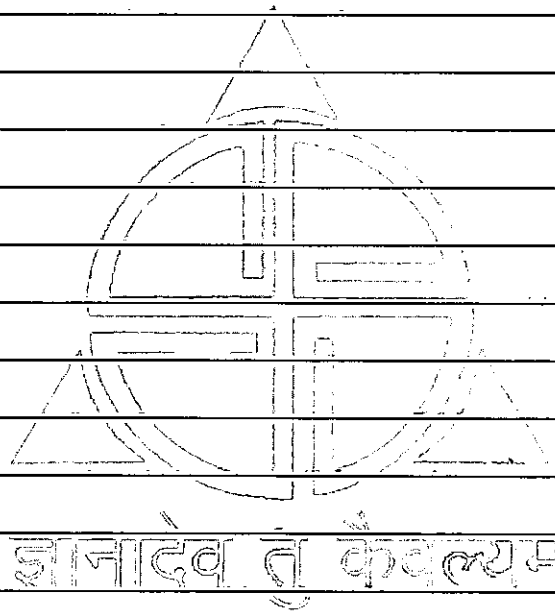








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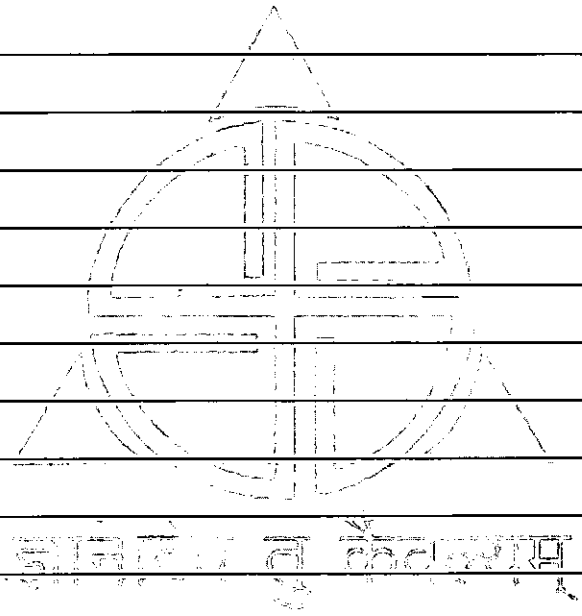
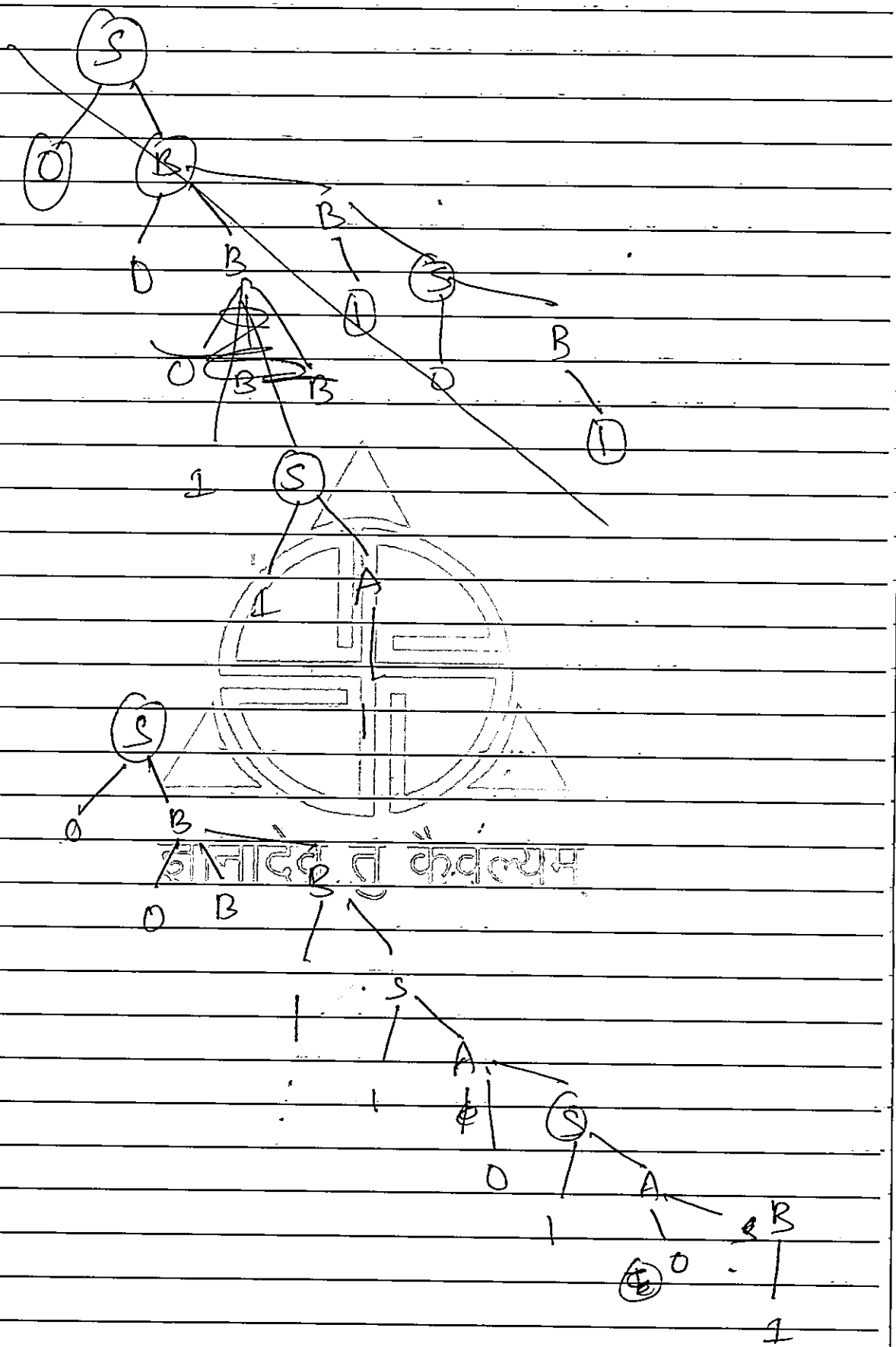
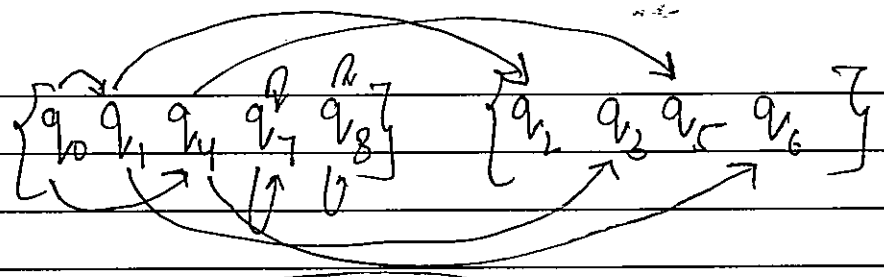
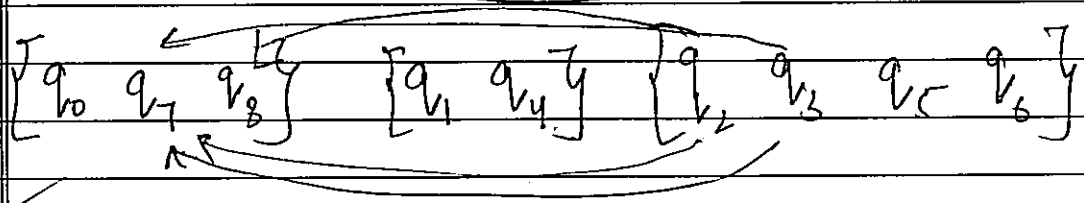




समाहृद्ध तु कैवल्यम





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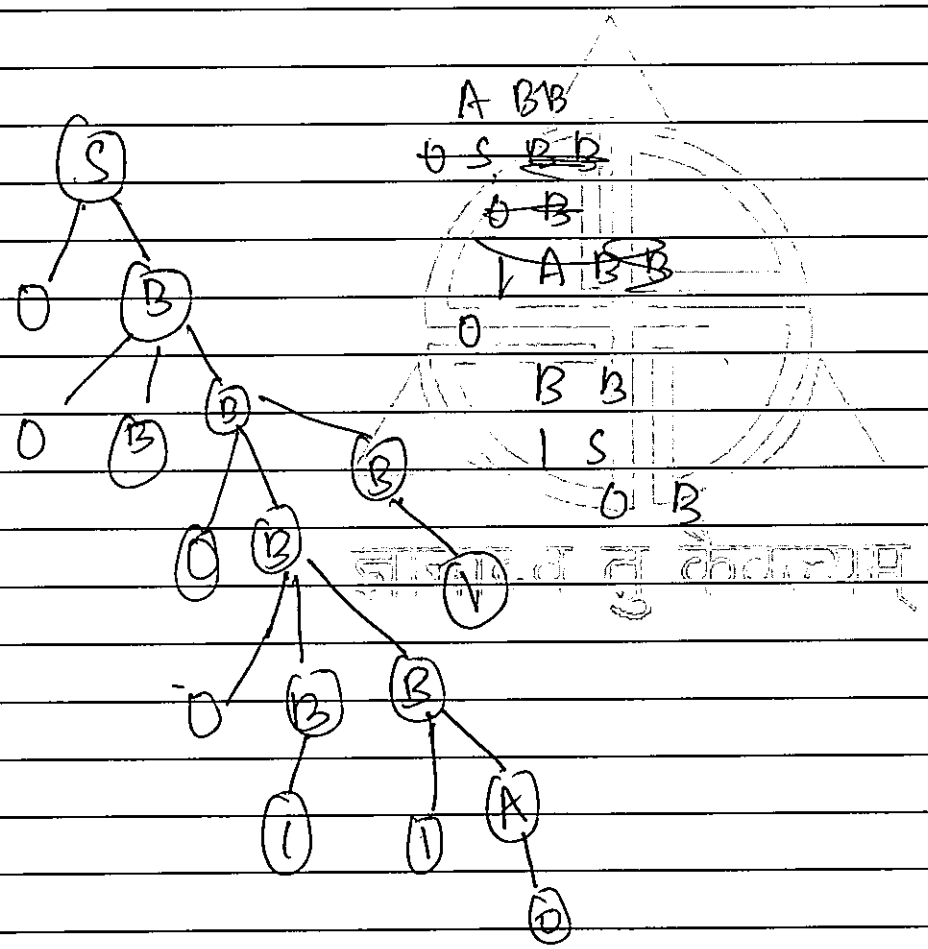

A BB

~~0 S BB~~

~~0 B~~

1 A ~~B B~~

0

B B

1 S

0 B