

# FSMS

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# Types

- Mealy
- Moore

# Mealy

## Mealy Machine

A Mealy Machine is an FSM whose output depends on the present state as well as the present input.

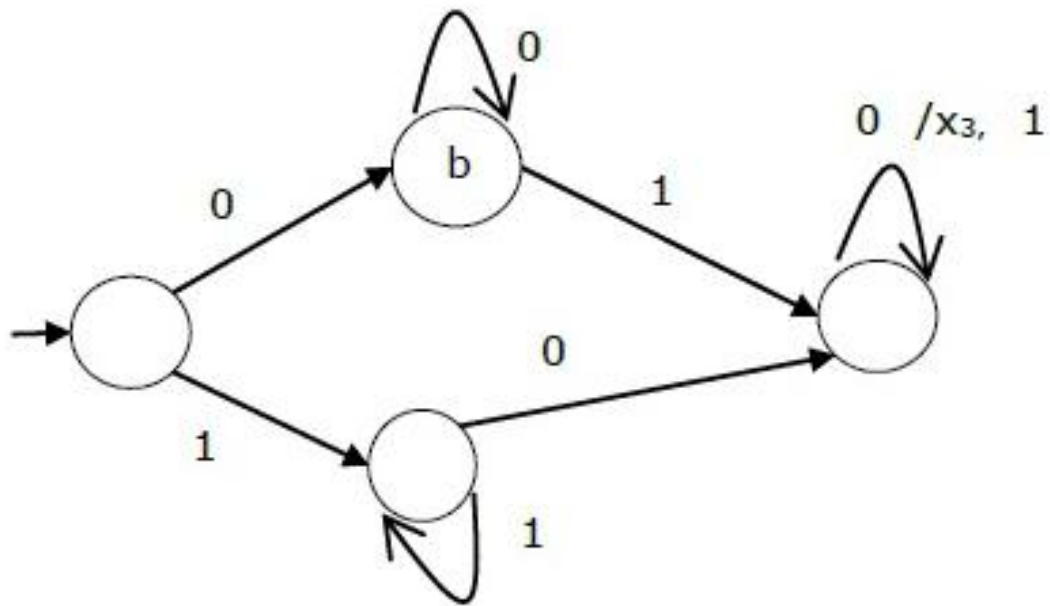
It can be described by a 6 tuple  $(Q, \Sigma, O, \delta, X, q_0)$  where –

- $Q$  is a finite set of states.
- $\Sigma$  is a finite set of symbols called the input alphabet.
- $O$  is a finite set of symbols called the output alphabet.
- $\delta$  is the input transition function where  $\delta: Q \times \Sigma \rightarrow Q$
- $X$  is the output transition function where  $X: Q \times \Sigma \rightarrow O$
- $q_0$  is the initial state from where any input is processed ( $q_0 \in Q$ ).

# State Table

Present state	Next state			
	input = 0		input = 1	
	State	Output	State	Output
→ a	b	x <sub>1</sub>	c	x <sub>1</sub>
b	b	x <sub>2</sub>	d	x <sub>3</sub>
c	d	x <sub>3</sub>	c	x <sub>1</sub>
d	d	x <sub>3</sub>	d	x <sub>2</sub>

# State Diagram



# Moore Machine

## Moore Machine

Moore machine is an FSM whose outputs depend on only the present state.

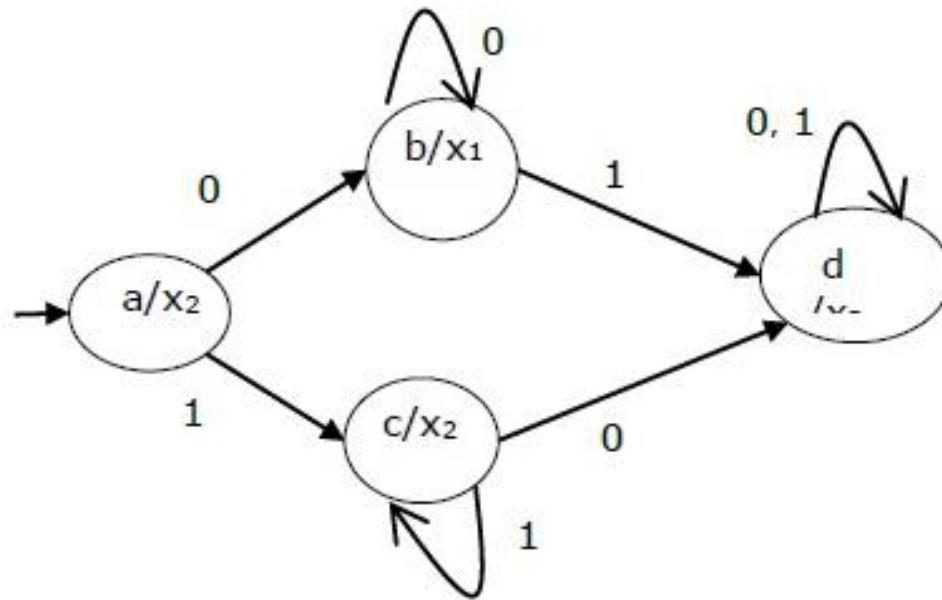
A Moore machine can be described by a 6 tuple  $(Q, \Sigma, O, \delta, X, q_0)$  where –

- $Q$  is a finite set of states.
- $\Sigma$  is a finite set of symbols called the input alphabet.
- $O$  is a finite set of symbols called the output alphabet.
- $\delta$  is the input transition function where  $\delta: Q \times \Sigma \rightarrow Q$
- $X$  is the output transition function where  $X: Q \rightarrow O$
- $q_0$  is the initial state from where any input is processed ( $q_0 \in Q$ ).

# State Table

Present state	Next State		Output
	Input = 0	Input = 1	
→ a	b	c	$x_2$
b	b	d	$x_1$
c	c	d	$x_2$
d	d	d	$x_3$

# State Diagram





# Comparison

Mealy Machine	Moore Machine
Output depends both upon the present state and the present input	Output depends only upon the present state.
Generally, it has fewer states than Moore Machine.	Generally, it has more states than Mealy Machine.
The value of the output function is a function of the transitions and the changes, when the input logic on the present state is done.	The value of the output function is a function of the current state and the changes at the clock edges, whenever state changes occur.
Mealy machines react faster to inputs. They generally react in the same clock cycle.	In Moore machines, more logic is required to decode the outputs resulting in more circuit delays. They generally react one clock cycle later.

# Real Time Examples-Few

- a vending machine.
- a subway entrance turnstile.
- a heating system.
- an automated subway system.
- a self-driving car system.
- an elevator.

# Shopping Cart

- "in shopping cart"  
"purchase attempted"  
"payment authorized"  
"allocated to warehouse"  
"packing"  
"shipped to customer"  
"payment charged"