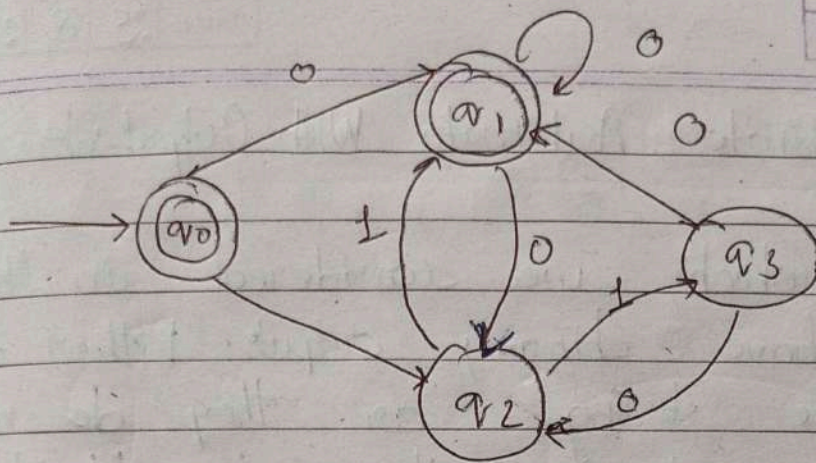
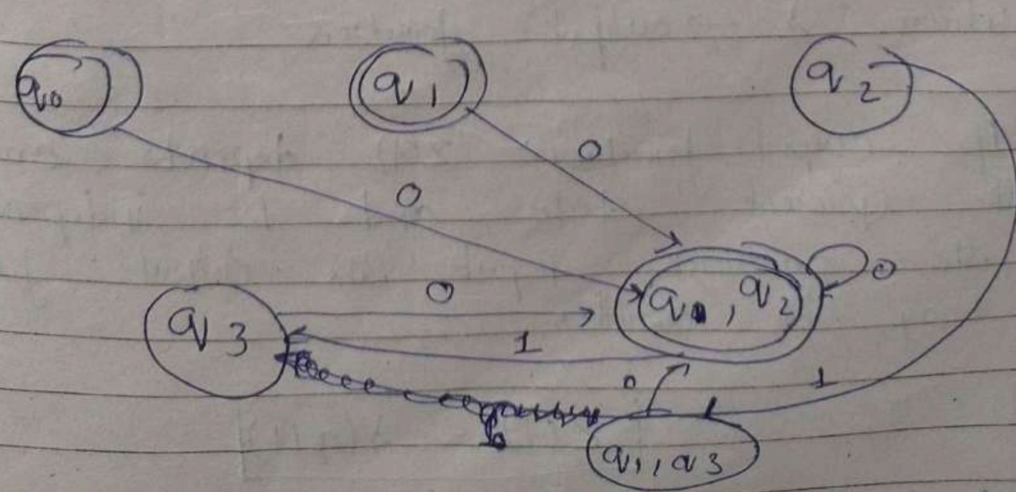
NFA with ε → without → DFA.



	0	1
q_0	q_1, q_2	–
q_1	q_1, q_2	–
q_2	ϕ	q_3, q_1
q_3	q_2, q_1	–

	0	1
$[q_0]$	$[q_1, q_2]$	–
$[q_1]$	$[q_1, q_2]$	–
$[q_2]$	ϕ	$[q_3, q_1]$
$[q_3]$	$[q_1, q_2]$	–
$[q_1, q_2]$	$[q_1, q_2]$	$[q_3]$
$[q_3, q_1]$	$[q_1, q_2]$	ϕ



Page No.			
Date:	25	8	21

Finite Automata With Output

The F.A which we considered in the earlier sections have binary outputs. Either they accept the string or they do not accept the string this acceptibility was decided on the basis of reachability of the final state by the initial state. Now we remove this restriction and consider the model where the output can be choosen from some other alphabets. The value of the output function $Z(t)$ in the most general case is a function of the present state $q(t)$. And the present input $x(t)$; That is -

present input

$$Z(t) = \lambda(q(t), x(t))$$

Pres. ste

If output depends on P.S and P.I called the "Mealey Machine"

where $\lambda \rightarrow$ output function

If output function $Z(t)$ depends only on the Present state and is independent of the current input the output function may be written as -

$$\boxed{Z(t) = \lambda(q(t))}$$

This model is called the "Moore Machine".

Page No.
Date:

Definition:- A Moarey Machine is a 6 tuple $(Q, \Sigma, \Delta, \delta, q_0, \lambda)$ where

$Q \rightarrow$ finite set of states.
$\Sigma \rightarrow$ finite set of input / Input Alphabet.
$\Delta \rightarrow$ Output Alphabet
$\delta \rightarrow$ Mapping Function / Transition state $(\Sigma \times Q)$
$q_0 \rightarrow$ initial state.
$\lambda \rightarrow$ Output function $(Q \times \Delta)$ / $(Q$ into $\Delta)$

Mealy Machine:- A Mealy machine is a 6 tuple $(Q, \Sigma, \Delta, \delta, \lambda, q_0)$ where, all the symbols except λ have same meaning as Moarey Machine.
$\lambda \rightarrow$ Output function $\Sigma \times Q$ into Δ

	Next state $a=0$	$a=1$	λ
$\rightarrow q_0$	q_3	q_1	0
q_1	q_1	q_2	1
q_2	q_2	q_3	0
q_3	q_3	q_0	0

Moarey Machine.

Input string 0111

Starting state (null state) $q_0 \rightarrow 0$ $q_1 \rightarrow 1$ ---

0111 $\quad q_0 \xrightarrow{0} q_3 \xrightarrow{1} q_0 \xrightarrow{1} q_1 \xrightarrow{1} q_2$.

$\quad$ 0 $\quad$ 0 $\quad$ 0 $\quad$ 1 $\quad$ 0

In input string length in Moorey Machine is n then output is 'n+1'.
For input string null →

$\lambda(q_0) \longrightarrow 0$

Mealy Machine →

	a = 0		a = 1	
	State	O/P	State	O/P
→ q_1	q_3	0	q_2	0
q_2	q_1	1	q_4	0
q_3	q_2	1	q_1	1
q_4	q_4	1	q_3	0

In. s → 0011

$$q_1 \xrightarrow{0} q_3 \xrightarrow{0} q_2 \xrightarrow{1} q_4 \xrightarrow{1} q_3$$

0 1 0 0

Input length (n) = Output length (n)
No output on null state.
or input null = output null.

$\lambda(q_1) = \wedge$

Procedure For Conversion of Mealy Machine To Moore :-

If not same output then split into two part.

q_2: q_{20} | q_{21}

q_4: q_{40} | q_{41}

		a = 0		a = 1		λ
1.	q_1	q_3	0 ×	q_{20}	0 ×	1
3.	q_3	q_{21}	1	q_1	1	0
2.[	q_{20}	q_1	1	q_{40}	0	0
	q_{21}	q_1	1	q_{40}	0	1
4[	q_{40}	q_{41}	1	q_3	0	0
	q_{41}	q_{41}	1	q_3	0	1
Add →	q_0	q_3 0		q_{20}		0

	a = 0	a = 1	λ
q_1	q_3	q_{20}	1
q_{20}	q_1	q_{40}	0
q_{21}	q_1	q_{40}	1
q_3	q_{21}	q_1	0
q_{40}	q_{41}	q_3	0
q_{41}	q_{41}	q_3	1

For null then it's not working right —

1) Should not consider null

Here we observe that is associated with output '1' with input null we get an output of '1' if machine starts at state q_1 so this Moarey machine a zero length sequence which is not accepted by the mealy machine to overcome the situation 1) either we must neglect the response of Moarey Machine'

2) we must add new starting state q_0 whose state transition are identical with those of q_1 but whose output is 0.

Procedure To convert Moarey To Mealy:-

	$a=0$	$a=1$	λ
$\rightarrow q_0$	q_3	q_1	0
q_1	q_1	q_2	1
q_2	q_2	q_3	0
q_3	q_3	q_0	0

	$a=0$		$a=1$	
	State	O/P	State	O/P
$\rightarrow q_0$	q_3	0	q_1	1
q_1	q_1	1	q_2	0
q_2	q_2	0	q_3	0
q_3	q_3	0	q_0	0

Consider the Moorey Machine describe by the Transition Table construct the corresponding Mealy Machine :-

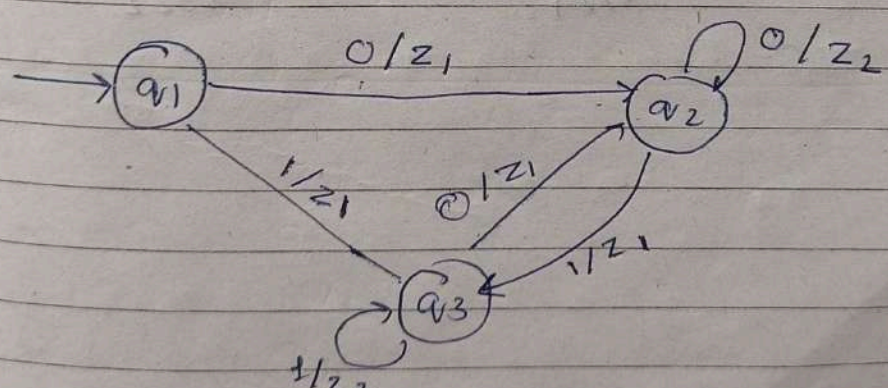
	a=0	a=1	λ
→ q_1	q_1	q_2	0
q_2	q_1	q_3	0
q_3	q_1	q_3	1

	q=0		a=1	
State	S	O/P	S	O/P
q_1	q_1	0	q_2	0
q_2	q_1	0	q_3	1
q_3	q_1	0	q_3	1

q_2

The row which is Identical can be removed

Mealy To Moorey :-



	a=0		a=1	
	State	O/P	State	O/P
q_1	q_2	(z_1)	q_3	z_1
q_2	q_2	(z_2)	q_3	z_1
q_3	q_2	(z_1)	q_3	z_2

λ

$q_2 \rightarrow z_1$ $q_3 \rightarrow z_1$

$q_2 \rightarrow z_2$ $q_3 \rightarrow z_2$.

Moarey :-

	$a=0$		$a=1$		λ
q_1	q_{2z_1}	z_1	q_{3z_1}	z_1	Null
q_{2z_1}	q_{2z_2}	z_2	q_{3z_1}	z_1	z_1
q_{2z_2}	q_{2z_2}	z_2	q_{3z_1}	z_1	z_2
q_{3z_1}	q_{2z_1}	z_1	q_{3z_2}	z_2	z_1
q_{3z_2}	q_{2z_1}	z_1	q_{3z_2}	z_2	z_2

	$a=0$	$a=1$	λ
q_1	q_{2z_1}	q_{3z_1}	Null
q_{2z_1}	q_{2z_2}	q_{3z_1}	z_1
q_{2z_2}	q_{2z_2}	q_{3z_1}	z_2
q_{3z_1}	q_{2z_1}	q_{3z_2}	z_1
q_{3z_2}	q_{2z_1}	q_{3z_2}	z_2

Page No. | Date: 27 8 21.

Minimization Of Finite Automata :-

Definition:- Two states q_1 and q_2 are equivalent (denoted by $q_1 = q_2$) if both $\delta(q_1, x)$ and $\delta(q_2, x)$ are final states or both of them are non-final states $(\forall x \in \Sigma^*)$.

Properties.

Procedure:-

State	0	1
$\rightarrow q_0$	q_1	q_5
q_1	q_6	q_2
q_2	q_0	q_2
q_3	q_2	q_6
q_4	q_7	q_5
q_5	q_2	q_6
q_6	q_6	q_4
q_7	q_6	q_2

I. First divide states in two parts. First of all find $\pi_0 = \{Q_1^0, Q_2^0\}$

$Q_1^0 \rightarrow$ set of final states.

$Q_2^0 \rightarrow$ set $Q^0 - Q_1^0 \longrightarrow$ Final states.

$Q^0 \rightarrow$ Total states

Zero equivalent, One equivalent π_1 then π_2 then π_3 ---- $\pi_n = \pi_{n+1}$

Page No.
Date:

$$\Pi_0 = \{\{q_2\}, \{q_0, q_1, q_3, q_4, q_5, q_6, q_7\}\}$$

$\Pi_1 = \{$

Check another list the check in question given if all input in same set then fine otherwise not fine.

$= \{q_0, q_4\} \rightarrow 1$ equivalent $\{q_0, q_6\} \rightarrow 1$ equi.

$Q_1' = \{q_0, q_4, q_6\}$.

$Q_2' = \{q_1, q_7\} \longrightarrow$ with same set.

$Q_3' = \{q_3, q_5\}$.

$$\Pi_1 = \{\{q_2\}, \{q_0, q_4, q_6\}, \{q_1, q_7\}, \{q_3, q_5\}\}$$

(Π_2). $Q_1'' = \{q_0, q_4\}$

$$\Pi_2 = \{\{q_2\}, \{q_0, q_4\}, \{q_6\}, \{q_1, q_7\}, \{q_3, q_5\}\}$$

1 2 3 4 5

$$\Pi_3 = \{\{q_2\}, \{q_0, q_4\}, \{q_6\}, \{q_1, q_7\}, \{q_3, q_5\}\}.$$

$$\Pi_2 = \Pi_{2+1}$$

Minimized states = q_2

q_0, q_4

q_6

q_1, q_7

q_3, q_5

States	0	1
$[q_0, q_4]$	$\{q_1, q_7\}$ $\{q_3, q_5\}$	
$[q_1, q_7]$	$\{q_6\}$.	q_2
$\{q_2\}$	$\{q_0, q_4\}$	$\{q_2\}$
$\{q_3, q_5\}$	$[q_2]$	$[q_6]$
$[q$	$[q_6]$	$[q_0, q_4]$

State	0	1
$\rightarrow q_0$	$\rightarrow q_1$	q_0
q_1	q_0	q_2
q_2	q_3	q_1
q_3	q_3	q_0
q_4	q_3	q_5
q_5	q_6	q_4
q_6	$\rightarrow q_5$	q_6
q_7	q_6	q_3

$\pi_0 = \{\{q_3\}, \{q_0, q_1, q_2, q_4, q_5, q_6, q_7\}$.

π_p $Q_1' = \{q_0, q_1, q_5, q_6\}$

$Q_2' = \{q_2, q_4\}$

$Q_3' = \{q_7\}$.

$\pi_1 = \{\{q_3\}, \{q_0, q_1, q_5, q_6\}, \{q_2, q_4\} \{q_7\}\}$.

$\pi_2 = \{\{q_3\} \{q_7\}, \{q_0, q_6\} \{q_1, q_5\}, \{q_2, q_4\} \{q_7\}\}$.

$\pi_3 = \{\{q_3\} \{q_7\} \{q_0, q_6\} \{q_1, q_5\} \{q_2, q_4\} \{q_7\}\}$

0

State		
	$[q_1, q_5]$	$[q_0, q_6]$
$[q_0, q_6]$	$[q_0, q_6]$	$[q_2, q_4]$
$[q_1, q_5]$	$[q_3]$	$[q_1, q_5]$
$[q_2, q_4]$	$[q_3]$	$[q_0, q_6]$
$[q_3]$	$[q_0, q_6]$	$[q_3]$.
$[q_7]$		

$(a+b+c)(a+b+c)(a+b+c)$