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2. I have neither impersonated anyone, nor have I been impersonated by any person for the purpose of assessments.

Signature of the Student : RPandey 10/05/21

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NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

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END-SEMESTER Rajneesh Pandey

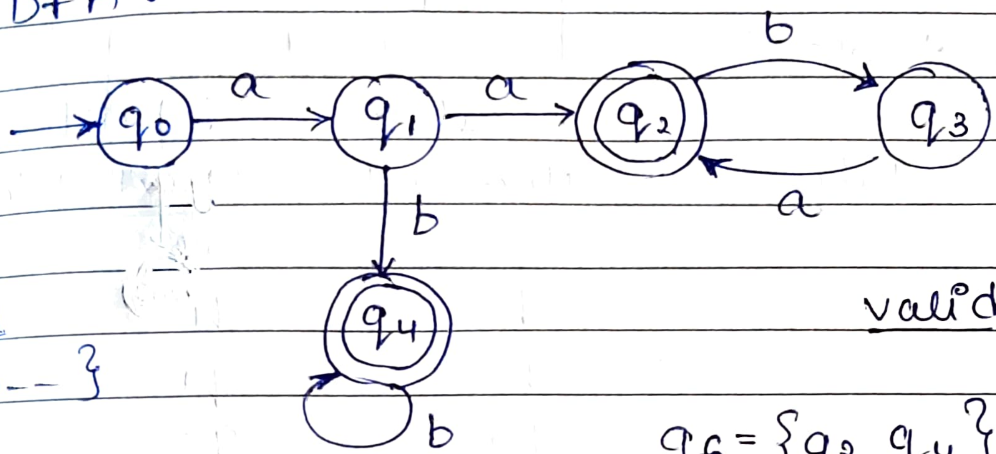
10/05/21

SET-4

Question (1)

(1)(a) $aa(ba)^* \mid abb^*$

DFA :



Invalid
{a, aab-- }

valid = {aa, ab, aaba, abb, aababa--}

$q_f = \{q_2, q_4\}$

Validation

Let $x =$ aababa.

length = 6.

$\delta(q_0, a) \longrightarrow q_1$

$\delta(q_1, a) \longrightarrow q_2$

$\delta(q_2, b) \longrightarrow q_3$

$\delta(q_3, a) \longrightarrow q_2$

$\delta(q_2, b) \longrightarrow q_3$

$\delta(q_3, a) \longrightarrow \boxed{q_2} \longrightarrow$ final state.

Hence. $\boxed{x = aababa}$ is valid string.

(1)(b)

Moore machine which counts the occurrence of substring "bab".

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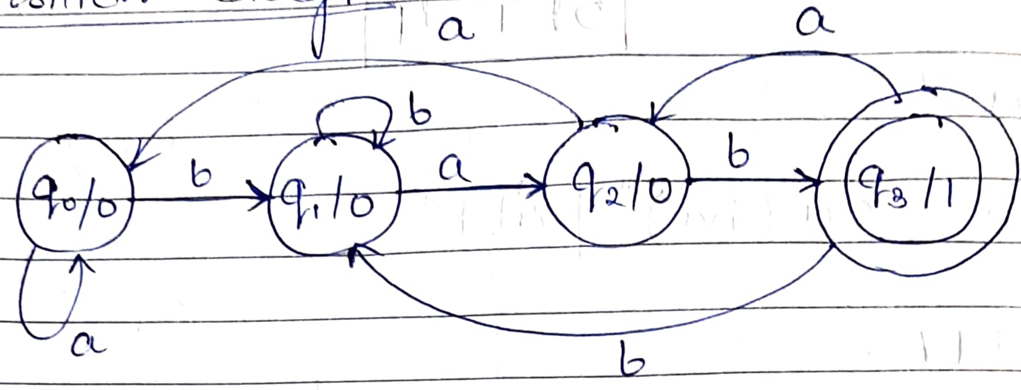
Transition diagram.



Transition table:

present state	Input=a Next State	Input=b Next state	o/p
q_0	q_0	q_1	0
q_1	q_2	q_1	0
q_2	q_0	q_3	0
q_3	q_2	q_1	1

Lets consider string ababbababb.

now,

$\delta(\underbrace{q_0, ababbababb}_{0}) \Rightarrow \delta(\underbrace{q_0, babbababb}_{0})$

$\Rightarrow \delta(\underbrace{q_1, abbababb}_{0})$

$\Rightarrow \delta(\underbrace{q_2, bbababb}_{0}) \Rightarrow \delta(\underbrace{q_3, bababb}_{1})$

$\Rightarrow \delta(\underbrace{q_1, ababb}_{0})$

$\Rightarrow \delta(\overbrace{q_0, babb}^{0}) \Rightarrow \delta(\overbrace{q_3, abb}^{1}) \Rightarrow \delta(\overbrace{q_2, bb}^{0})$

$\Rightarrow \delta(\underbrace{q_3, b}_{1}) \Rightarrow \overset{0}{q_1}$

$\boxed{\text{output} \Rightarrow 00001001010}$ hence, 10 6 11 9 100

So there are 3 occurrance of bab in string

a|bab|ba|b|ab|b

Question (2) $\{S \rightarrow AB,\ S \rightarrow CA,\ A \rightarrow a,\ B \rightarrow BC,\ B \rightarrow AB,\ C \rightarrow aB,\ C \rightarrow b\}$

1) As, B has no terminal string to it so, we remove production containing B.

$S \rightarrow CA \qquad A \rightarrow a \qquad C \rightarrow b.$

remaining unit production $\Rightarrow$ $S \rightarrow ba$
Rule c

(2)(a) Hence the language generated

$L = \{ba\}$.

(2)(b) as, the production rule is $\boxed{S \rightarrow ba}$ hence, grammar is unambiguous.

(2)(c) To derive GNF form
$S \rightarrow ba$
Replacing "a" by a non-terminal Na.

GNF form :

$S \rightarrow bNa$

$Na \rightarrow a.$

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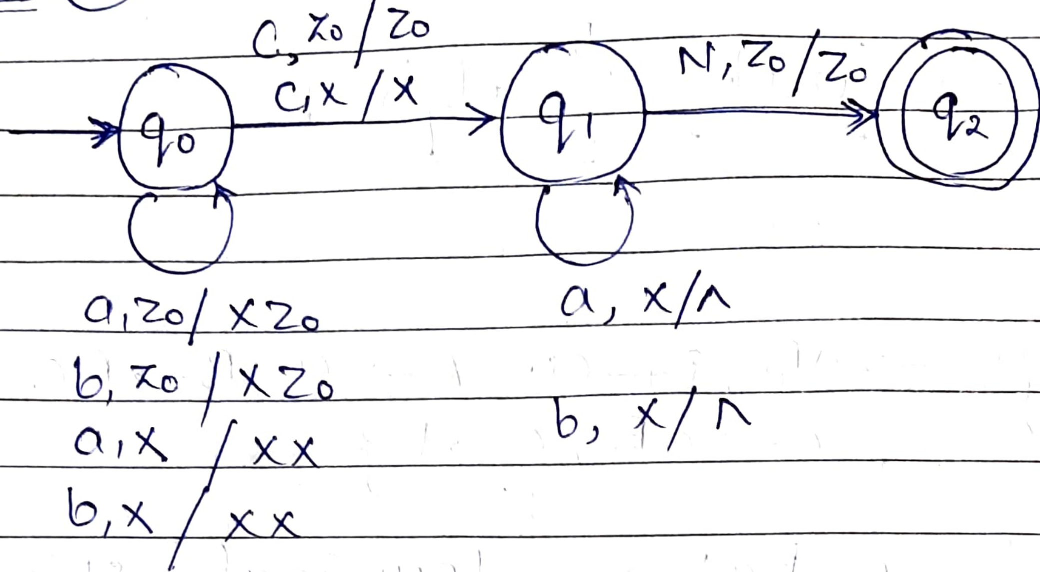
Question (3)



The given language is of the form

$(a|b)^n \; c \; (a|b)^n \quad n \geq 0.$

This is because in q_0 we keep pushing x for every accurrance of 'a' or 'b'.

Then we move to q_1 if we encounter 'c'.

In q_1 we keep popping a's and b's for x until stack gets empty

There fore

$L = (a|b)^n \, c \, (a|b)^n$ where $n \geq 0$.

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Question (4)

Given

$L = \{wcy \mid w$ and y in $\{a,b\}^*, w \neq y\}$.

we introduce an extra track on the tape that holds a blank (B) The blank appears where the symbol below it has considered by the Turing machine in one of its comparison.

initial state $= q_0$
blank symbol $= B$.
final state $= \{q_f\}$

These are some transitions.

$\delta = \delta(q_0, B) \to (q_1, B, R)$

$\delta(q_1, B, R) \to (q_2, P, R)$

$\delta(q_3, P) \to q_3, P, R)$

$\delta(q_3, a) \to (q_4, B, R)$

$\delta(q_4, b) \to (q_5, b, L)$

⋮

$\delta(q_9, a) \to (q_9, a, b)$

⋮

$\delta(q_f', P) \to \delta(q_P', a, b)$

$\delta(q_3, B) \to \delta(q_P', B, L)$

Now the Turing machine will look like:

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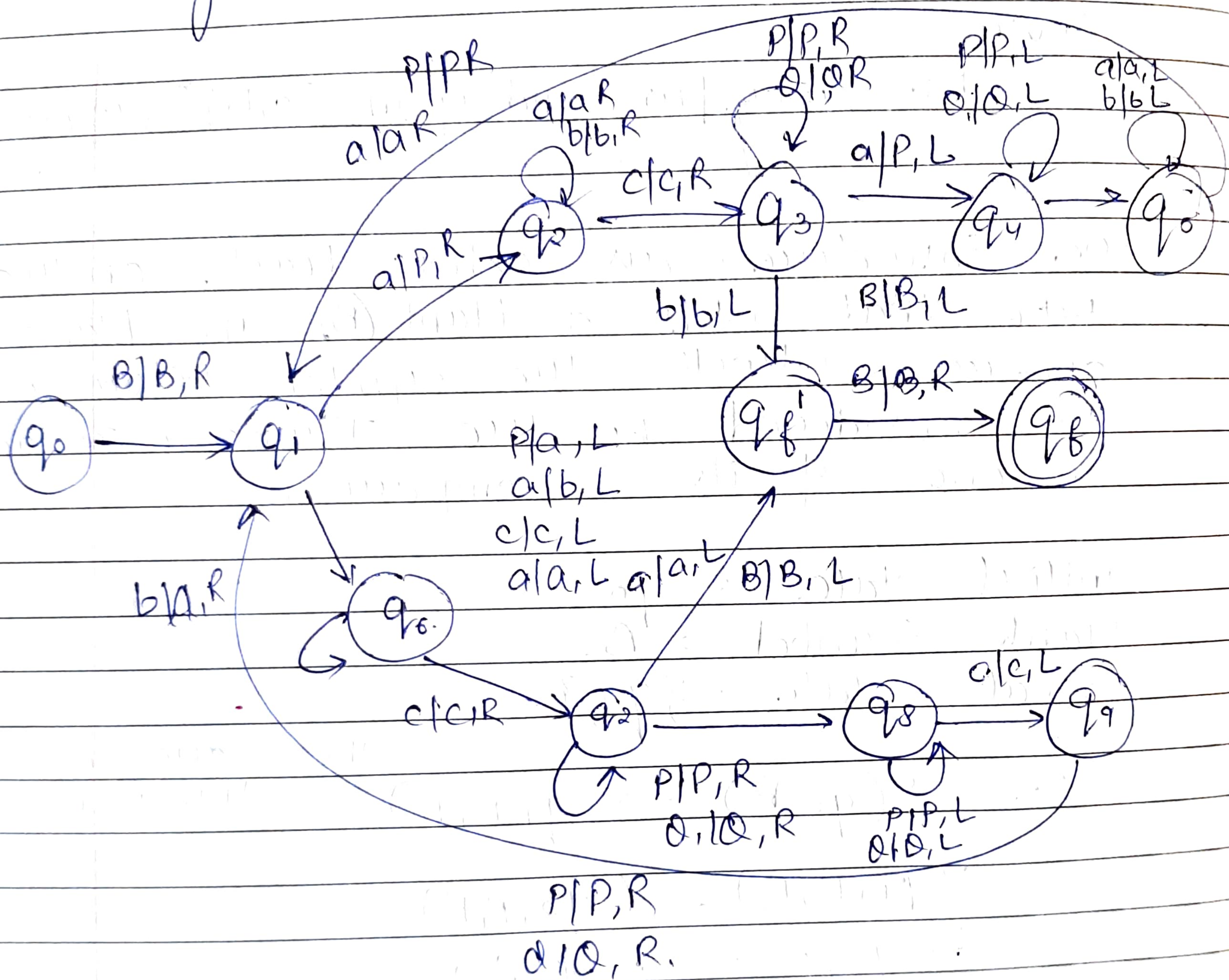
Turing machine.



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Question (5)

Given,

$S \rightarrow \{C_bA \mid C_aB,\ A \rightarrow C_bD \mid C_aS \mid a,\ B \rightarrow C_aE \mid C_bS \mid a$
$D \rightarrow AA,\ E \rightarrow BB,\ C_a \rightarrow a,\ C_b \rightarrow b\}$

(i) for string "baba":

4	S			
3	ϕ	A		
2	S	ϕ	S	
1	C_b	{A, B, C_a}	C_b	{A, B, C_a}
	b	a	b	a

therefore "baba" will be accepted.

(ii) for string "bbaa":

4	S, E			
3	B	{A, B}		
2	ϕ	S	{D, E, S}	
1	C_b	C_b	{A, B, C_a}	{A, B, C_a}
	b	b	a	a

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now,

for, $bb \Rightarrow b,b = C_b \times C_b = C_bC_b = \phi$

$ba \Rightarrow b,a = C_bA, C_bB, C_bC_a = \{S\}$

$a,a \Rightarrow AA, AB, AC_a, BA, BB, BC_a, C_aA, C_aB, C_aC_a$

$= DES$

For $bba \Rightarrow b,ba = C_b\{S\} = C_bS = B$

and $bb,a = \phi \times --- = \phi$

for "bbaa" $\Rightarrow b, baa = C_b \times \{A,B\} = C_bB = \phi$

$bb, aa = \phi \times ---- = \phi$

$bba, a = B \times \{A, B, C_a\} = BA, BB, BC_a$
$= \phi, E, \phi = \{E\}$

fau "baa" $\Rightarrow$ [illegible]

$ba,a = S \times \{A, B, C_a\} = \{A, B\}$.

Hence "bbaa" will be accepted.