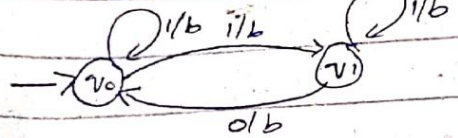
Topic: Moore & Mealy Machine

Q- What is difference b/w Moore and Melay machine?

Meelay	Moore
o In meelay machine the output is depend on the present state as well as the present input state.	o it is FSM whose output depends only on the present state.
o Mealy machine places its output on the transition.	o moore machine also places its output on the transition
o Input string is of length n and output is also of length n.	o Input string is of length n, and output string of length n+1
o $\lambda : Q \times \Sigma \rightarrow \Delta$	o $\lambda : Q \rightarrow \Delta$
o O/p is asynchronous.	o O/p is synchronous with clock.

o it require more states	o it require less states.
o Fastest	• predictable
o Requires very little hardware.	o Require more hardware.
o Ex: 	o Ex: 

Note:

- Mealy and moore machines are Finite automata with output.
- There is no acceptance and rejection Criteria.
- There is no final state.

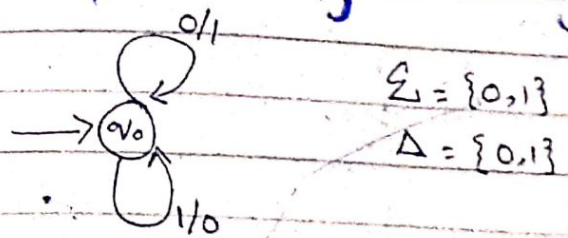
Definition:

Moore Machine:

- A moore machine is a collection of five (or six) things:

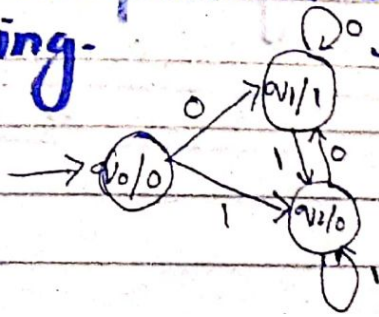
Q: A finite set of states.
v_0: An initial state
Σ: An alphabet of letters forming the input string.
∴ $\Sigma = \{a, b, c, \ldots\}$
λ: An output function
$\lambda: Q \rightarrow \Delta$
Δ: An output symbols.

Q. Design a Mealy machine for complement of binary string.



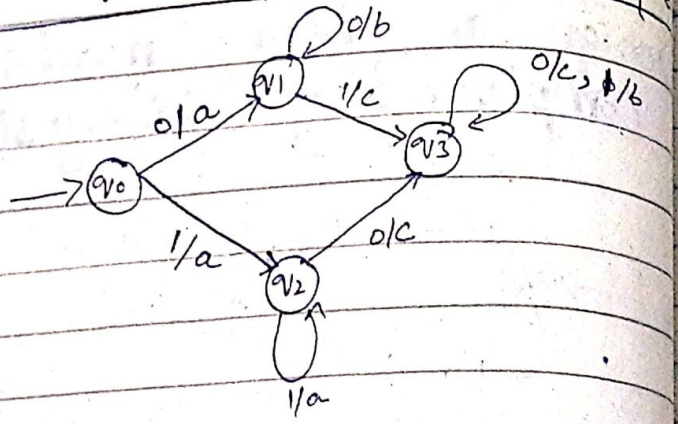
$\Sigma = \{0, 1\}$
$\Delta = \{0, 1\}$

Q. Design a Moore machine for complement of binary string.



Design a ... machine from given transition table

Present state	Next state, Input = 0		Next state, Input = 1	
	State	o/p	State	o/p
v_0	v_1	a	v_2	a
v_1	v_1	b	v_3	c
v_2	v_3	c	v_2	a
v_3	v_3	c	v_3	b



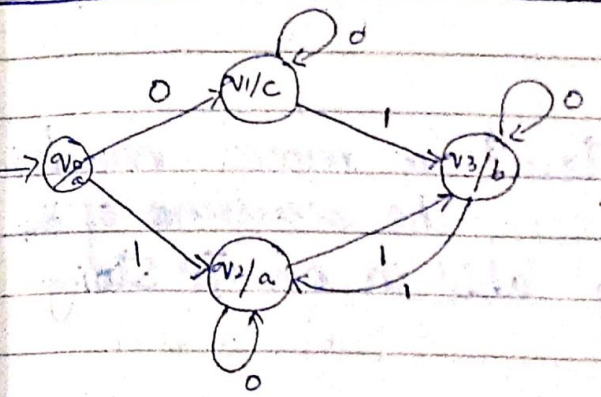
find the output of a Str... "011011" by ... given machine

String = 0 1 1 0 1 1

o/p = a c b c b b

Design a moore machine from given transition table.

Present state	Next states, Input = 0	Input = 1	o/p
v_0	v_1	v_2	a
v_1	v_1	v_3	c
v_2	v_2	v_3	a
v_3	v_3	v_2	b



Find the output of "101100" by given moore machine.

String = 1 0 1 1 0 0

output = a a a b a a a

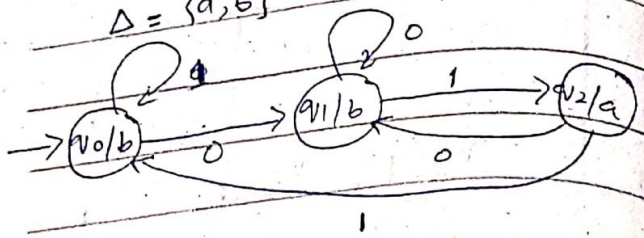
current state of machine

output of moore machine is always = n+1

Construct moore machine points 'a' whenever '01' encounter in any binary

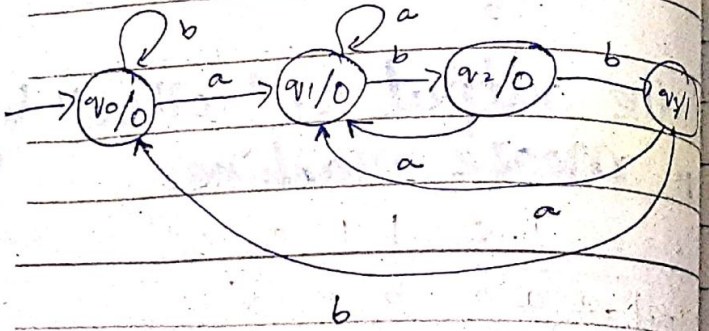
$\Sigma = \{0,1\}$

$\Delta = \{a,b\}$



Construct a moore mach that count the occurrence of the string 'abb' in an i/p string.

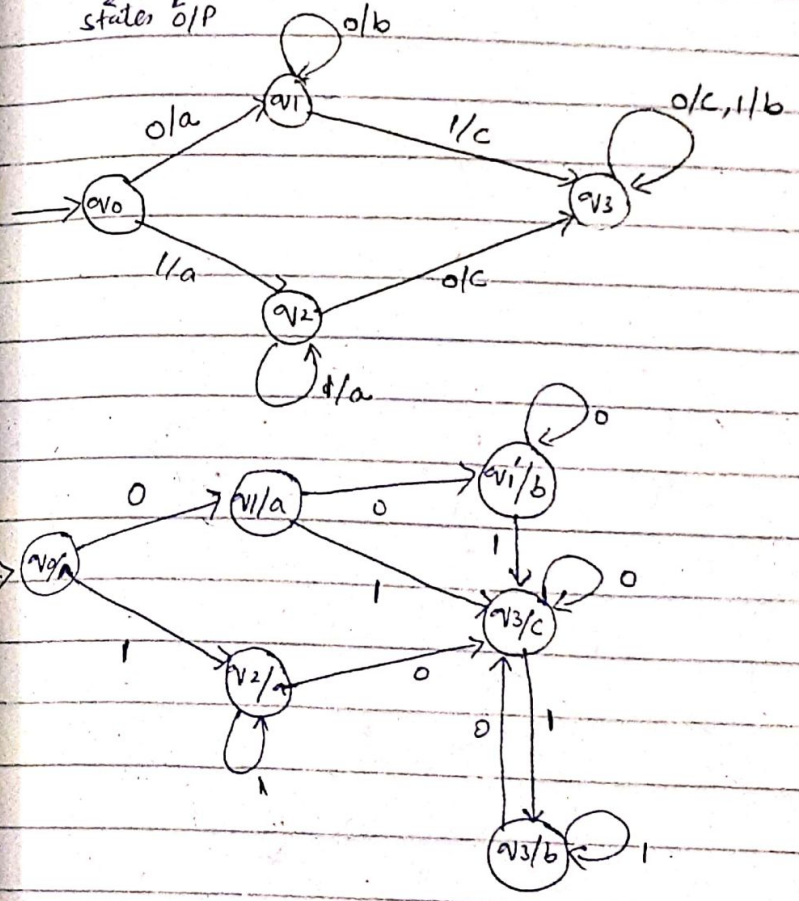
$\Sigma = \{a,b\}$, $\Delta = \{0,1\}$



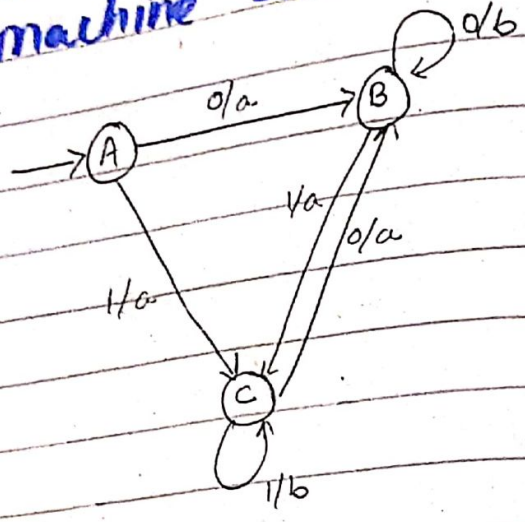
Conversion from Mealy to Moore Machine.

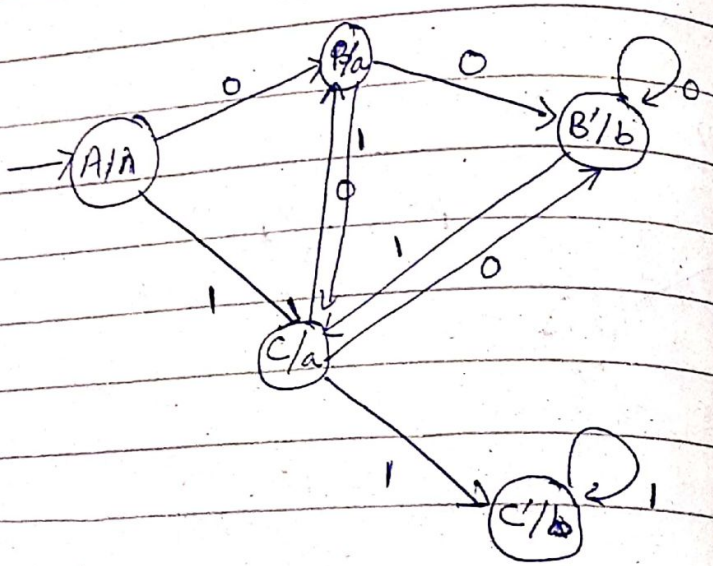
Mealy to moore Conversion there are m x n states.

(m = states, n = o/p)

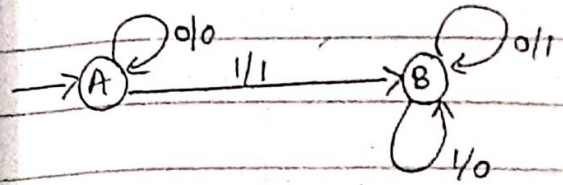


1 Convert the following mea machine to moore mach

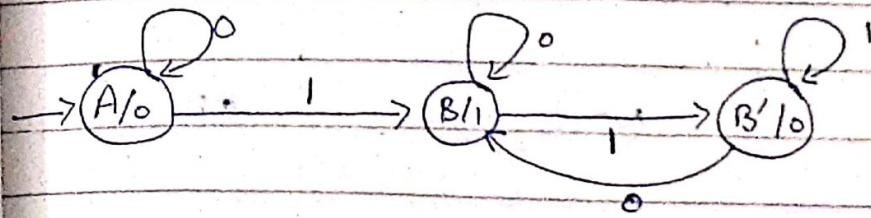




Convert the given mealy machine that gives 2's complement of any binary input to its equivalent moore machine.



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



e.g 1 0 1 0 0

1's C 0 1 0 1 1

+1

0 1 1 0 0

Conversion mealy to moore (using transition table).

State	Next state a	Next state b
→ q_0	$q_3, 0$	$q_1, 1$
q_1	$q_0, 1$	$q_3, 0$
q_2	$q_2, 1$	$q_2, 0$
q_3	$q_1, 0$	$q_0, 1$

Moore machine

Present state	Next state I/P = a	Next state Input = b	O/P
q_0	q_3	q_{11}	1
q_{10}	q_0	q_3	0
q_{11}	q_0	q_3	1
q_{20}	q_{21}	q_{20}	0
q_{21}	q_{21}	q_{20}	1
q_3	q_{10}	q_0	0

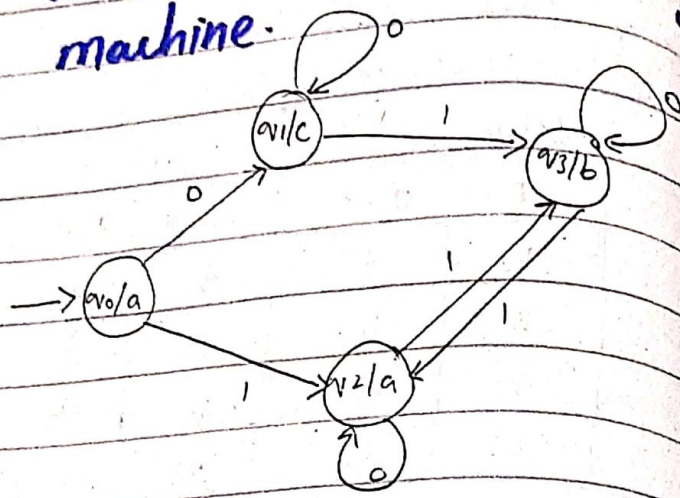
Ex: 2

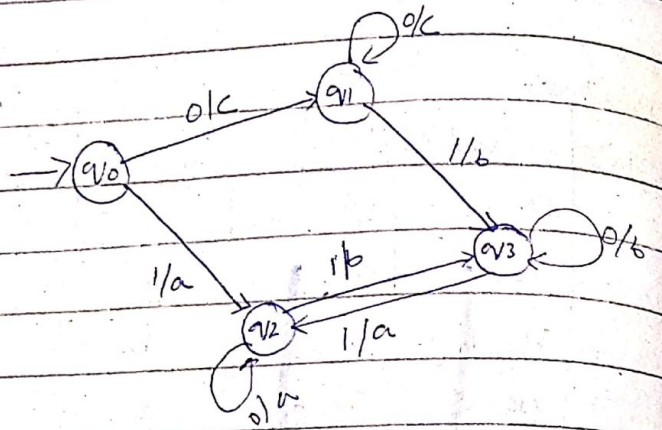
Present state	Next state Input = 0 State	Next state Input = 0 O/P	Next state Input = 1 State	Next state Input = 1 O/P
q_0	q_0	a	q_2	a
q_1	q_1	b	q_3	c
q_2	q_3	c	q_2	a
q_3	q_3	c	q_3	b

Moore Machine

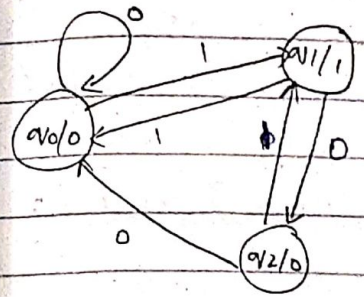
Present state	Next state I/P = 0	Next state I/P = 1	O/P
q_0	q_0,	q_2,	a
q_1	q_1,	q_3,	b
q_2	q_{30},	q_2, a	a
q_{30}	q_{30},	q_{31},	c
q_{31}	q_{30},	q_{31},	b

Moore machine to Mealy machine.





Construct a transition table of given moore machine and convert it into transition table of mealy machine.



Transition table of moore machine

Present state	Next state		o/p
	I/P=0	I/P=1	
q_0	q_0	q_1	0
q_1	q_2	q_0	1
q_2	q_0	q_1	0

Mealy table

PS	I/P=0		I/P=1	
	state	o/p	state	o/p
q_0	q_0	0	q_1	1
q_1	q_2	0	q_0	0
q_2	q_0	0	q_1	1

Both moore and mealy machine are special case of DFA.
Both acts like o/p procducers rather than language acceptors.
No need to define the final states
No concepts of dead states
Mealy & moore are equivalent in power.

Rules for mealy to moore Conversion:-

Input: Mealy machine
O/P: Moore machine

Step1: Calculate the number of different outputs for each state (Q_i).

Step2: if all the outputs of Q_i are same, copy state Q_i. if it has n distinct o/p, break Q_i into n states as Q_{in} where $n = 0, 1, 2, \ldots$.

Step3: if the output of the initial state is 1, insert a new initial state at the beginning which gives o output.