Theory of computation

Paper code :- CC-12

unit :- 2

Moore & Mealy Machine

Automata with output

Moore Machine :- E. F Moore in 1956.

Definition :- Mathematically Moore machine is a six-tuple machine and defined as

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

Q = A nonempty finite set of state in M_o.

Σ = A nonempty finite set of input symbol.

Δ = A nonempty finite set of outputs.

δ = It is transition function which takes two arguments as in finite automata, one is input state and another input symbol. The output of this function is a single state, so clearly δ is the function which is responsible for the transitions in M_o.

q_0 = is the initial state of M_o and $q_0 \in Q$.

λ' = is a mapping function which maps Q to Δ, giving the output associated with each state.

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* In Moore machine, it's output depends only on present state.

Representation of Moore Machine.

Moore machine can be represented by transition table as well as transition diagram.

Present State	Next State at input a = 0	Next State at input a = 1	output
→ 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

$\therefore M_0 = \{ Q, \Sigma, \Delta, \delta, \lambda', q_0 \}$

where

$Q = \{ q_0, q_1, q_2, q_3 \}$

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

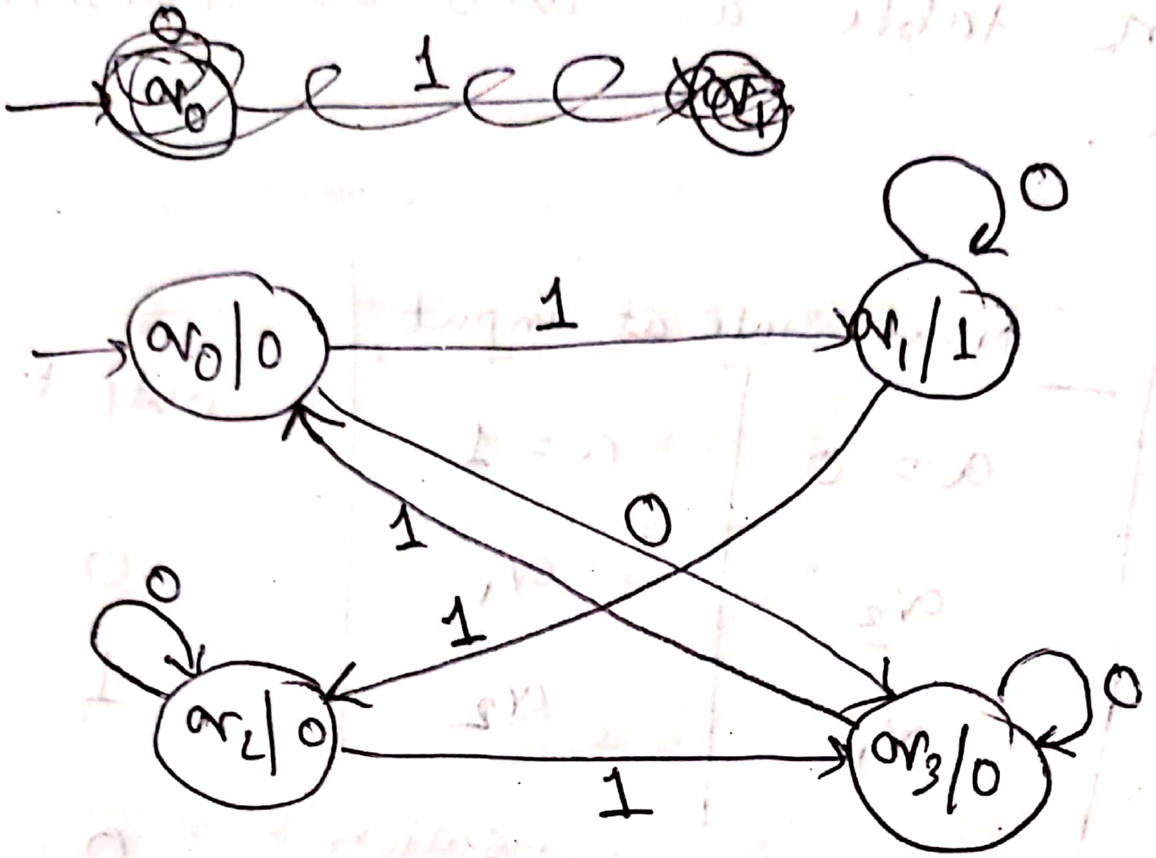
$\Delta = \{ 0, 1 \}$

$\lambda'(q_0) = 0, \quad \lambda'(q_1) = 1$

$\lambda'(q_2) = 0, \quad \lambda'(q_3) = 0$

q_0 is the initial state.

we can also viewed it by transition diagram as,



By the analysing moore machine transition diagram, we can easily noticed that it is FA without any final state and output is there for every corresponding state. output of for every state is written just above the corresponding state.

MEALY MACHINE (G. H. Mealy, 1955)

In Mealy machine every transition for a particular input symbol has a fix output.

Mathematically Mealy machine is a six tupple.

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

in Moore machine, in mapping function which maps Q to Δ.

but in Mealy machine, λ' maps

$Q \times \Sigma \rightarrow \Delta$.

Representation of Mealy machine.

Present state	For input a=0		For input a=1	
	state	output	State	output
$\rightarrow q_1$	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

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

$Q = (q_1, q_2, q_3, q_4)$

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

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

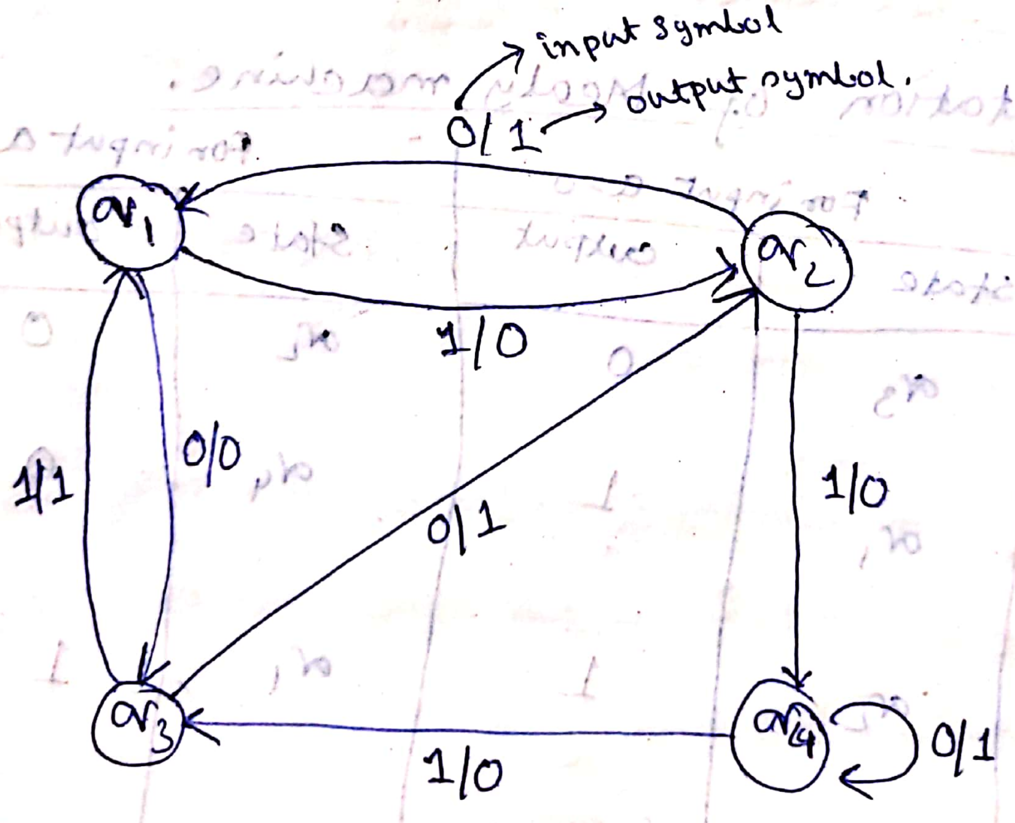
q_0 is initial state and δ is transition function.

$\lambda'(q_1, 0) = 0$ $\quad$ $\lambda'(q_1, 1) = 0$

$\lambda'(q_2, 0) = 1$ $\quad$ $\lambda'(q_2, 1) = 0$

$\lambda'(q_3, 0) = 1$ $\quad$ $\lambda'(q_3, 1) = 1$

$\lambda'(q_4, 0) = 1$ $\quad$ $\lambda'(q_4, 1) = 0$



Differentiate Between Moore and Mealy Machine :-

Moore	Melay
1) it's output depends only on present State	1) it's output depends on the transition (input) and present state.
2) if input string is of length n, the output string is of length n+1.	2) It input String is of length n then the output string is of length n.
3) At the different input on the same state it's output is same.	3) At the different input on the same state, it's output is also different