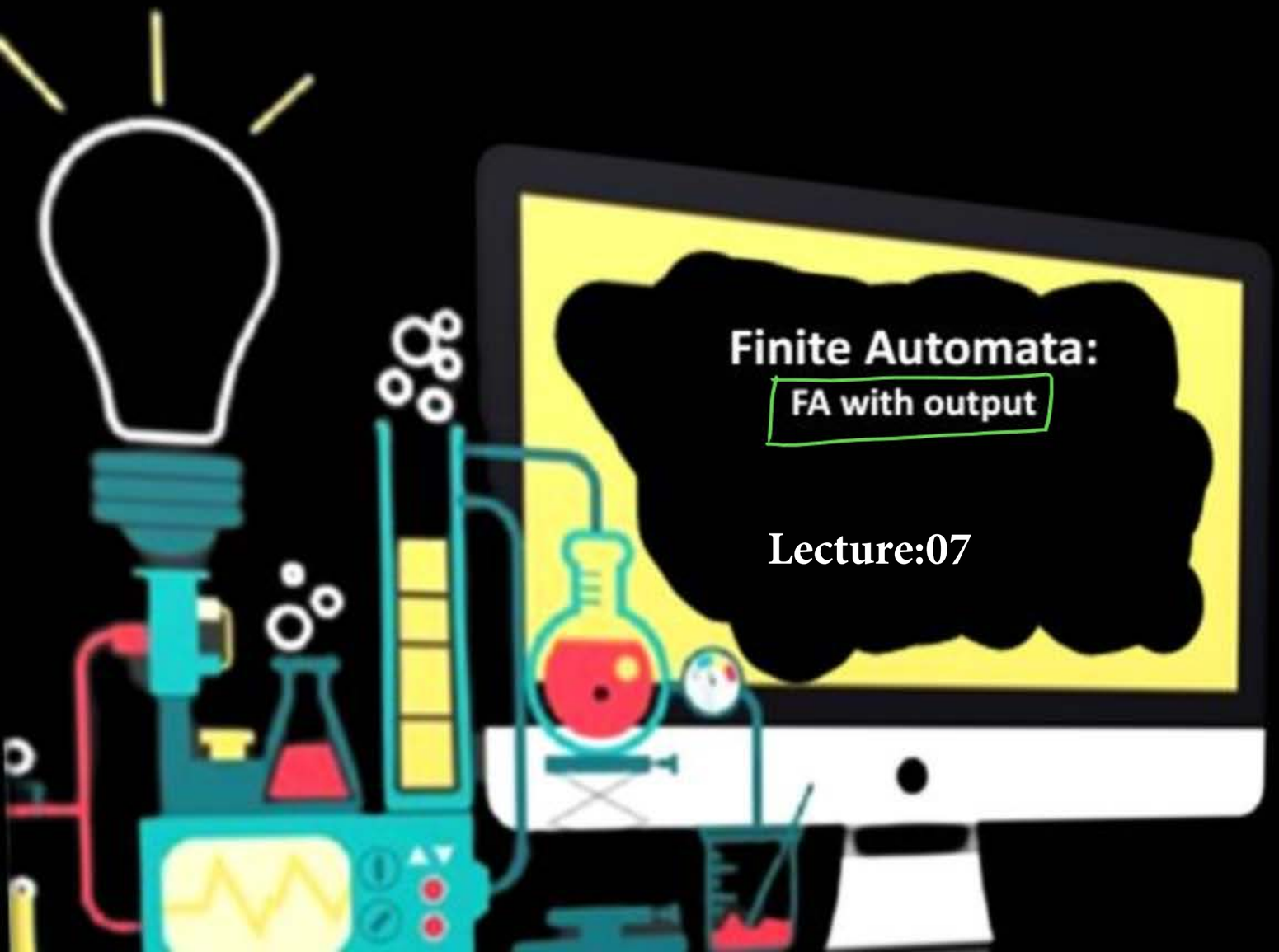
CS & IT Engineering



Finite Automata:
FA with output

Lecture:07

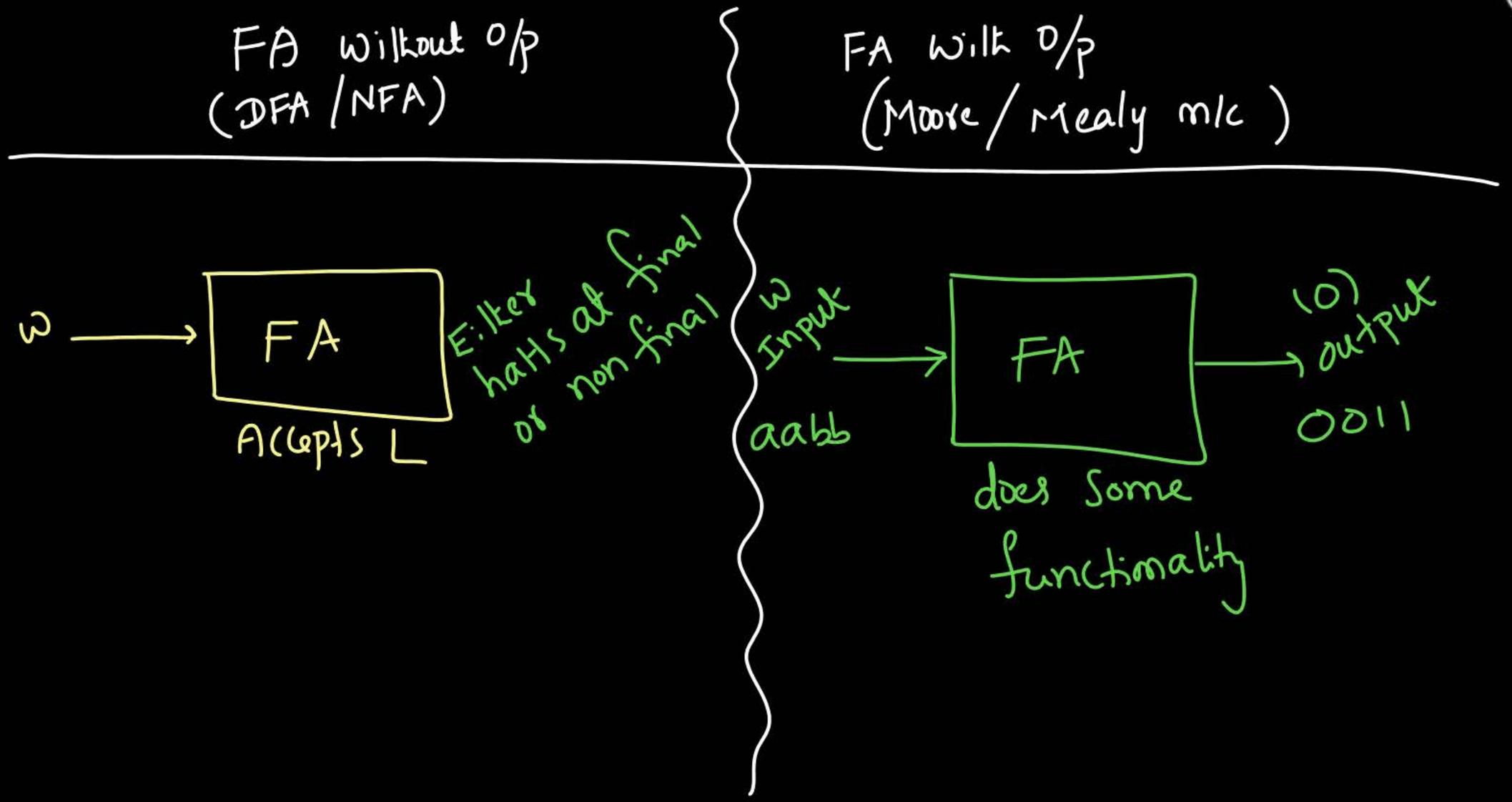
Deva sir

Previous Class Summary:

- practice session on FA/Reg Exp
  - GATE Questions

Topics to be covered Today:

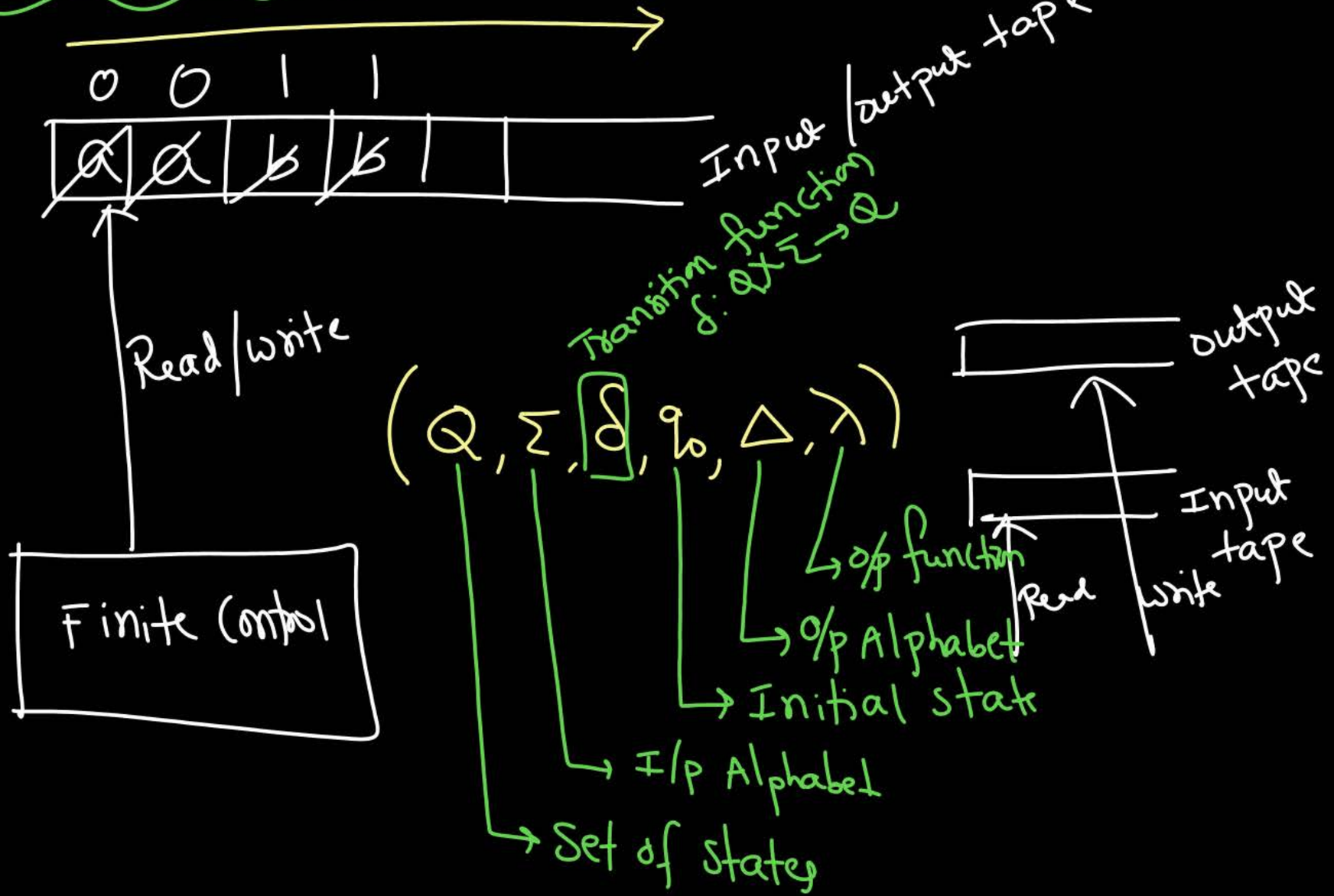
- FA with o/p Vs FA without o/p
- FA with o/p
- Construction of Moore m/c Mealy m/c


FA without o/p
(DFA / NFA)
FA with o/p
(Moore / Mealy m/c)
w
FA
Accepts L
Either halts at final or non final
w Input
aabb
FA
(0) output
0011
does some functionality

Configuration of FA with O/p :

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

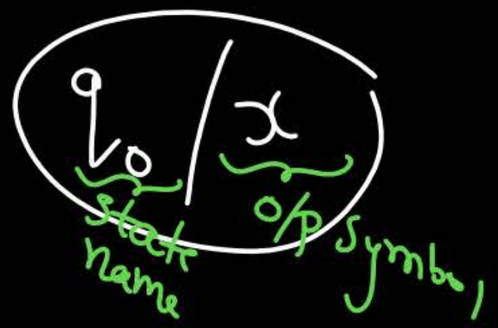
$\Sigma = \{a, b\}$



Moore M/C

$\lambda : Q \rightarrow \Delta$

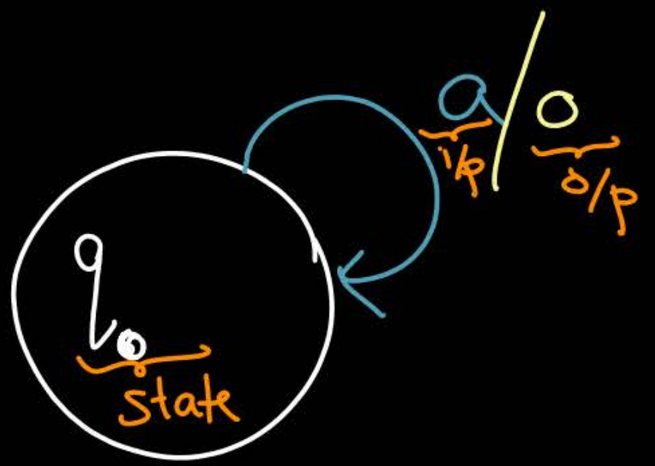
o/p is associated with state



Mealy M/C

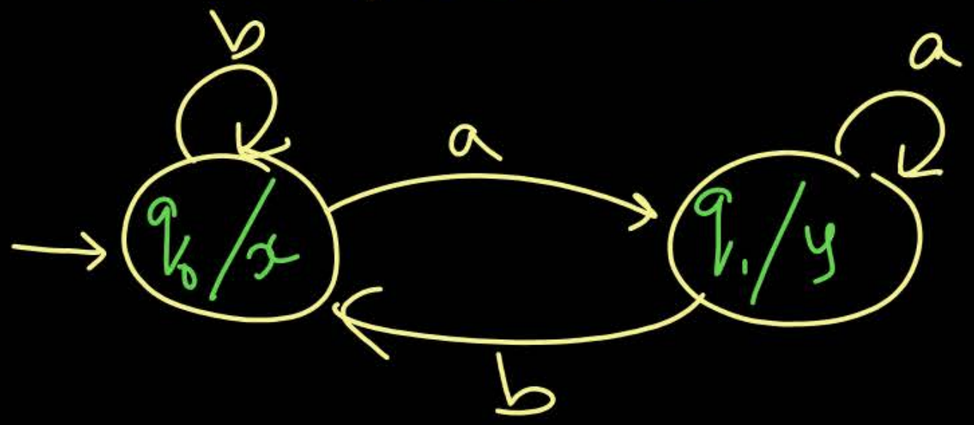
$\lambda : \underbrace{Q \times \Sigma}_{\text{transition}} \rightarrow \Delta$

o/p is associated with transition.



FA with Output

Moore m/c



I/p: a a b

$q_0 \xrightarrow{a} q_1 \xrightarrow{a} q_1 \xrightarrow{b} q_0$

x y y x

ignored

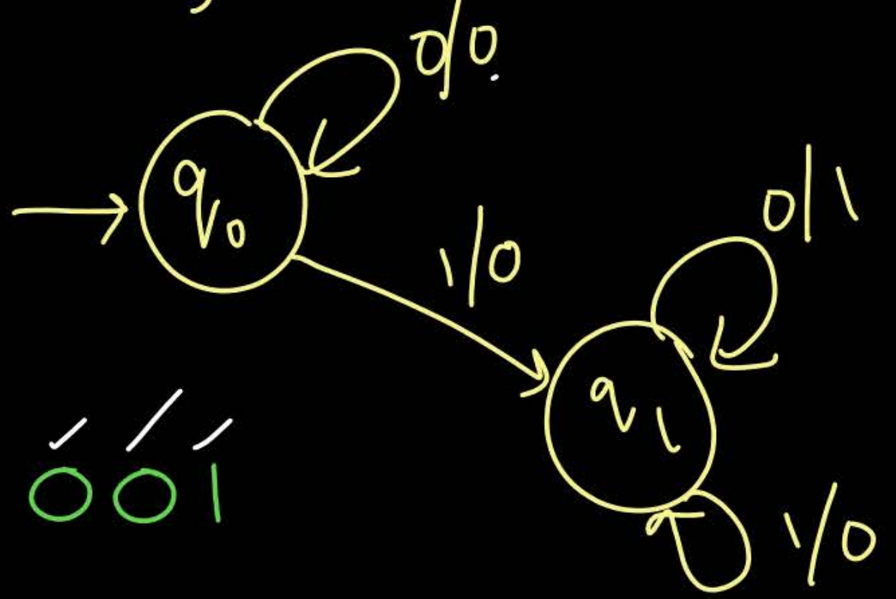
O/p: x y y x

q_0/x

q_0, x

q_0 x

Mealy m/c



I/p 0 0 0 1

$q_0 \xrightarrow{0} q_0 \xrightarrow{0} q_0 \xrightarrow{0} q_1$

0 0 0

O/p: 0 0 0

Moore M/c

I) If For every i/p, one o/p symbol produced then

For n length i/p ⇒ o/p length = n+1

II) If every i/p symbol produces 2 o/p symbols then

For n length i/p ⇒ o/p length = 2(n+1) = 2n+2

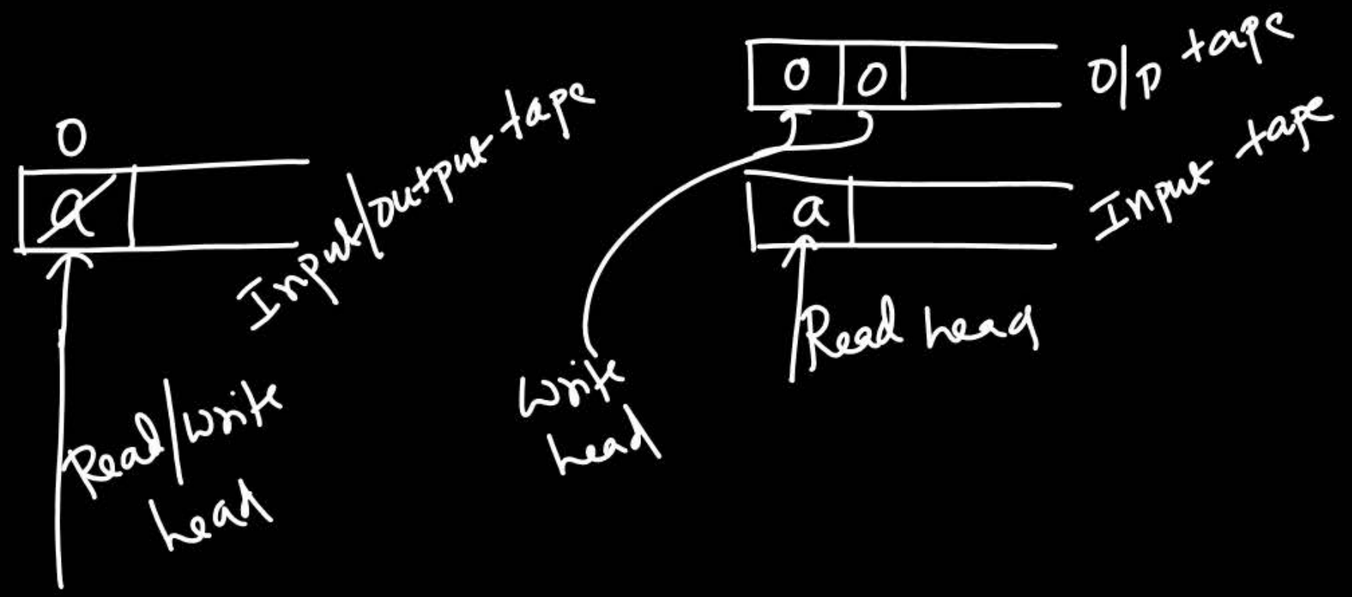
Mealy M/c

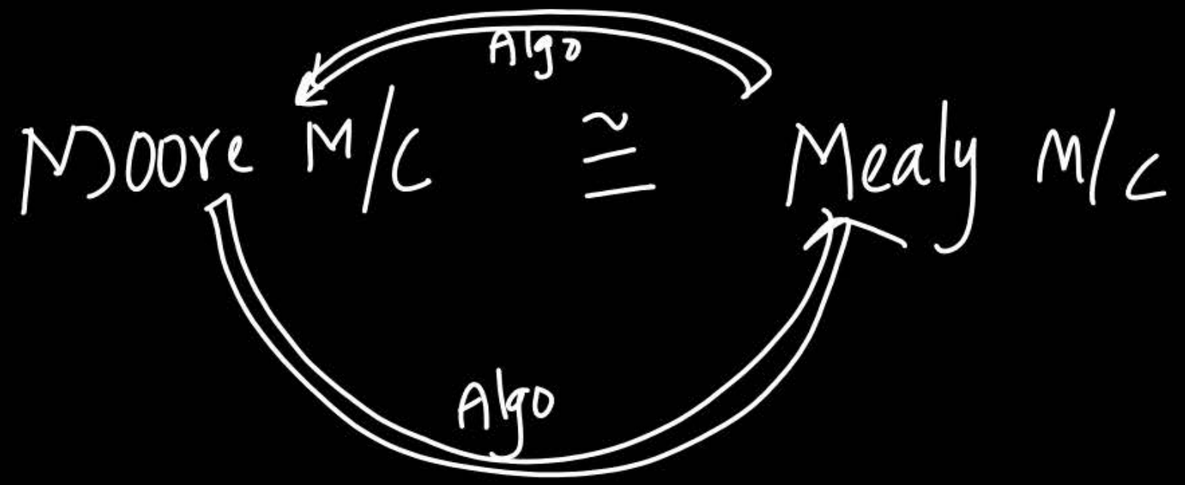
I)

For n length i/p ⇒ o/p length = n

For n length i/p ⇒ o/p length = 2n

FA with Output





$\delta: Q \times \Sigma \to Q$

It is same for both

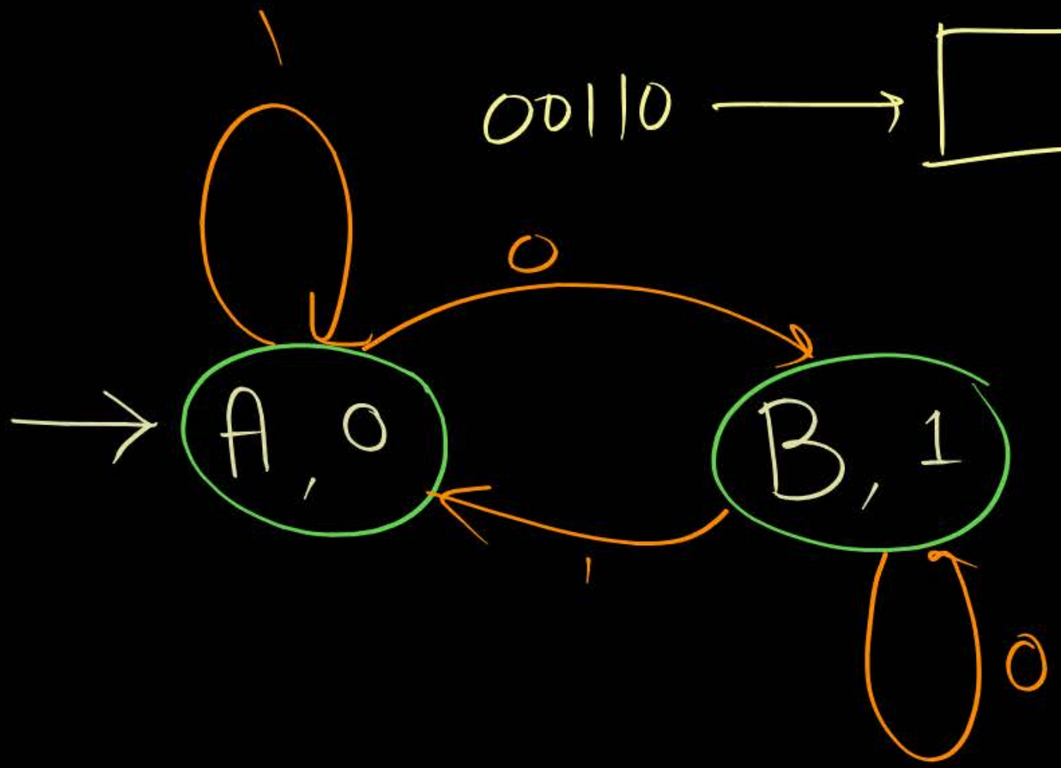
Both Moore & Mealy m/cs are DFAs by default

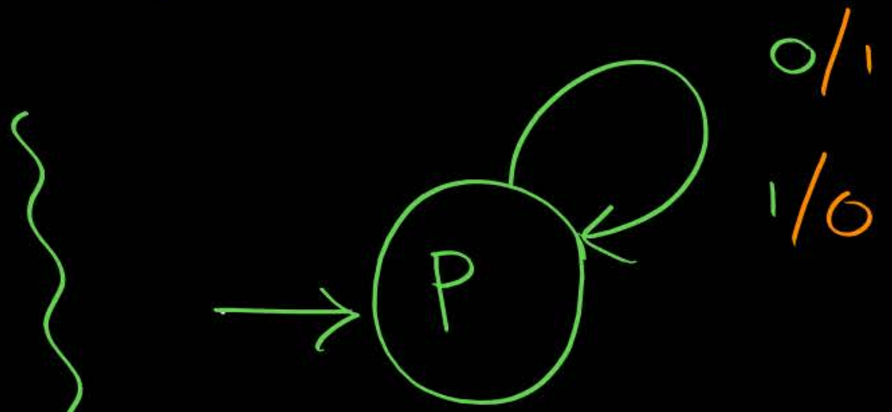
Construction:

① one's complement of binary input.

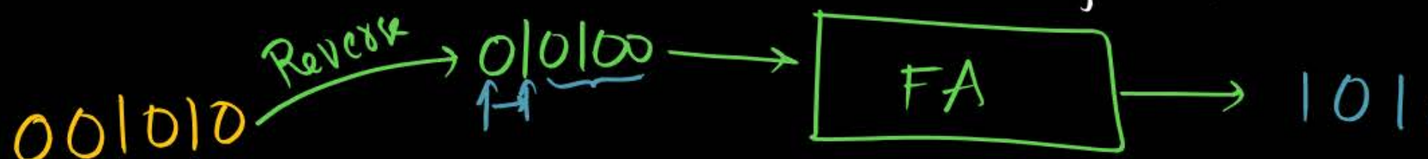
$\Sigma = \{0, 1\}$ $\Delta = \{0, 1\}$

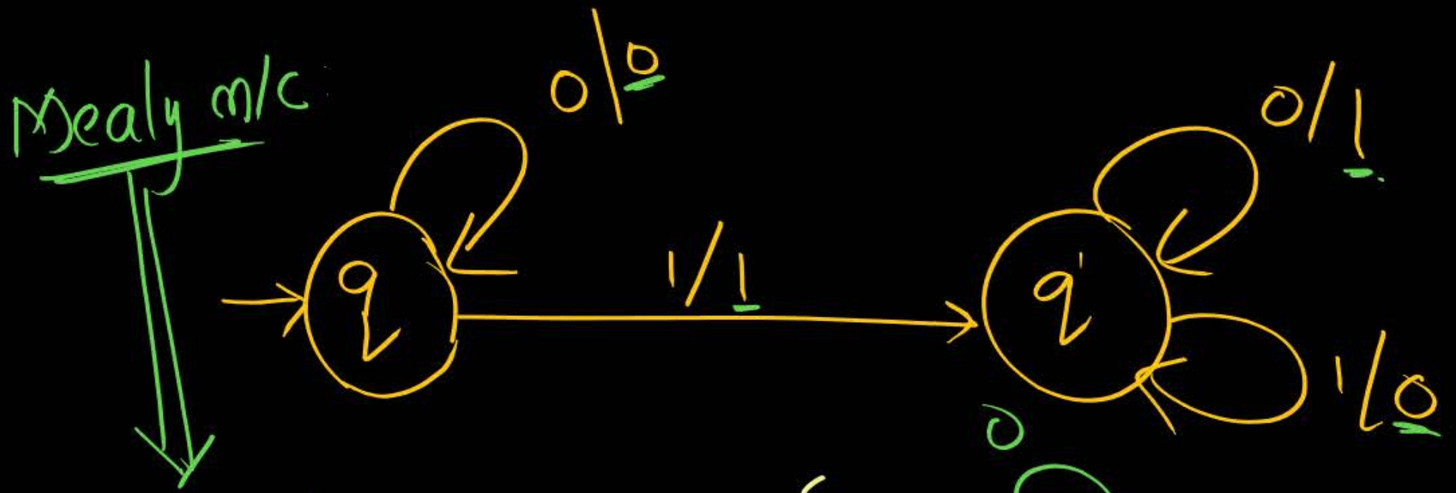
00110 → FA → 11001

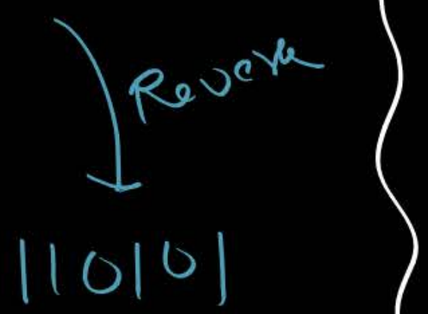


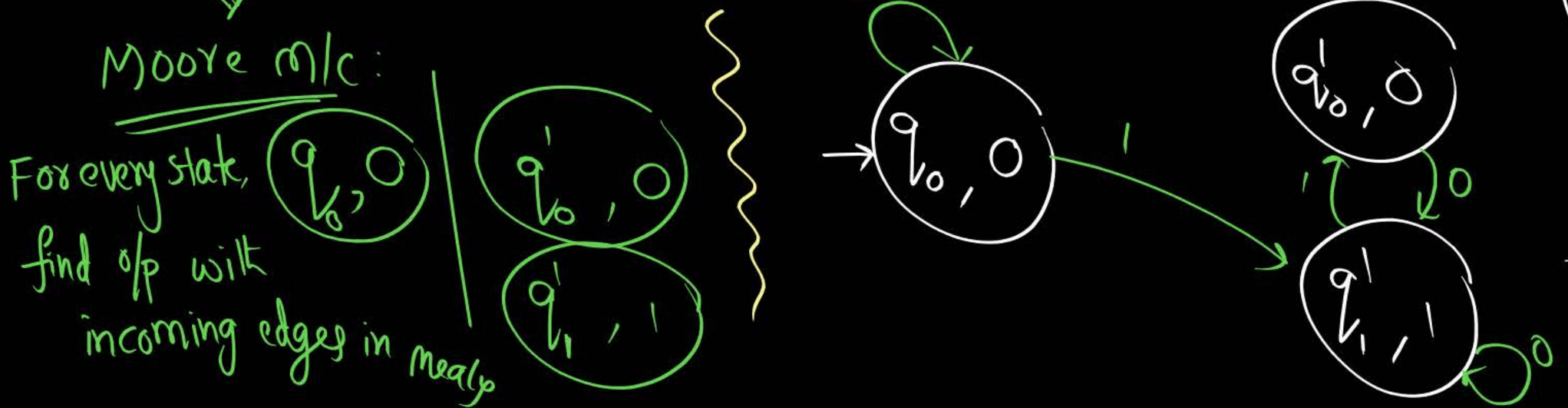


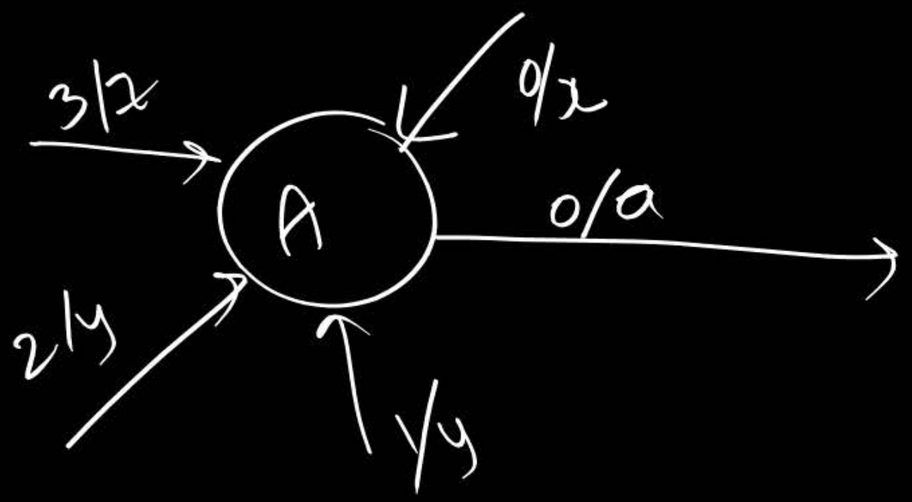
② 2's complement of binary input











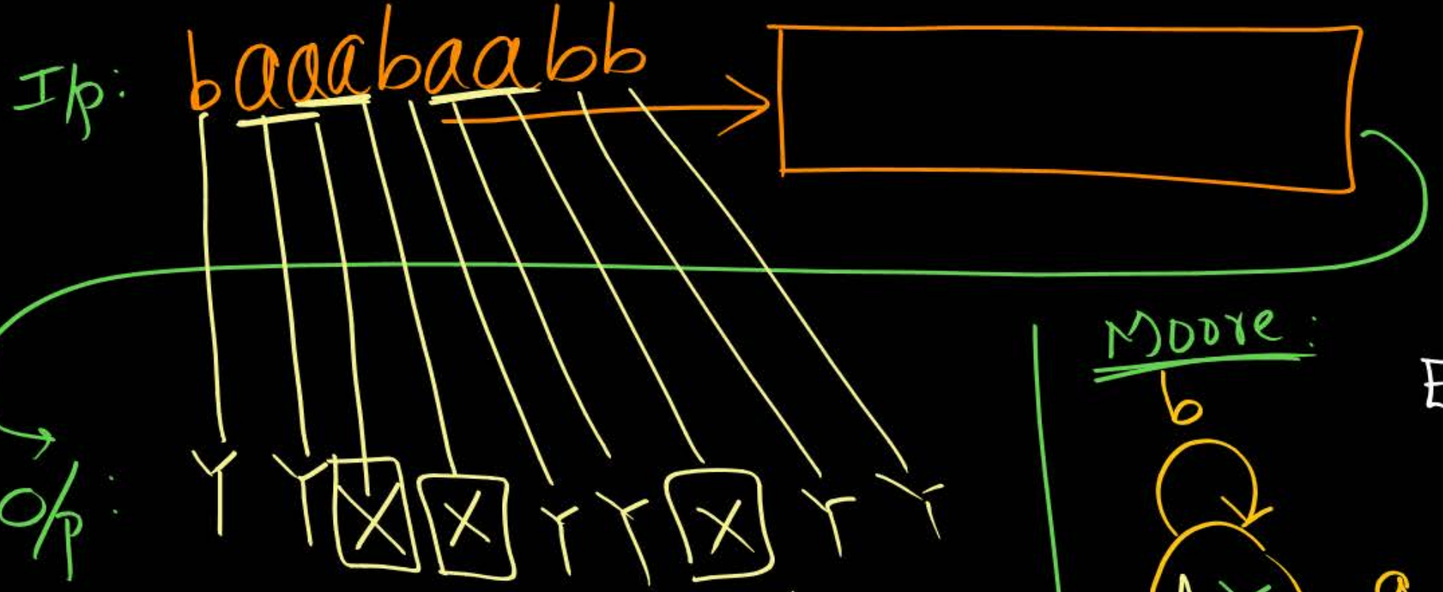
A_x, x

A_y, y

A_z, z

③ count no. of occurrences of "aa" in given input over $\Sigma = \{a, b\}$

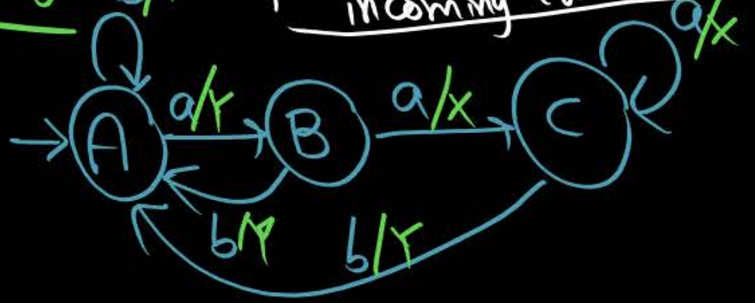
If aa ⇒ produce X
Otherwise produce Y



Send o/p to all incoming transitions

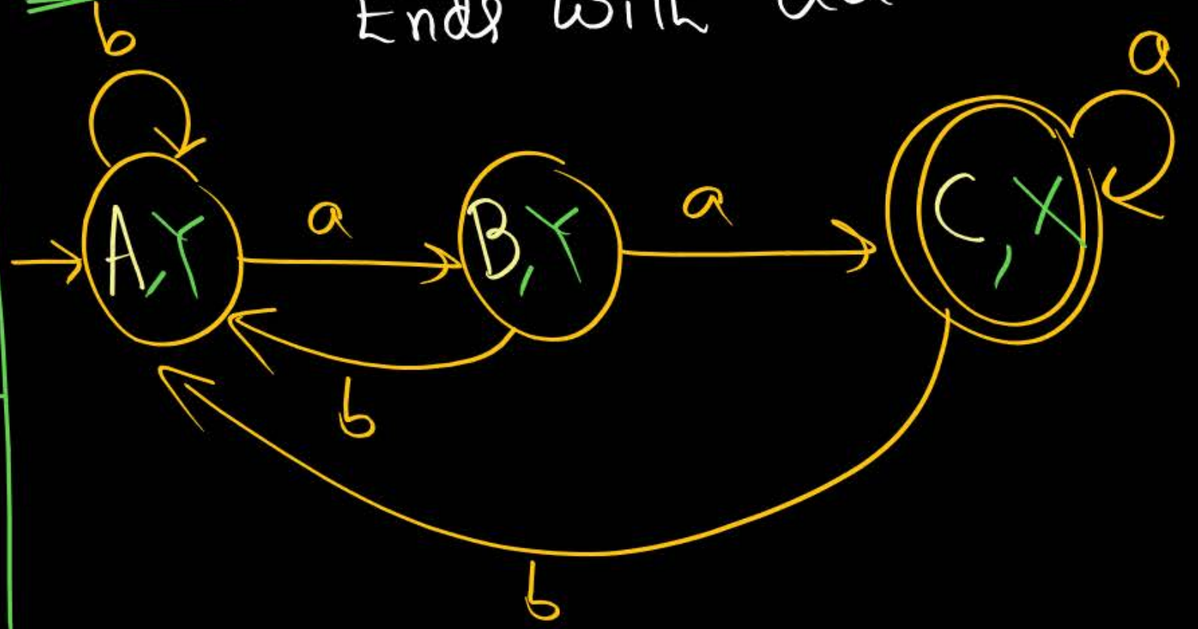
Algo

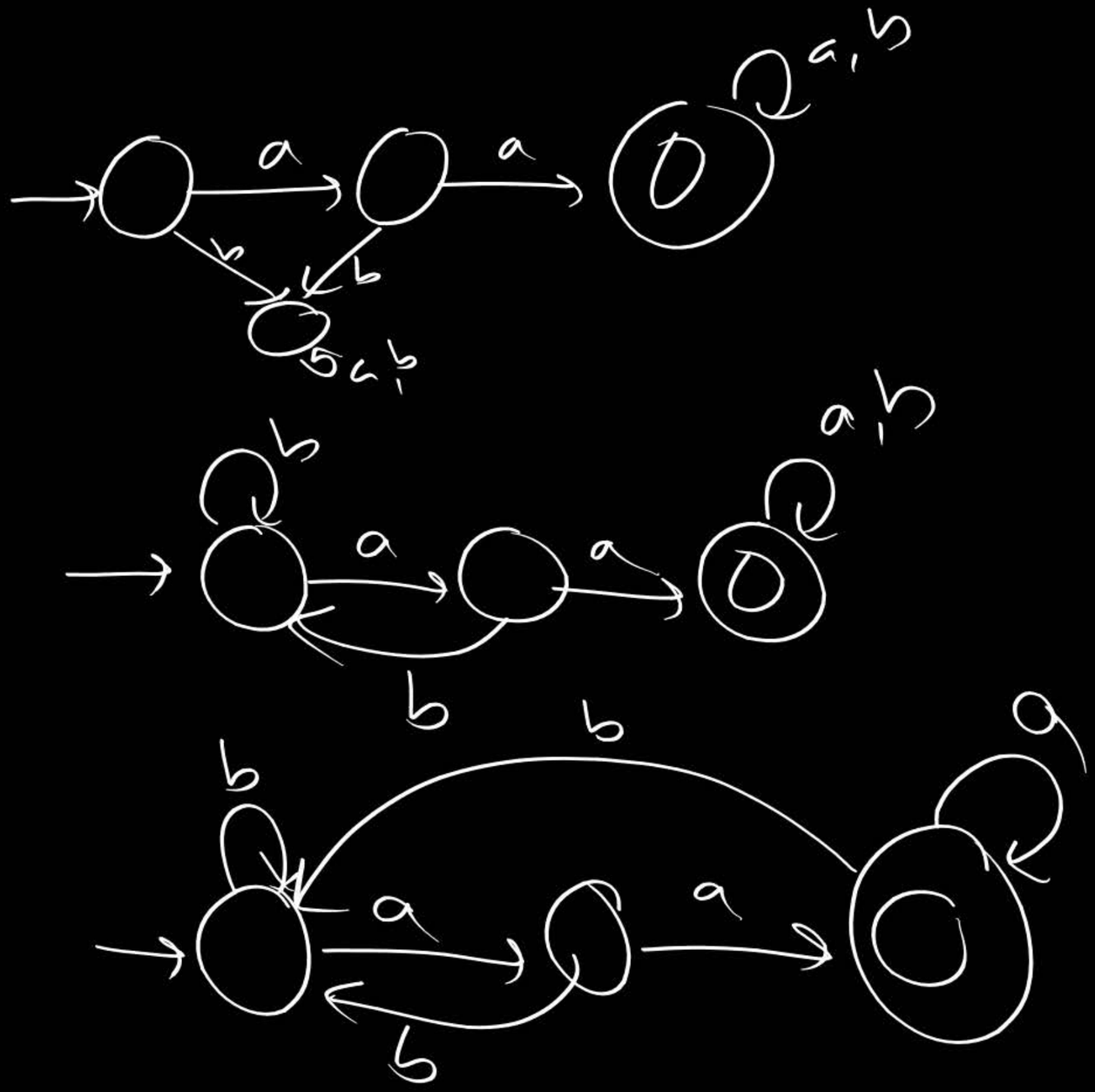
Mealy:



Moore:

Ends with "aa"



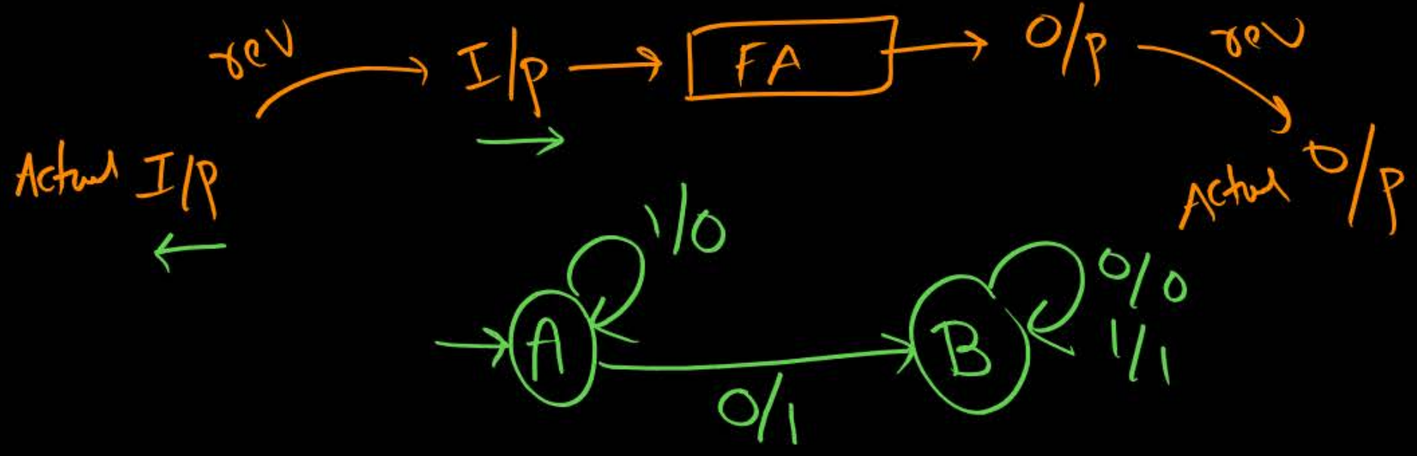

a
a
a,b
b
a,b
b
a
a
a,b
b
b
b
a
a
b

(4) Increment of binary input

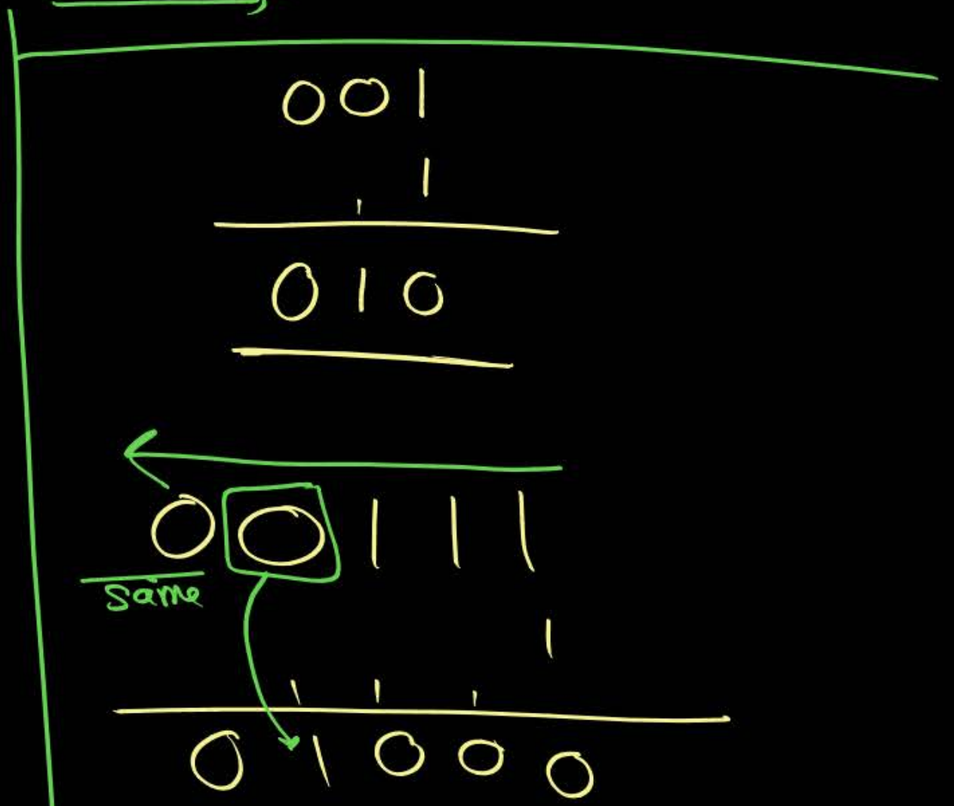
Assume i/p is given in reverse order.

0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1

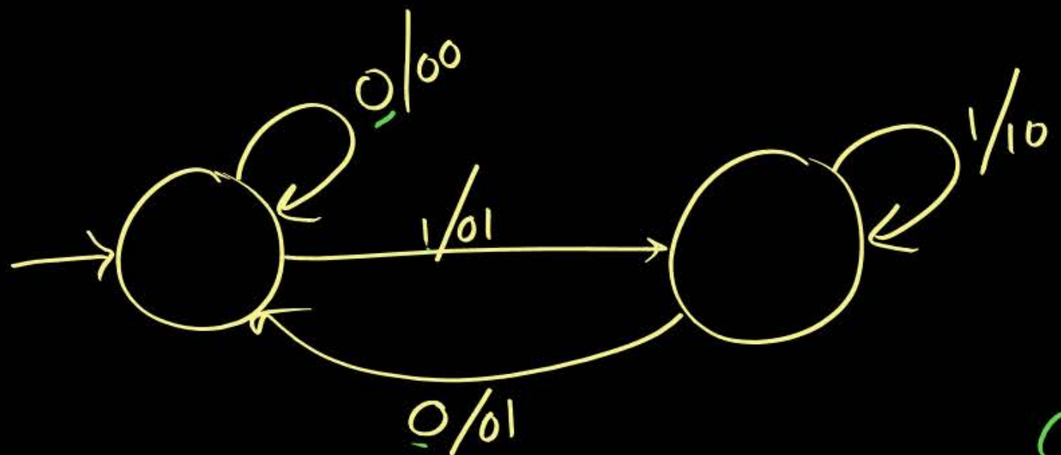
0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0



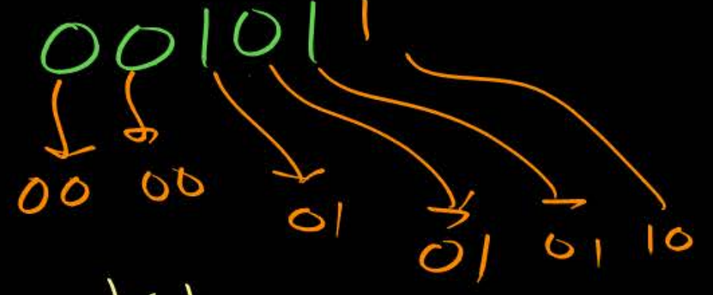
1 1 1 1 1 0 0 1 0 1 0 1 0



(5)



1+1 = 10



~~A~~. Sum of 2 binary numbers

~~B~~. Sum of present bit and previous bit

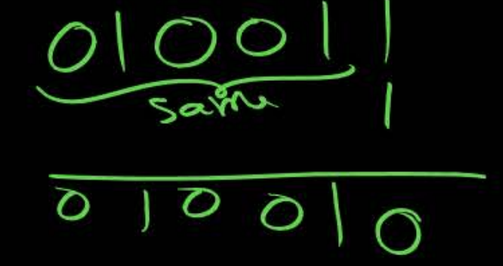
~~C~~. Increment of binary i/p

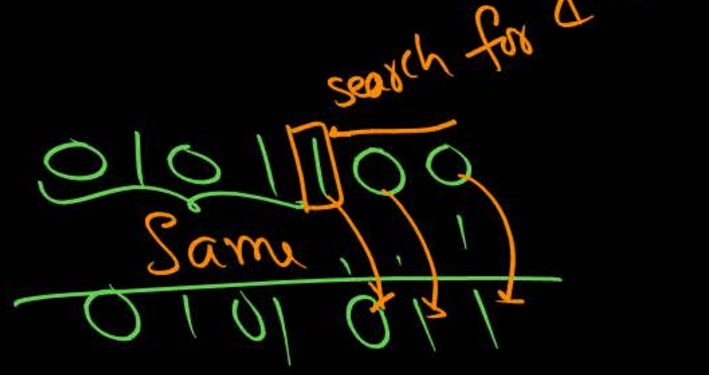
~~D~~. Decrement of binary i/p

1+0 = 1

⑥ Decrement of binary i/p

H.W.





*** (7) Addition of 2 binary numbers | from B (+1)

H.W:

Input1: 0 1 0 1

Input2: 1 0 0 1

Carry: 0 0 1 0

1 1 1 0

1100101

11,00,10,01

0111

reverse

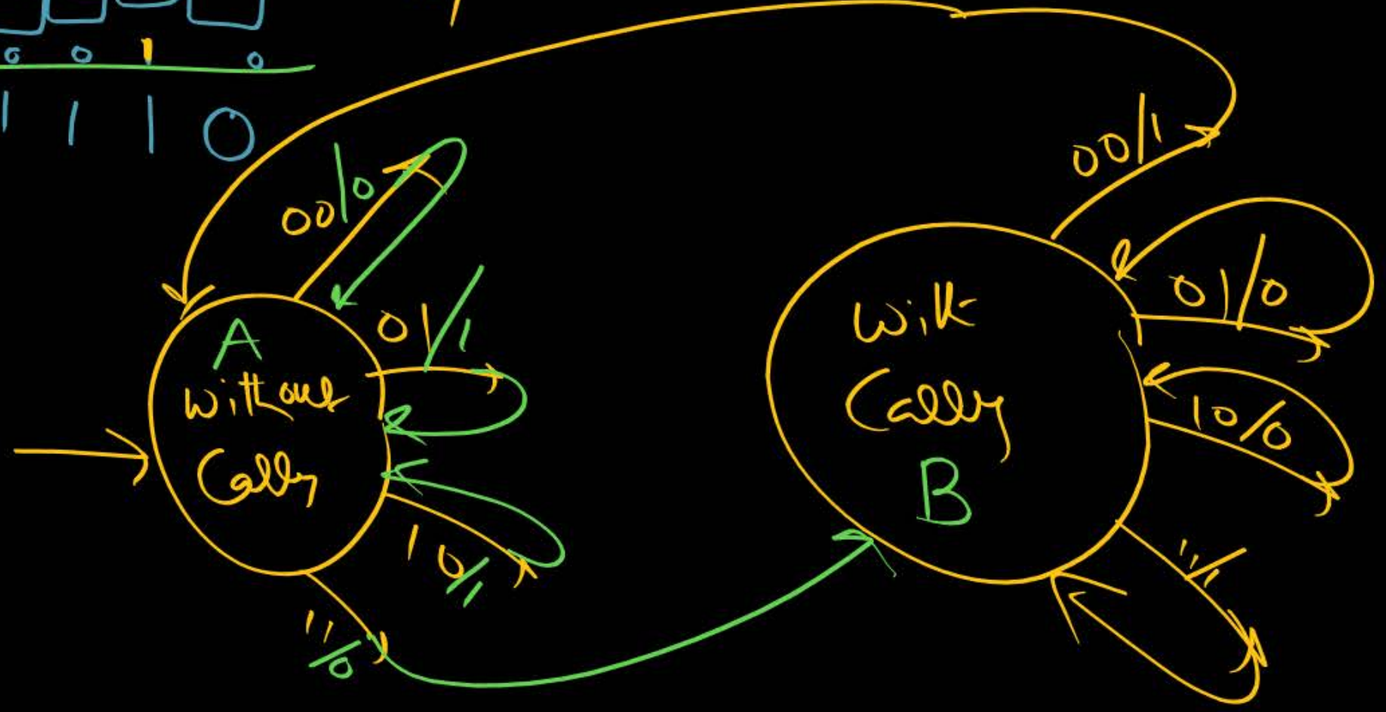
1110

From A

0+0=0
0+1=1
1+0=1
} No Carry

1+1=0 [carry]

0+0=1 (no carry)
0+1=0 (carry)
1+0=0 (carry)
1+1=1 (carry)



(8) Count occurrences of "000" in binary input

(9) Subtraction of 2 binary inputs

Summary

- Moore & Mealy
- Moore ⇌ Mealy

Moore ≅ Mealy

Applications

- Addition of 2 Arbitrary
- Subtraction
- Increment
- Decrement
- 1's Complement
- 2's Complement
- Shift

multiplication of 2 numbers ✗

↳ multiplication of numbers with Constant

Thank you