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PAGE NO. 1

Assignment No. 01

Q.1 Define
a) DFA
b) NFA
c) Moore Machine
d) Mealy Machine

a) DFA :

Definition :- DFA consists of finite set of state, one state is called start state and there can be one or more final states. In DFA from each state on each i/p symbol there is exactly one transition.

DFA is represented using five tuple representation

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

where

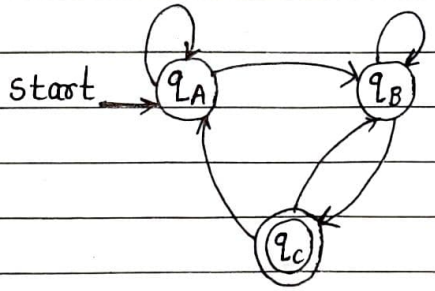
Q = finite set of states
Σ = i/p alphabet
δ = transition function $\delta : Q \times \Sigma \longrightarrow Q$
q_0 = start state $q_0 \in Q$
F = Finite set of final states $F \subseteq Q$

eg :- $Q = \{q_A, q_B, q_C\}$

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

$q_0 = q_A$

Q | Σ	0	1
→ q_A	q_A	q_B
q_B	q_C	q_B
q_C^*	q_A	q_B



Non-Deterministic Finite Automata (NFA):

Definition :- NFA consists of finite set of states. one state is called start state & there can be one or more final states

NFA is represented using five tupple representation and it is defined as follows.

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

Where,

Q = finite set of states

Σ = i/p alphabet

δ = transition function $\delta : Q \times \Sigma \rightarrow 2^Q$

q_0 = start state $q_0 \in Q$

F = finite set of final states $F \subseteq Q$

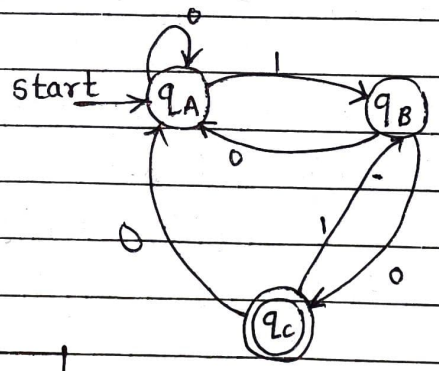
eg. $Q = \{q_A, q_B, q_C\}$

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

$q_0 = q_A$

$F = \{q_C\}$

δ :



$Q \setminus \Sigma$	0	1
$\rightarrow q_A$	q_A	q_B
q_B	$\{q_A, q_B\}$	$\{\}$
q_C^*	q_A	q_B

c) Moore Machine :-

Definition :-

It is a FA with no final state & it produces the o/p sequence for the given i/p sequence. In Moore m/c, the o/p symbol is associated with each state.

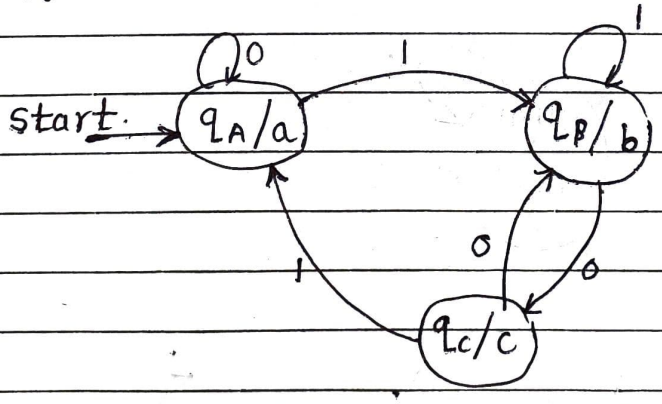
Moore machine is represented using six tupple representation & six tupple representation is given below

$$M = (Q, \Sigma, \Delta, \delta, \lambda, q_0)$$

where,

Q = finite set of states
Σ = i/p alphabet
Δ = o/p alphabet
δ = transition function $\delta : Q \times \Sigma \to Q$
λ = o/p mapping $\lambda : Q \to \Delta$
q_0 = start state $q_0 \in Q$

eg.



$Q = \{q_A, q_B, q_C\}$ $\Delta = \{a, b\}$

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

$q_0 = q_A$.

$Q \backslash \Sigma$	0	1
$\to q_A$	q_A	q_B
q_B	q_C	q_B
q_C	q_B	q_A

$\lambda(q_A) = a$
$\lambda(q_B) = b$
$\lambda(q_C) = a$

d) Mealy Machine :-

It is FA with no final state & it produces the o/p sequence for the given i/p sequence.

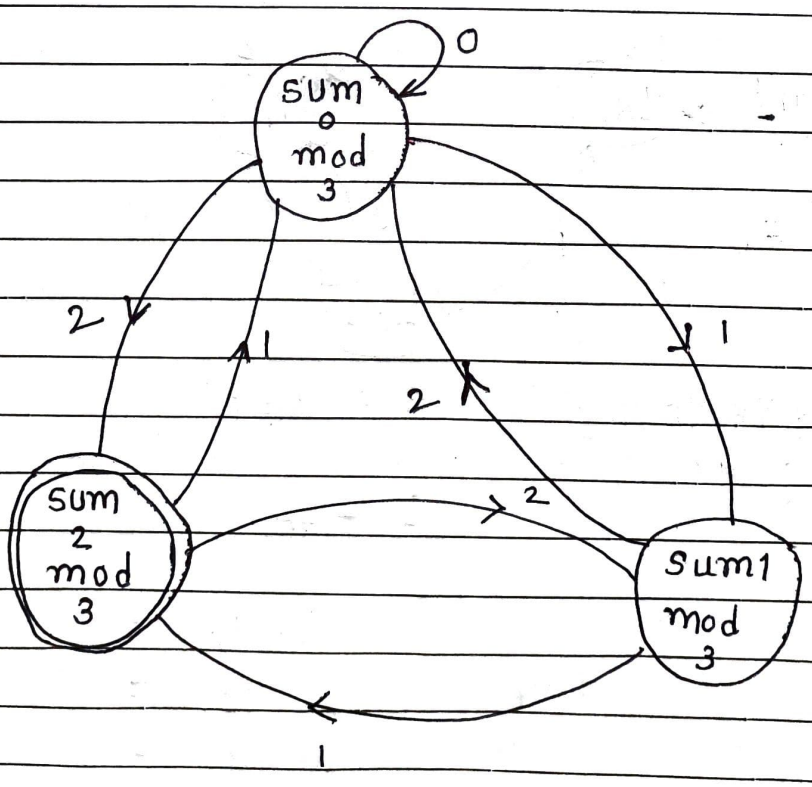
In mealy m/c, the o/p symbol is associated with each transition.

$$M = (Q, \Sigma, \Delta, \delta, \lambda, q_0)$$

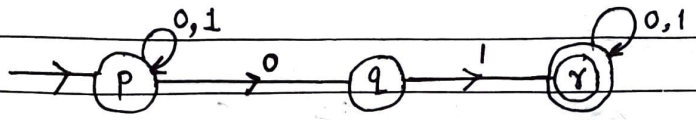
Where,

Q = finite set of states
Σ = i/p alphabet
Δ = o/p alphabet
δ = transition function $\quad \delta : Q \times \Sigma \to Q$
λ = o/p mapping $\quad \lambda : Q \times \Sigma \to \Delta$
q_0 = start state $\quad q_0 \in Q$

Q.2 Design FA for the language whose binary representation is x such that number is 2 mod 3.



Q.3 Convert NFA to DFA.

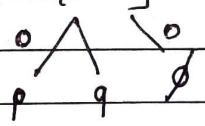


→ Intial state for DFA is p & we should always start with initial state.

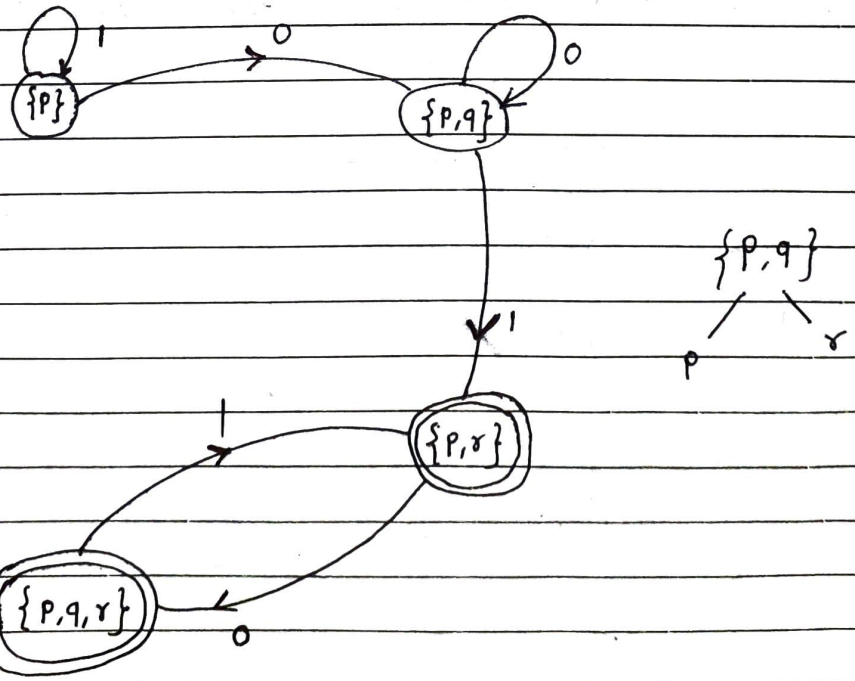
	0	1
→ {p}	{p,q}	{p}
{p,q}	{p,q}	{p,r}
{p,r}	{p,q,r}	{p,r}
{p,q,r}	{p,q,r}	{p,r}

So we found p another state which is reachable from p. so now consider that state p.

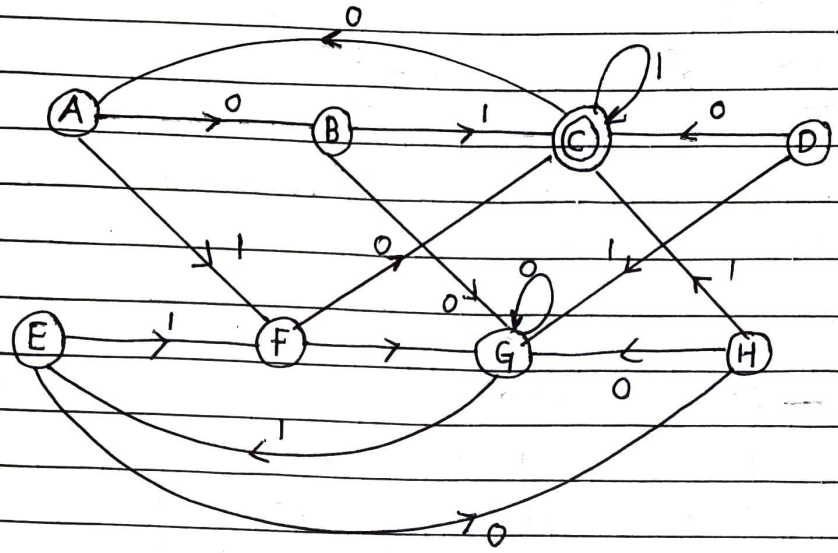
DFA is in {p,q}



Union = {p,q}



Q.4 Minimize the states of DFA.



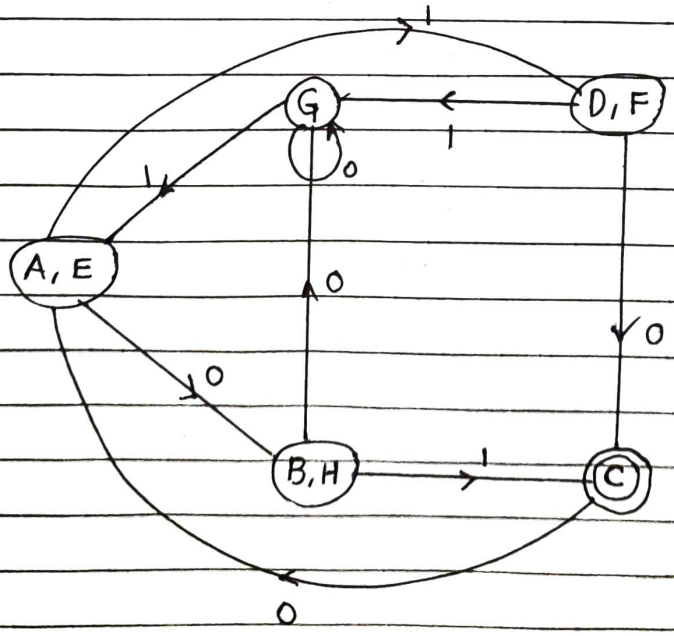
→

B	X							
C	X	X						
D	X	X	X					
E		X	X	X				
F	X	X	X		X			
G	X	X	X	X	X	X		
H	X		X	X	X	X	X	
	A	B	C	D	E	F	G	

→ Equivalent states (A, E)

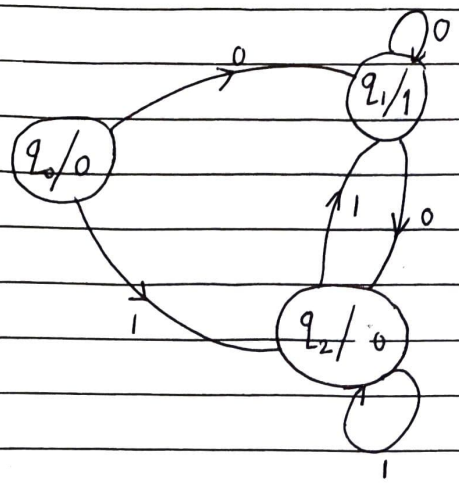
X - represents distinguishable states.

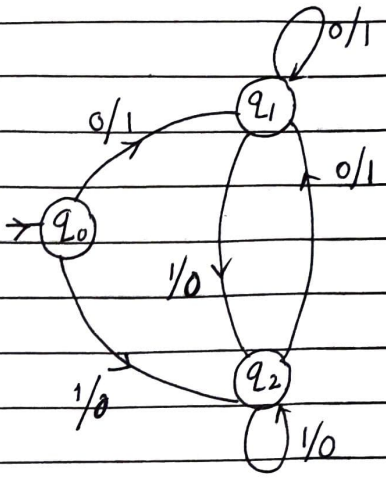
Q = {(A, E), (B, H), (D, F), C, G} ⇒ Equivalent states merge equivont state.



Q.5 Design a Moore & Mealy Machine to generate 1's complement of given binary number.

⇒





for instance

Take one binary number : 1011

Input :-

Input		1	0	1	1
state	q_0	q_2	q_1	q_2	q_2
output	0	0	1	0	0

Current state	Next state	Output
→ q_0	q_1	q_2	0
q_1	q_1	q_2	1
q_2	q_1	q_2	0