MODULE 1

1)Design DFA that accepts Strings that contain "ba" or "ab" as suffix over $\Sigma=\{a,b\}$.

2)Design DFA that accepts Strings with at least 3 a's. over $\Sigma=\{a,b\}$

3.Compare and Contrast Moore and Mealy Machines. Design Moore machine for $\Sigma=\{0,1\}$, print the residue modulo 3 for binary numbers.

4.Design a Mealy machine to change every occurrence of a with x, b with y and c is kept unchanged. Convert the same to equivalent Moore machine.

5. iDesign DFA that accepts Strings that ends in either "110" or "101" over $\Sigma=\{0,1\}$.
ii Design NFA that accepts strings starting with "abb" or "bba".

6.

b Given NFA with epsilon, Find equivalent DFA. q1 is the initial state, q3 is final state

	0	1	2	ε
→q1	{q1}	-	-	{q2 }
q2	-	{q2}	-	{ q3}
*q3	-	-	{ q3}	-

7. Design DFA that accepts Strings that are multiples of 4 $\Sigma=\{0,1\}$.

8. Design NFA that accepts strings starting with a and ending with a or starting with b and ending in b.

9. Design a DFA to accept string of 0"s and 1"s ending with the string 100.

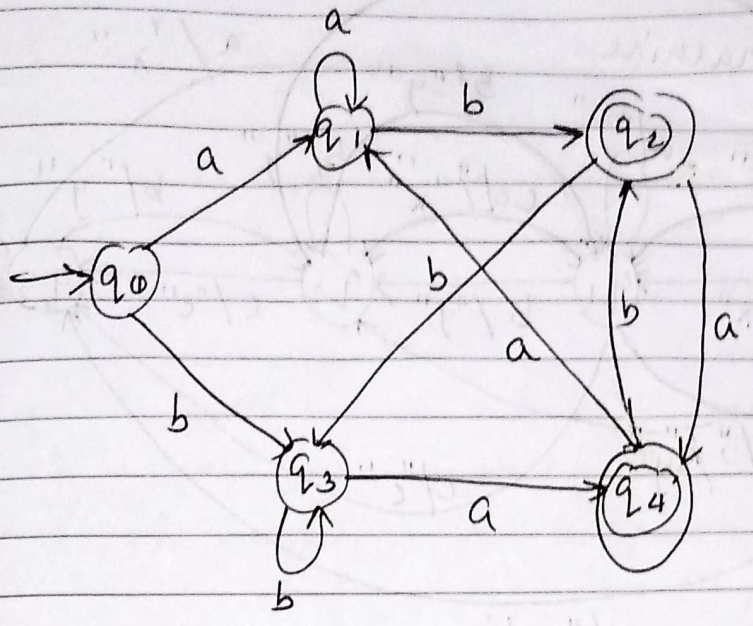
10.

(a) Design NFA for recognizing the strings that end in "aa" over $\Sigma=\{a,b\}$ & convert above NFA to DFA. 10

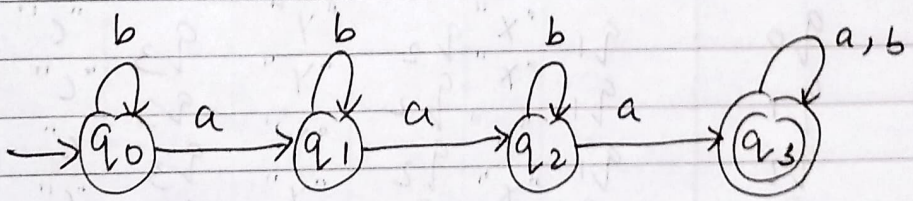
(b) Design moore m/c for following:- If input ends in „101" then output should be A, if input ends in „110" output should be B, otherwise output should be C and convert it into mealy m/c

PYQ's on module 1

Q1)



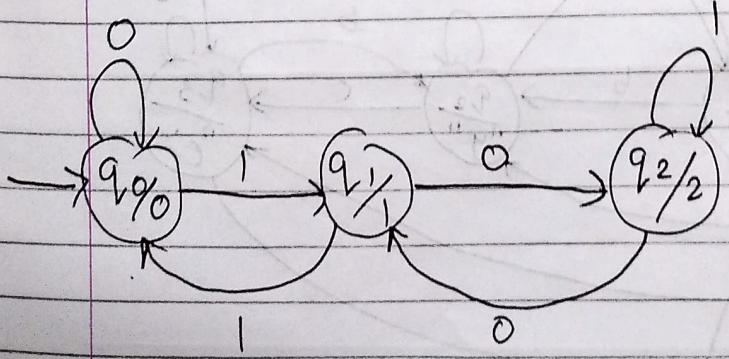
Q2)



Q3) $\Sigma = \{0, 1\}$,

1 % 3 , 2 % 3 , 3 % 3

$\Delta = \{0, 1, 2\}$



	^	b
0 % 3 = 0	0 → 0	0 0
1 % 3 = 1	1 → 0	0 1
2 % 3 = 2	2 → 0	1 0
3 % 3 = 0	3 → 0	1 1
4 % 3 = 1	4 → 1	0 0
5 % 3 = 2	5 → 1	0 1
6 % 3 = 0	6 → 1	1 0
7 % 3 = 1	7 → 1	1 1

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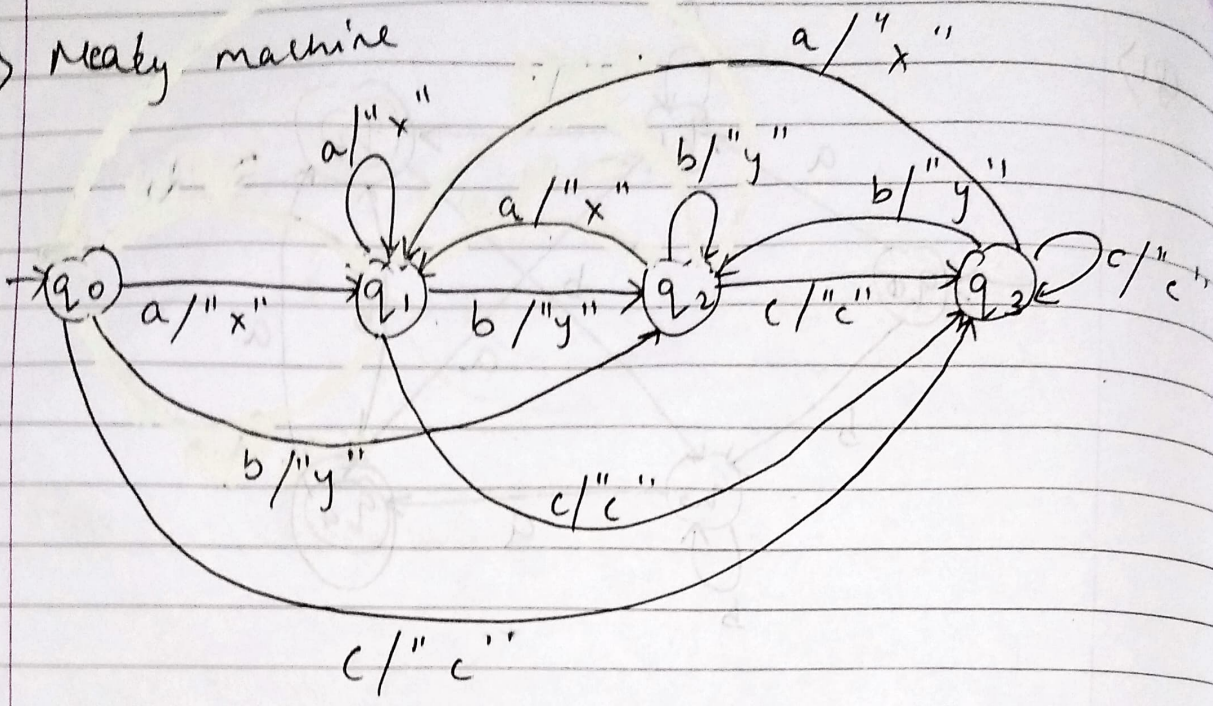
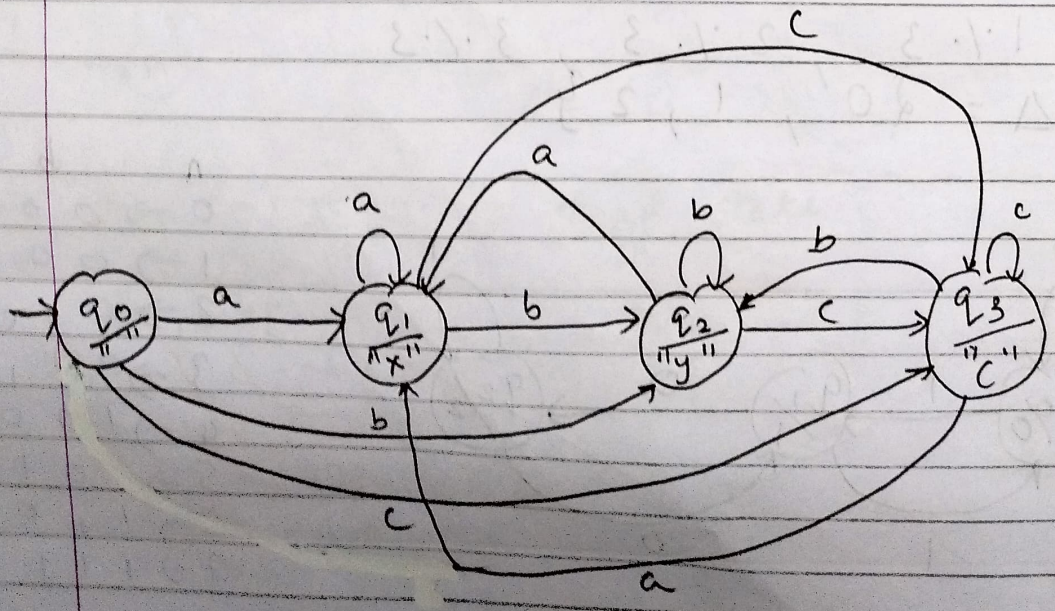
Q4) Mealy machine



	a	Δ	b	Δ	c	Δ
q_0	q_1	"x"	q_2	"y"	q_3	"c"
q_1	q_1	"x"	q_2	"y"	q_3	"c"
q_2	q_1	"x"	q_2	"y"	q_3	"c"
q_3	q_1	"x"	q_2	"y"	q_3	"c"

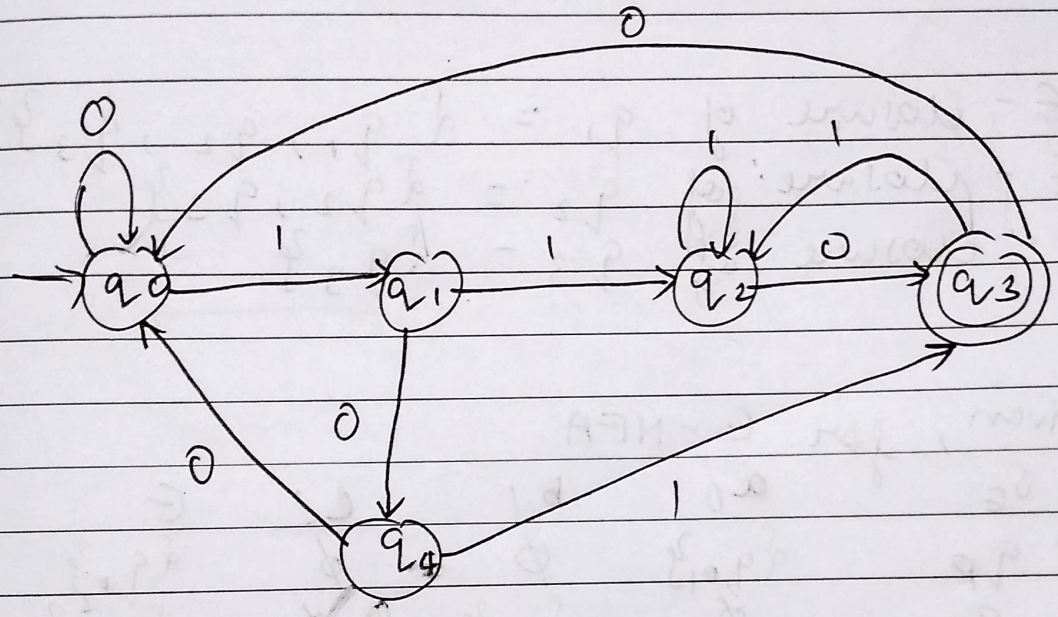
Moore machine



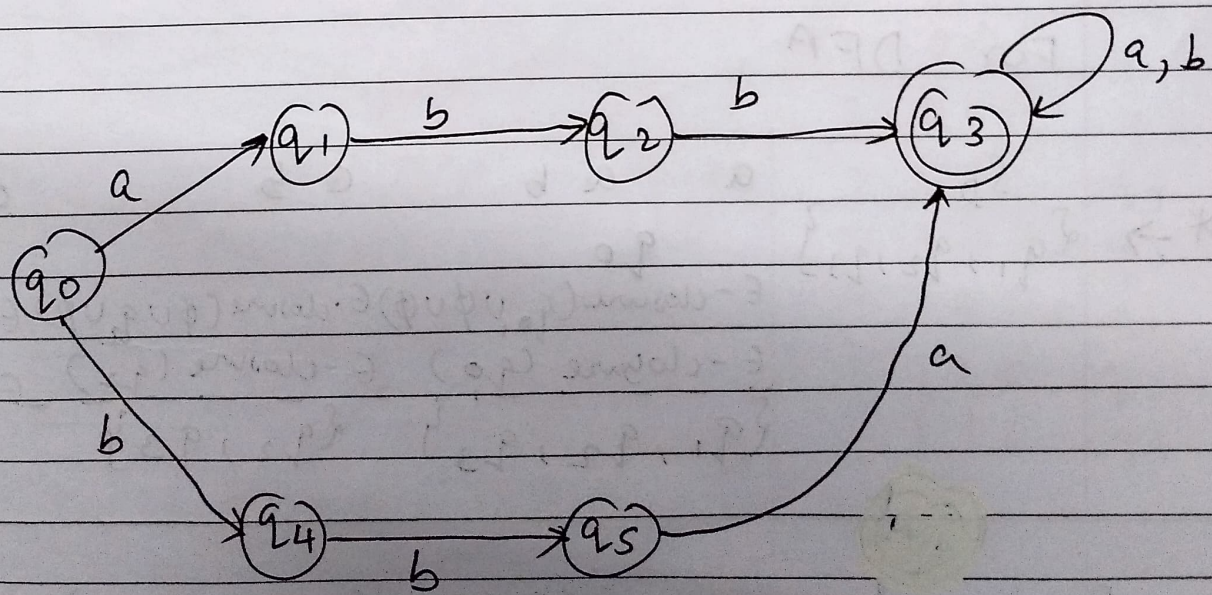
	a	b	c	Δ
q_0	q_1	q_2	q_3	" "
q_1	q_1	q_2	q_3	"x"
q_2	q_1	q_2	q_3	"y"
q_3	q_1	q_2	q_3	"c"

Q5)

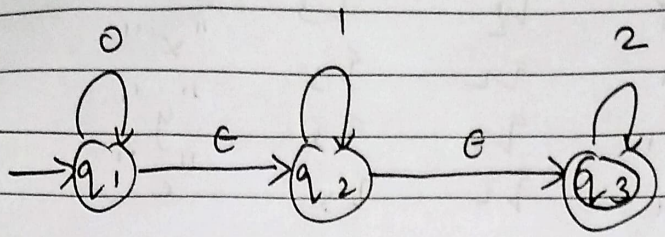
(i)



(ii)



Q6)



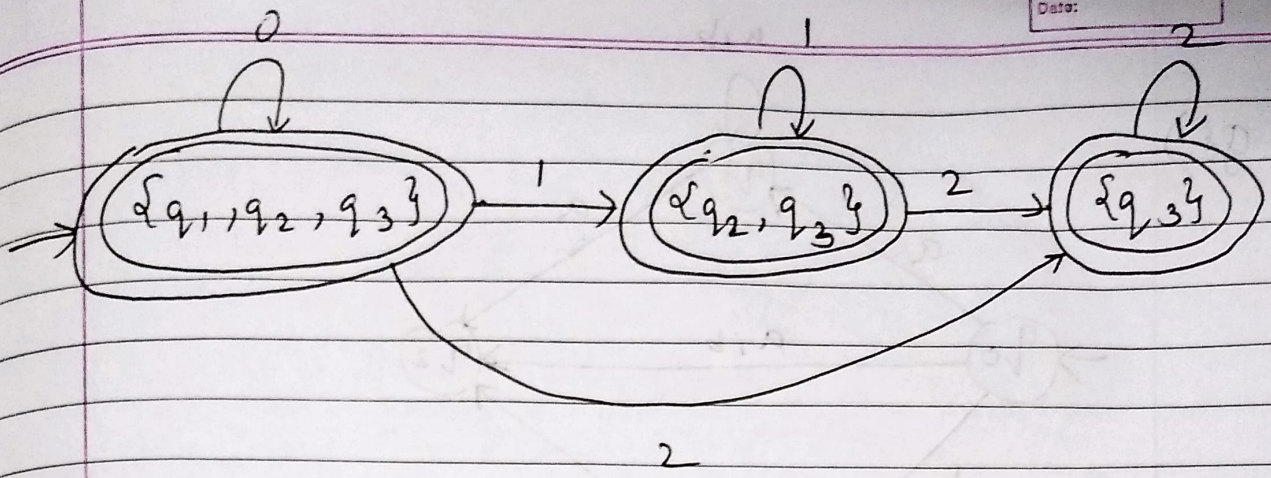
ε - closure of $q_1 = \{q_1, q_2, q_3\}$
ε - closure of $q_2 = \{q_2, q_3\}$
ε - closure of $q_3 = \{q_3\}$

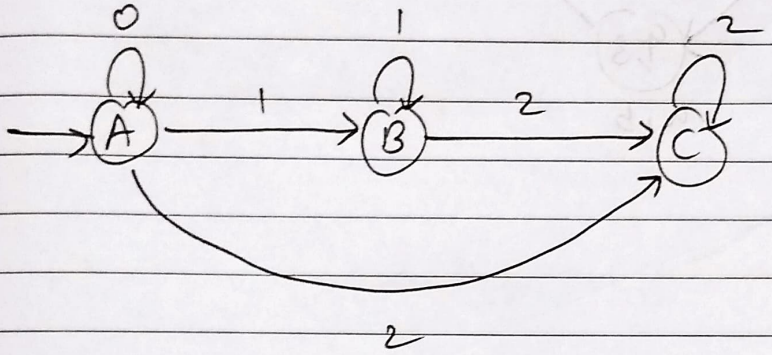
Given, for ε - NFA

S_E	0	1	2	ε
→ q_1	$\{q_1\}$	ϕ	ϕ	$\{q_2\}$
q_2	ϕ	$\{q_2\}$	ϕ	$\{q_3\}$
* q_3	ϕ	ϕ	$\{q_3\}$	ϕ

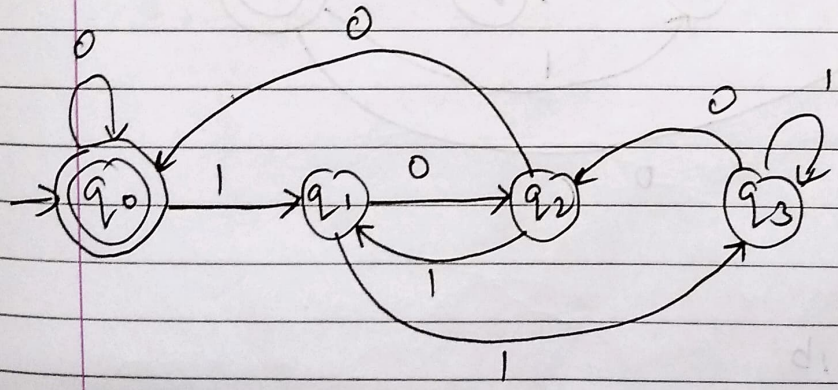
For DFA

S_D	0	1	2
* → $\{q_1, q_2, q_3\}$	ε-closure $(q_1 \cup \phi \cup \phi)$ ε-closure (q_1) $\{q_1, q_2, q_3\}$	ε-closure $(\phi \cup q_2 \cup \phi)$ ε-closure (q_2) $\{q_2, q_3\}$	ε-closure $(\phi \cup \phi \cup q_3)$ ε-closure (q_3) $\{q_3\}$
* $\{q_2, q_3\}$	ε-closure $(\phi \cup \phi)$ ϕ	ε-closure $(q_2 \cup \phi)$ ε-closure (q_2) $\{q_2, q_3\}$	ε-closure $(\phi \cup q_3)$ ε-closure $\{q_3\}$ $\{q_3\}$
* $\{q_3\}$	ε-closure (ϕ) ϕ	ε-closure (ϕ) ϕ	ε-closure (q_3) $\{q_3\}$





Q7)



n	b	s
0	0 0 0	q_0
1	0 0 1	q_1
2	0 1 0	q_2
3	0 1 1	q_3
0	1 0 0	q_0
1	1 0 1	q_1
2	1 1 0	q_2
3	1 1 1	q_3

	0	1
q_0	q_0	q_1
q_1	q_2	q_3
q_2	q_0	q_1
q_3	q_2	q_3

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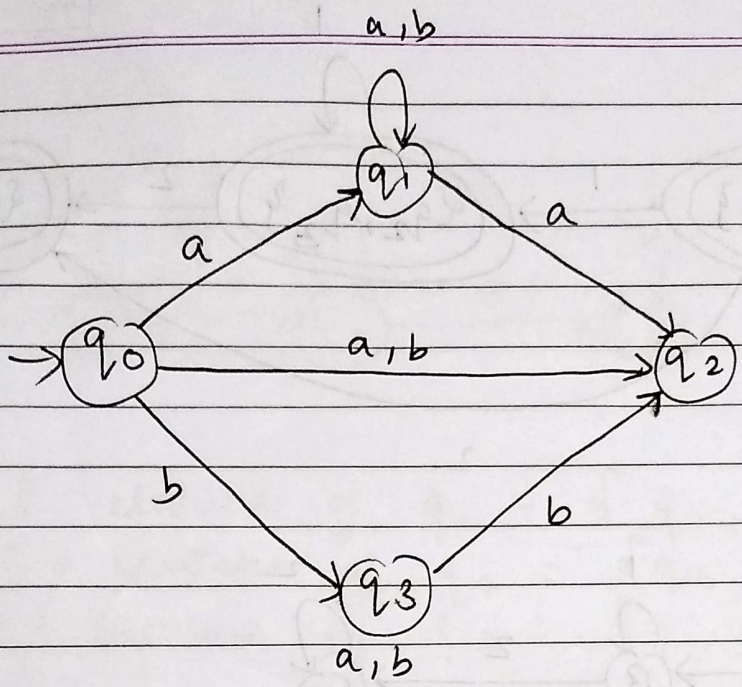
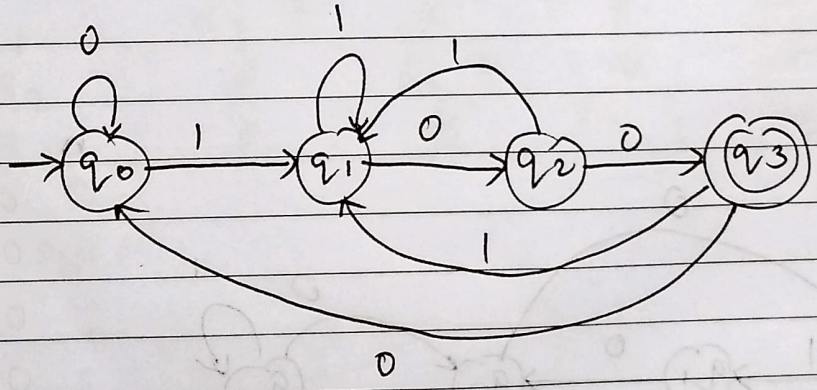
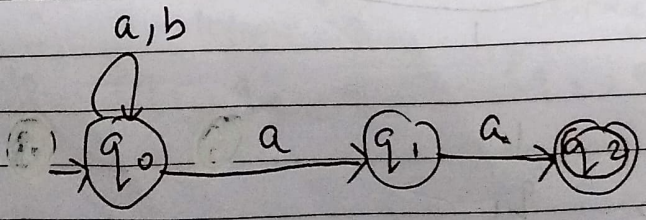
Q8)



Q9)



Q10) a) NFA

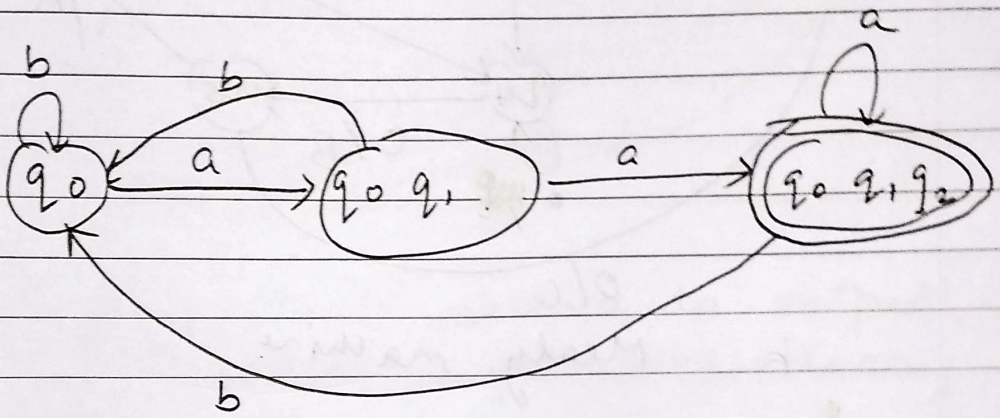


Transition table

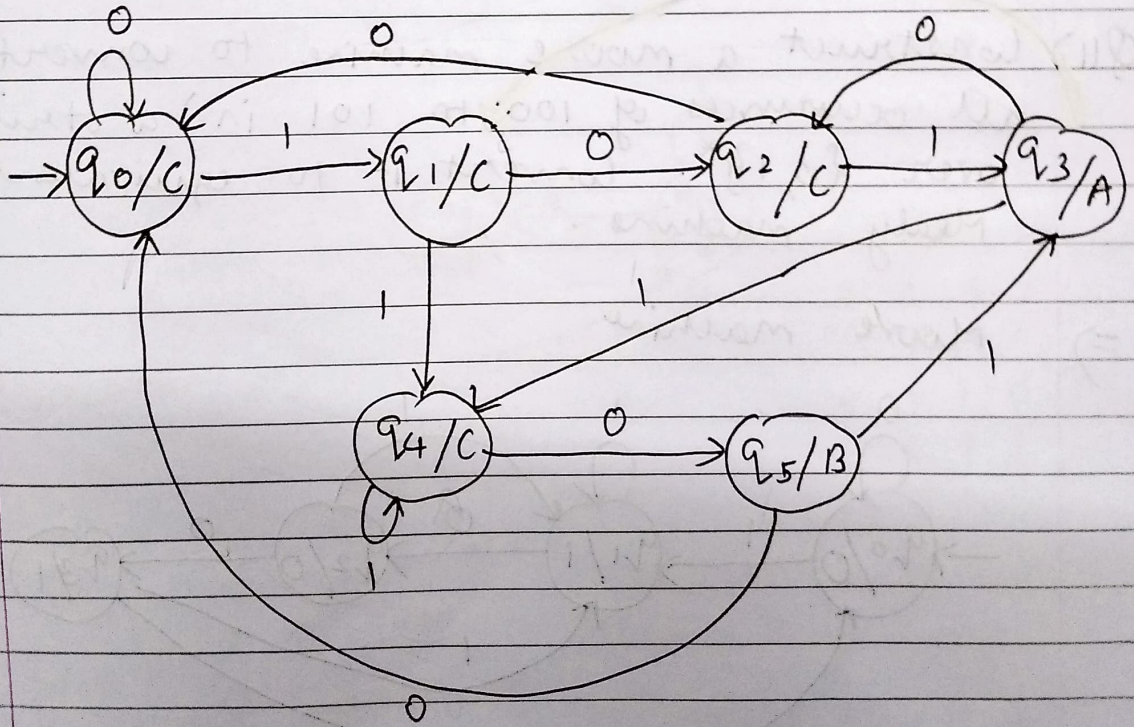
	a	b
q_0	$q_0 q_1$	q_0
q_1	q_2	—
q_2	—	—

DFA table

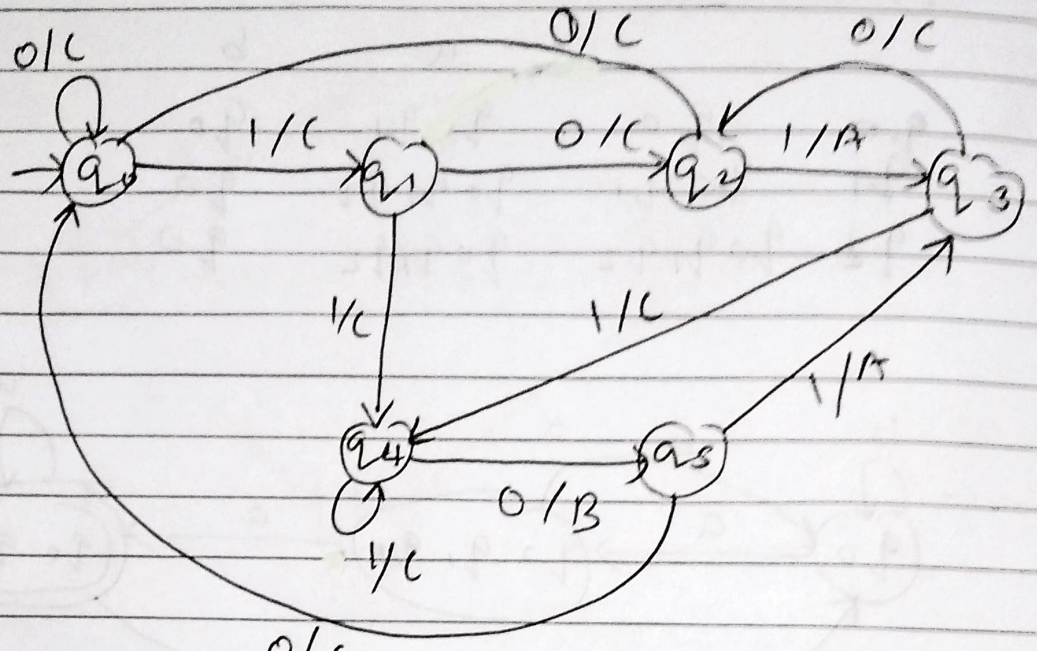
	a	b
q_0	$q_0 q_1$	q_0
$q_0 q_1$	$q_0 q_1 q_2$	q_0
$q_0 q_1 q_2$	$q_0 q_1 q_2$	q_0



b)



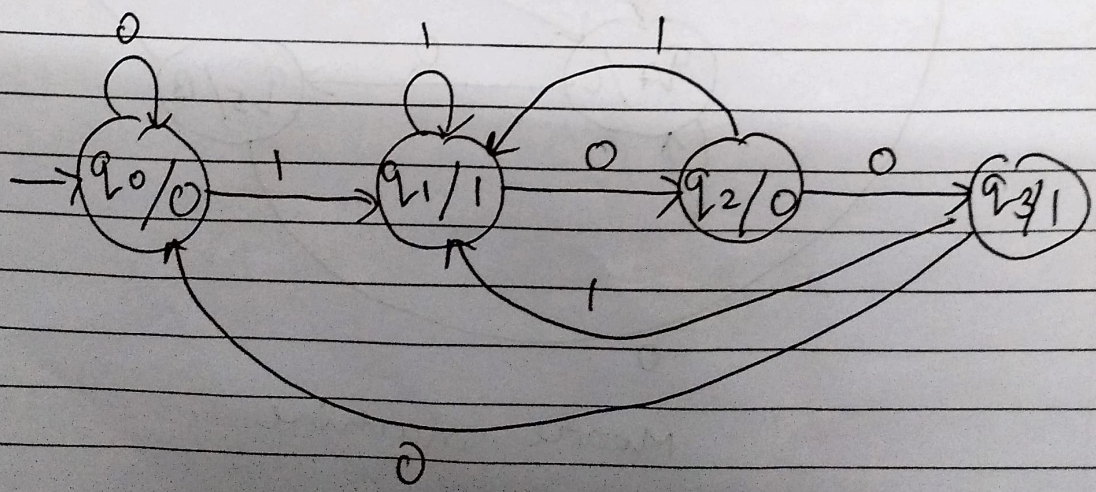
Moore machine



Mealy machine

Q11) Construct a moore machine to convert all occurences of 100 to 101 in a string over $\{0,1\}^*$. Convert it to equivalent Mealy machine.

⇒ Moore machine



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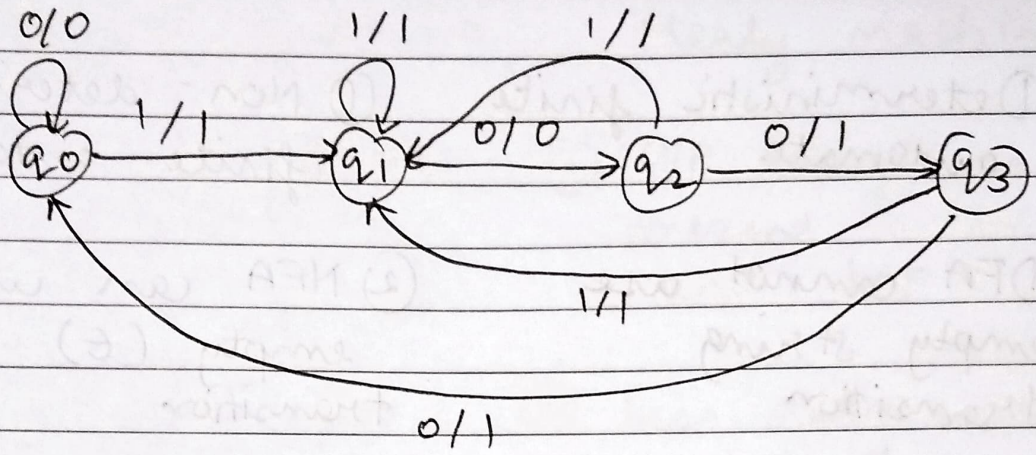
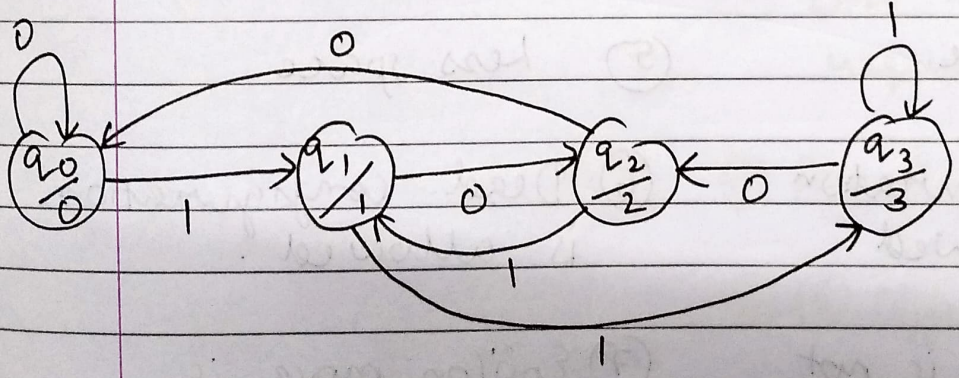
Mealy machine



Q12) Construct a Moore machine to output remainder modulo 4 for any binary number



n	b	r
0	0 0 0	0
1	0 0 1	1
2	0 1 0	2
3	0 1 1	3
4	1 0 0	0
5	1 0 1	1
6	1 1 0	2
7	1 1 1	3

Q13) Difference between DFA & NFA

	DFA	NFA
(1)	Deterministic finite automata	(1) Non-deterministic finite automata
(2)	DFA cannot use empty string transition	(2) NFA can use empty (ϵ) string transition
(3)	More difficult to construct	(3) Easy to construct.
(4)	All DFA are NFA	(4) Not all DFA are NFA
(5)	More space	(5) Less space
(6)	Dead configuration is not allowed	(6) Dead configuration is allowed.
(7)	Epsilon move is not allowed in DFA	(7) Epsilon move is allowed in NFA
(8)	One transition for each input symbol	(8) There can be multiple transitions for each input symbol.
(9)	$\delta : Q \times \Sigma \rightarrow Q$	(9) $\delta : Q \times (\Sigma \cup \epsilon) \rightarrow 2^Q$
(10)	Less execution time	(10) More execution time

O/P : output
I/P : input

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Q14) Difference between Moore & Mealy machine

Moore Machine	Mealy machine
(1) O/P depends on the present state	(1) O/P depends on the present state and I/P
(2) More states are required	(2) Less states are required
(3) Places its O/P in state	(3) Places its O/P in transition
(4) More hardware requirements	(4) Less hardware requirements
(5) React slower to I/P	(5) React faster to I/P
(6) Easy to design	(6) Difficult to design
(7) If I/P changes, O/P does not change	(7) If I/P changes, O/P also changes
(8) Has more or same states than mealy machine	(8) Has less or same states than moore machine.