



Digital Design Scribe

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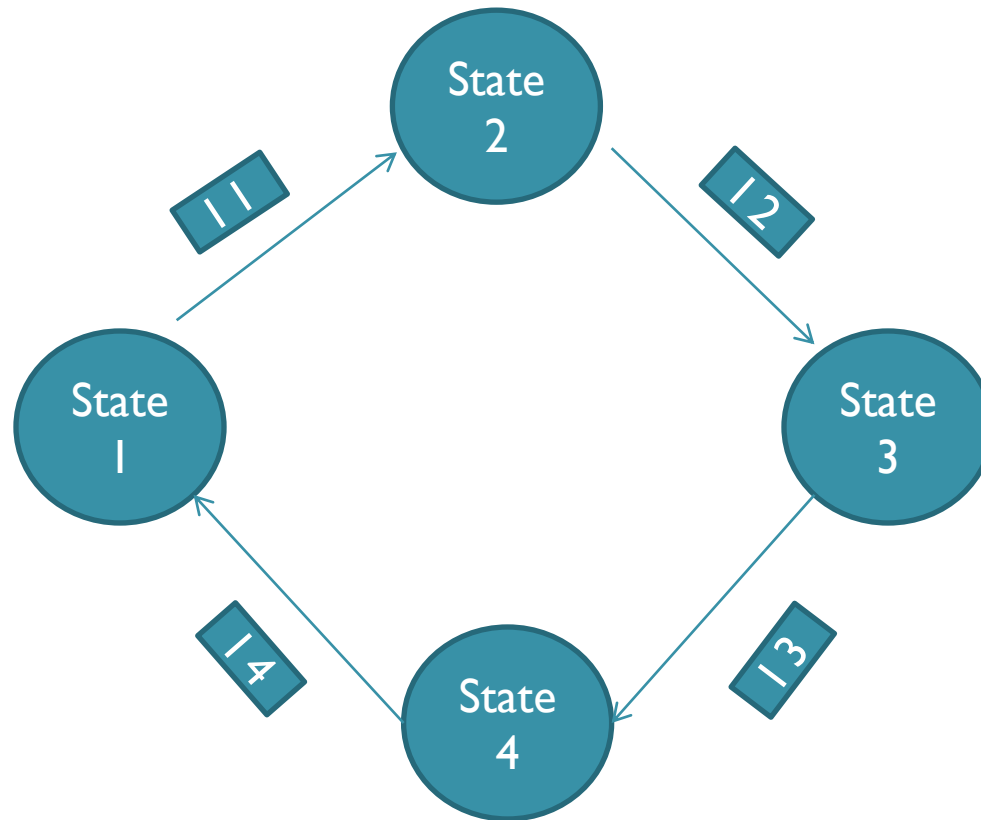
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Finite State Machine

- A sequential logic unit which
 - Takes an input in current state
 - Produces an output and a new state
- Finite-state machines provide a simple computational model with many applications.
- It consists of a finite no. of states and is composed of a combinational logic unit and flip flops in such a way so as to maintain state information.

State Diagram of a FSM



Types of FSM

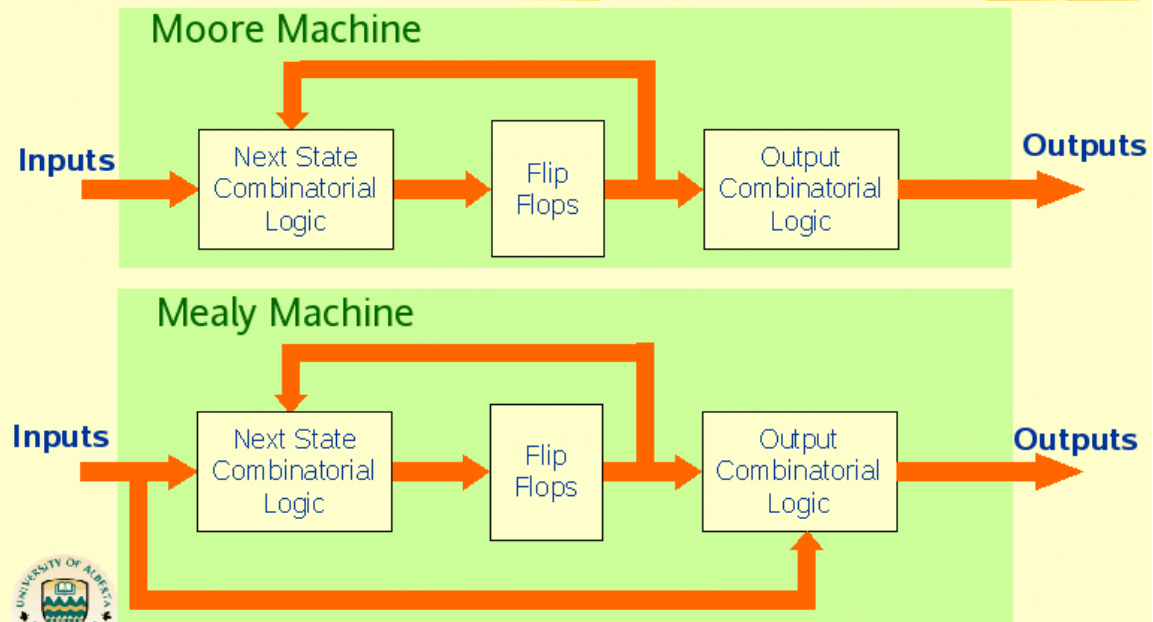
There are two types of Finite State Machines :

- MOORE MACHINE
- MEALY MACHINE

In the theory of computation , a Moore machine is a finite state machine whose input values are determined by its current state. In contrast to it, a mealy machine's output is determined by its current state and values of its input.

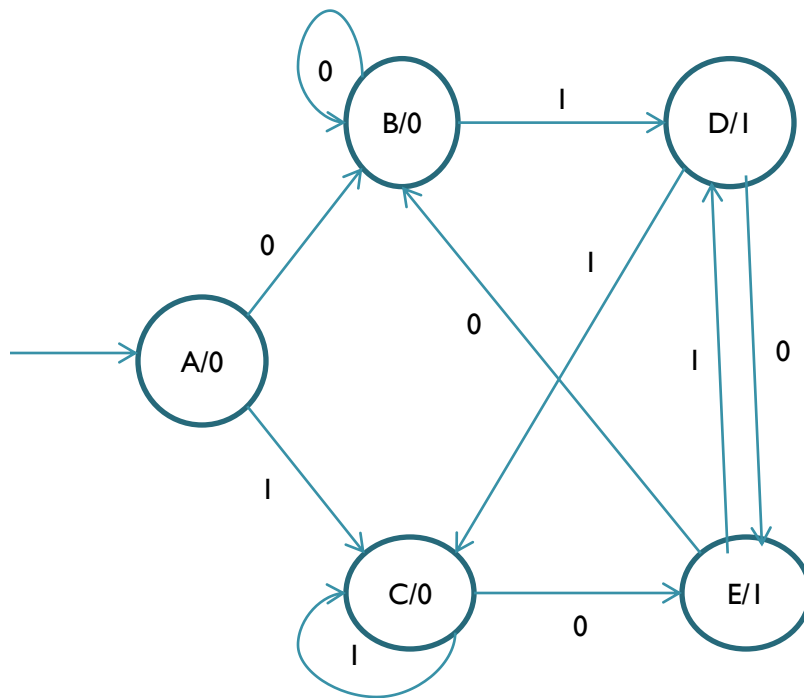
Circuit diagram of Moore and Mealy machine

Mealy and Moore Machines



Specifying outputs for a Moore machine

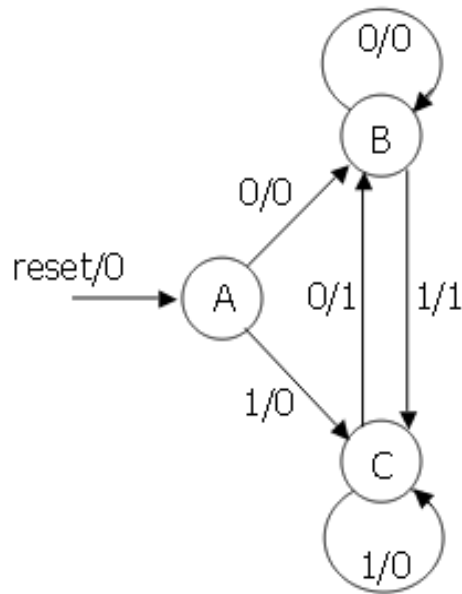
- Output is only function of state
- Outputs are specified “state bubbles” in state diagram.



reset	input	current state	next state	output
1	—	—	A	
0	0	A	B	0
0	1	A	C	0
0	0	B	B	0
0	1	B	D	0
0	0	C	E	0
0	1	C	C	0
0	0	D	E	1
0	1	D	C	1
0	0	E	B	1
0	1	E	D	1

Specifying outputs for a Mealy machine

- Output is a function of state and inputs
- Outputs are specified on transition arcs between states



reset	input	current state	next state	output
1	—	—	A	0
0	0	A	B	0
0	1	A	C	0
0	0	B	B	0
0	1	B	C	1
0	0	C	B	1
0	1	C	C	0

Comparison of Moore and Mealy machine

MEALY MACHINE

- Mealy Machines have less number of states because several inputs can be specified in one state.
- It generates faster response than Moore machines.
- Mealy machines are a bit unsafe to use as an input change can cause the output change.

MOORE MACHINE

- Moore have more number of states.
- Moore machines reacts slower as it waits until the next state to respond.
- Moore machines are safe to use as output changes at clock edge.



Examples of Finite State Machines

- ❑ Odd Parity Checker
- ❑ 2-Bit Gray code up-counter

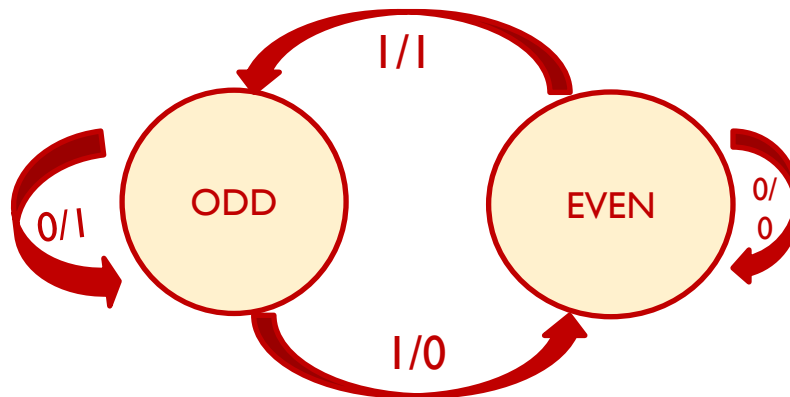
Odd Parity Checker

- The output is high when there are odd number of 1s.

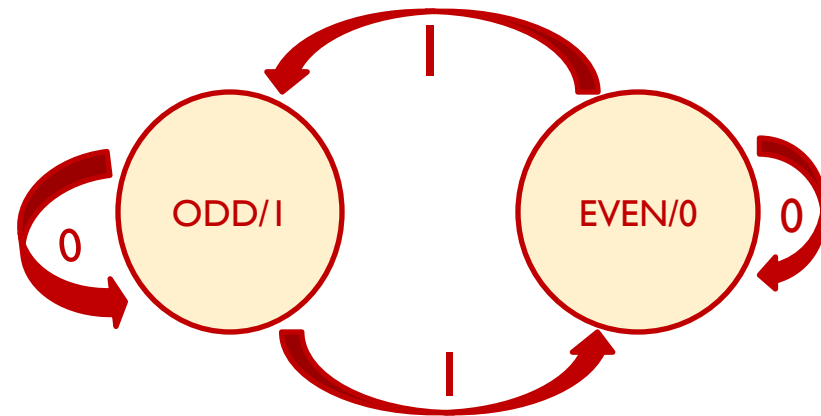
O/P { 1 ; odd number of 1s
0 ; even number of 1s

State Diagrams of Odd Parity Checker

Mealy Machine



Moore Machine



State Transition Tables and local minimization

Mealy Machine

PS	I/P	NS	O/P
0	0	0	0
0	1	1	1
1	0	1	1
1	1	0	0

NS - PS \oplus I/P

O/P - PS \oplus I/P

Moore Machine

PS	I/P	NS	O/P
0	0	0	0
0	1	1	0
1	0	1	1
1	1	0	1

O/P - PS

NS - PS \oplus I/P

2-Bit Gray Code Up-Counter

- $I/P = 1$ (continue up counting)
- $I/P = 0$ (count=0)
- Entering and exiting initial state ($O/P=0$)
- Otherwise ($O/P=1$)

State Diagram of 2-Bit Gray Code Up-Counter

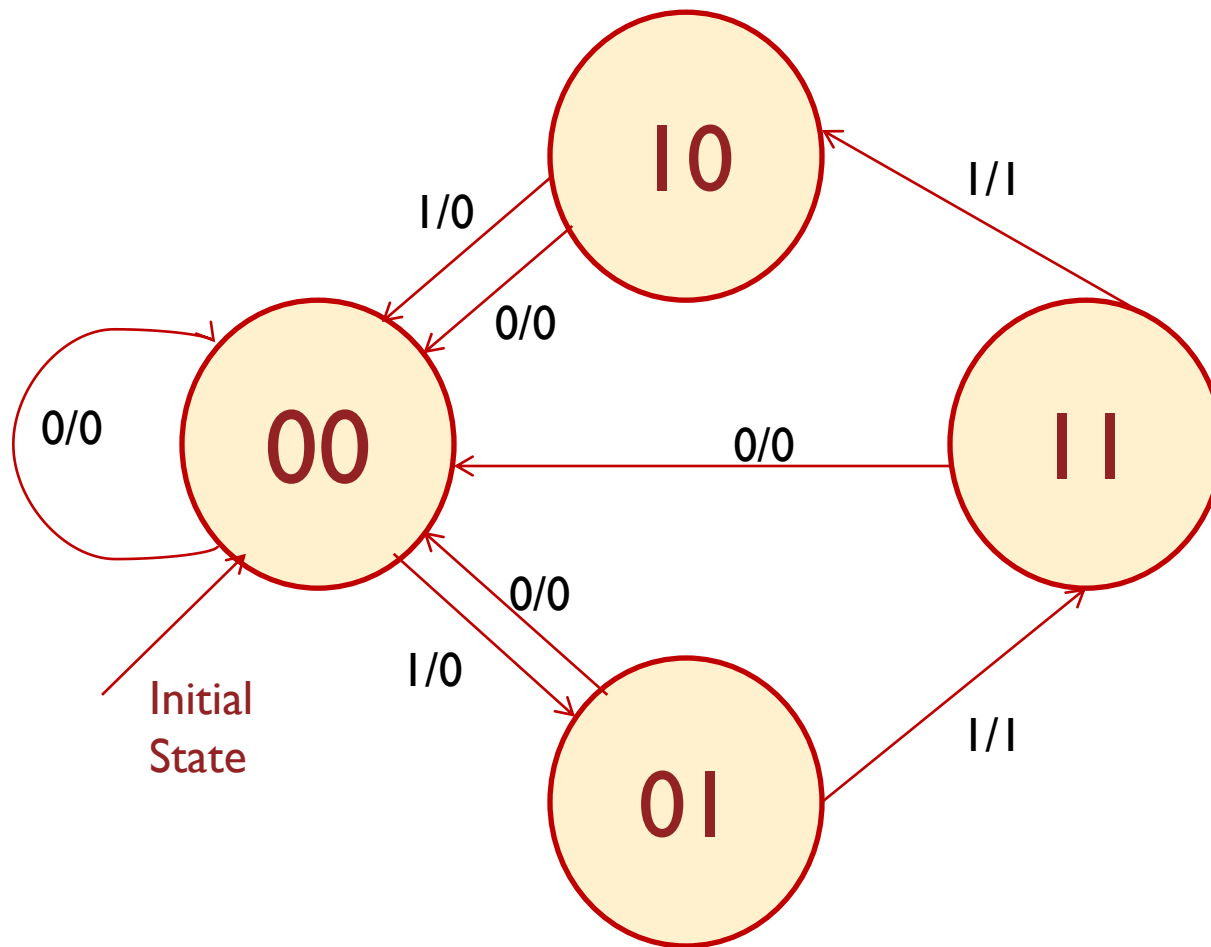


Table of Next State and O/P

PS	I/P	NS	O/P
00	1	01	0
00	0	00	0
01	1	11	1
01	0	00	0
11	1	10	1
11	0	00	0
10	1	00	0
10	0	00	0

**THANK
YOU**