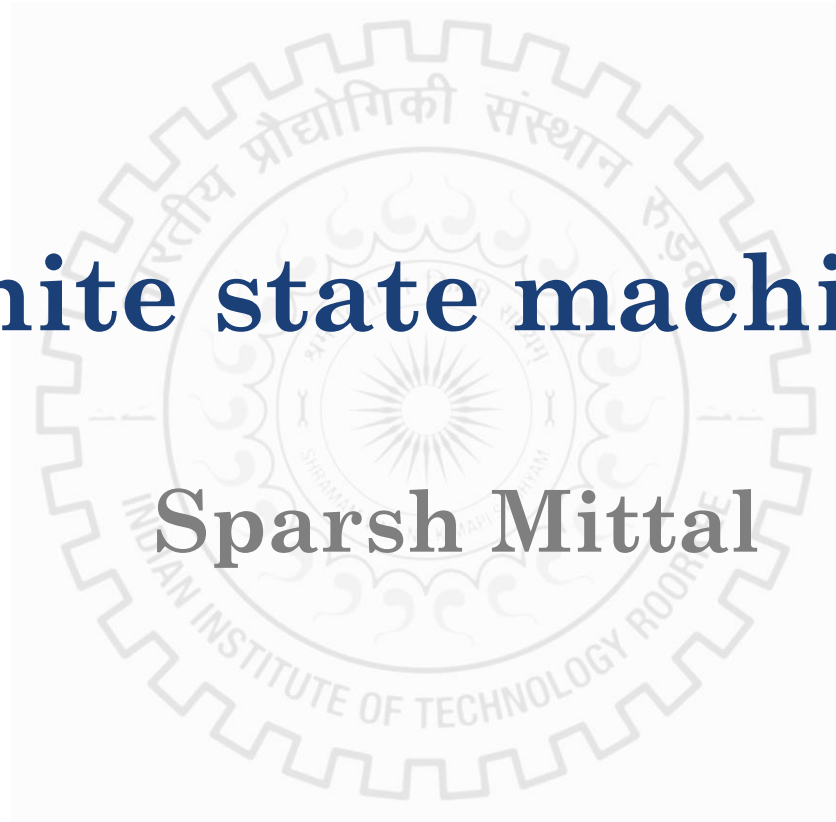


# Finite state machines

Sparsh Mittal



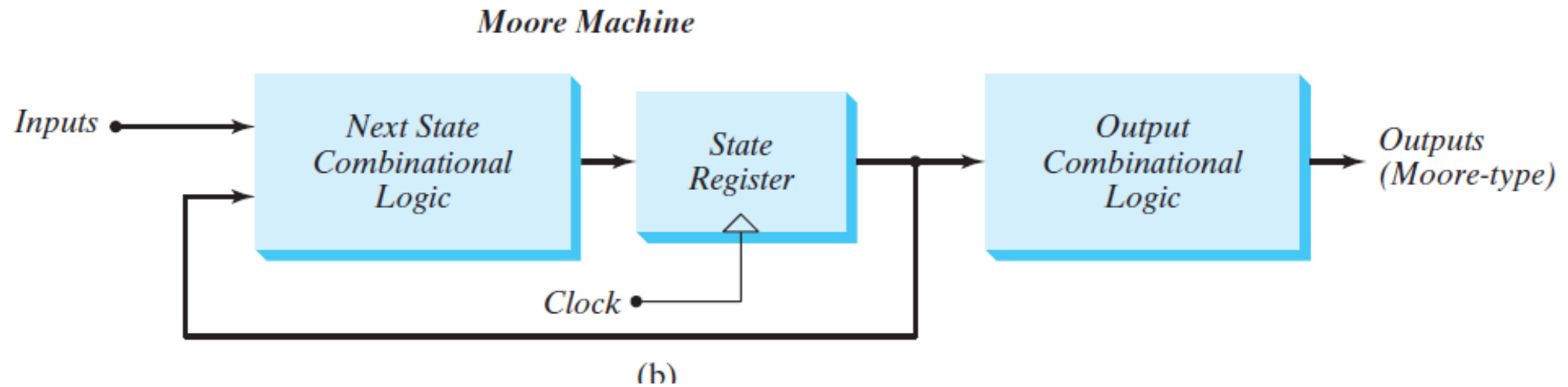
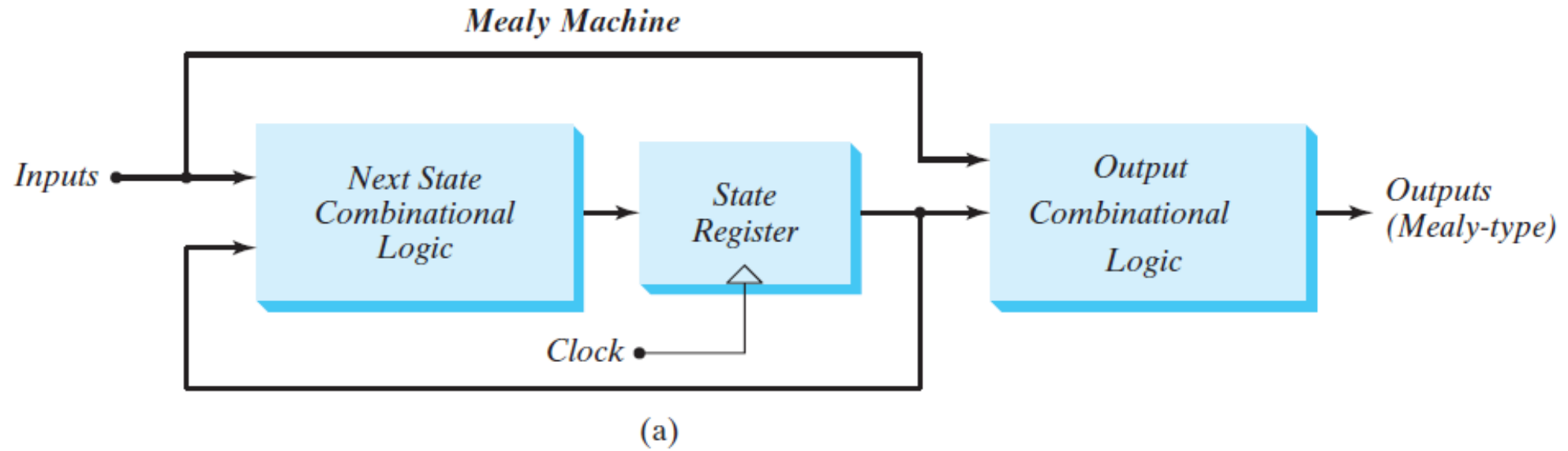
It is customary to distinguish between two models of sequential circuits: the Mealy model and the Moore model. They differ only in the way the output is generated.

Mealy model: output is a function of both the present state and the input.

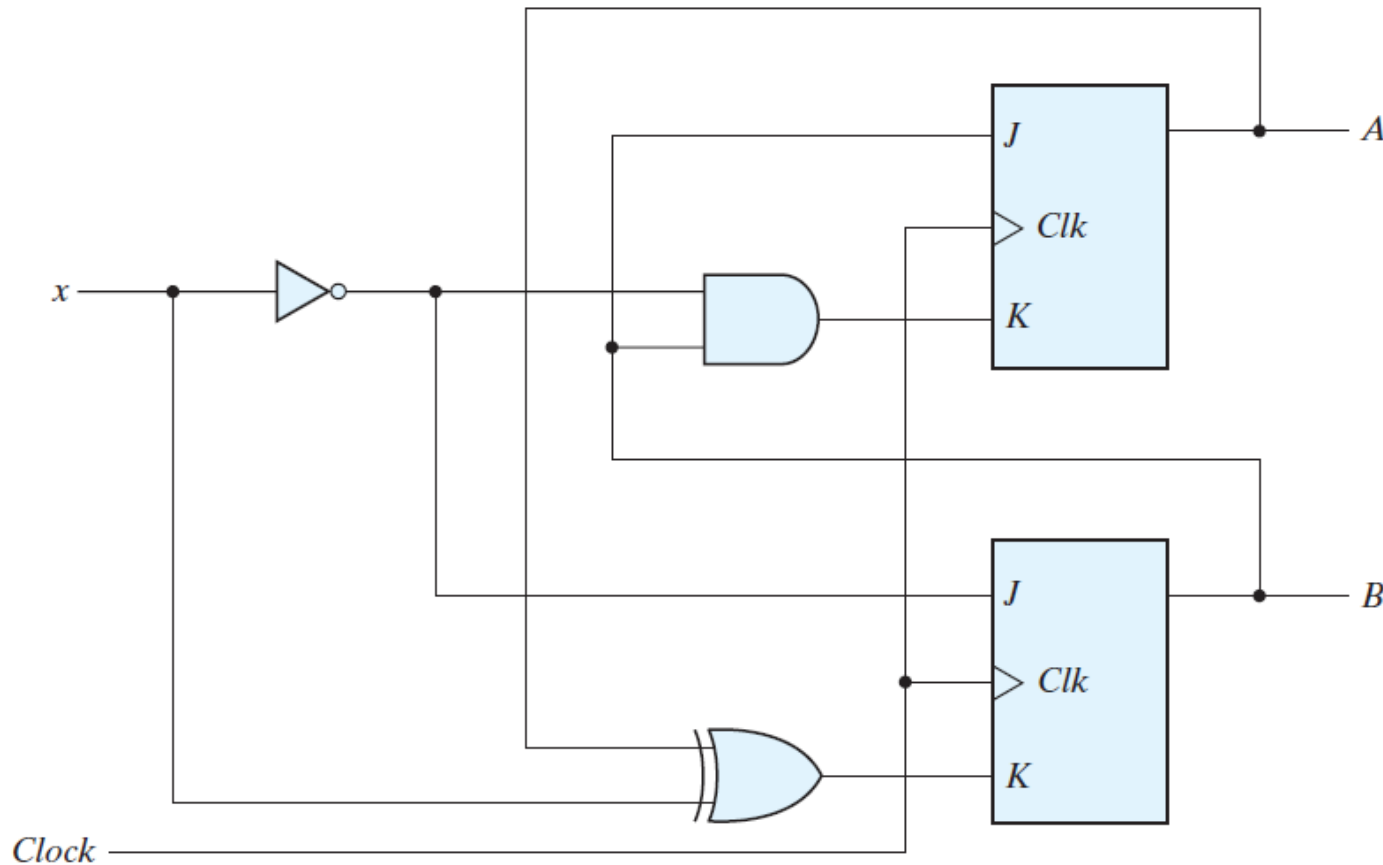
Moore model: output is a function of only the present state.

**A circuit with no output is considered a Moore model.**

A circuit may have both types of outputs.

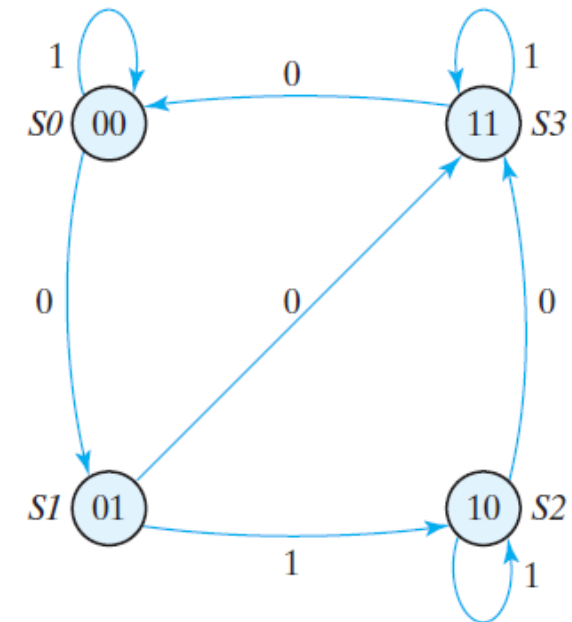


# Is it Moore or Mealy machine?



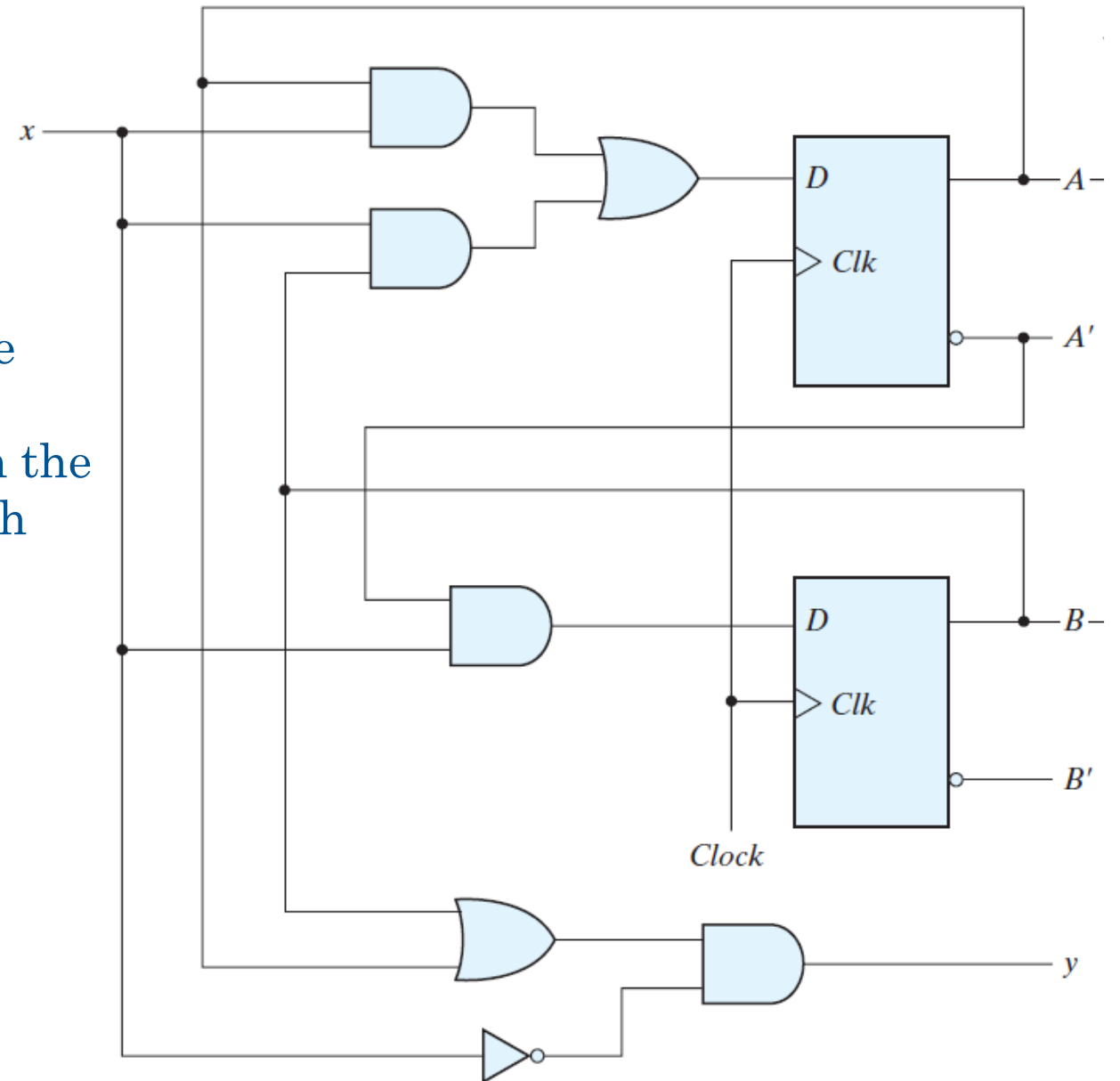
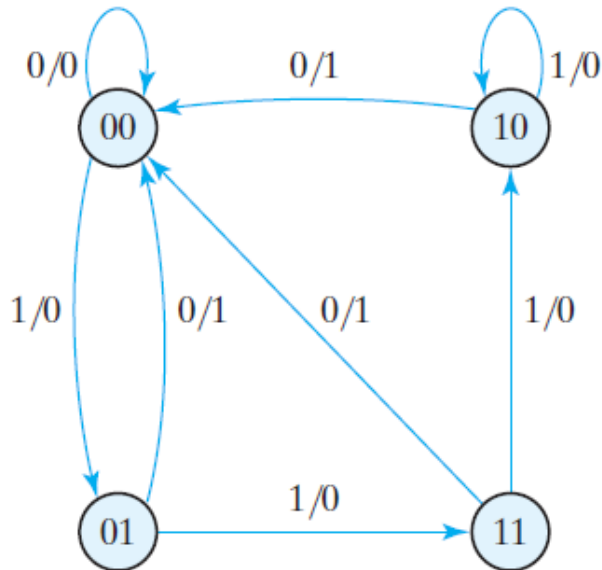
Moore machine.

Output is a function of present state only.  
The corresponding state diagram has only inputs marked along the directed lines.  
The outputs are the flip-flop states marked inside the circles.



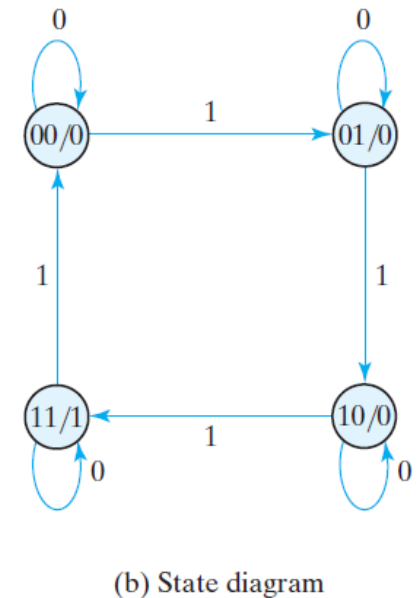
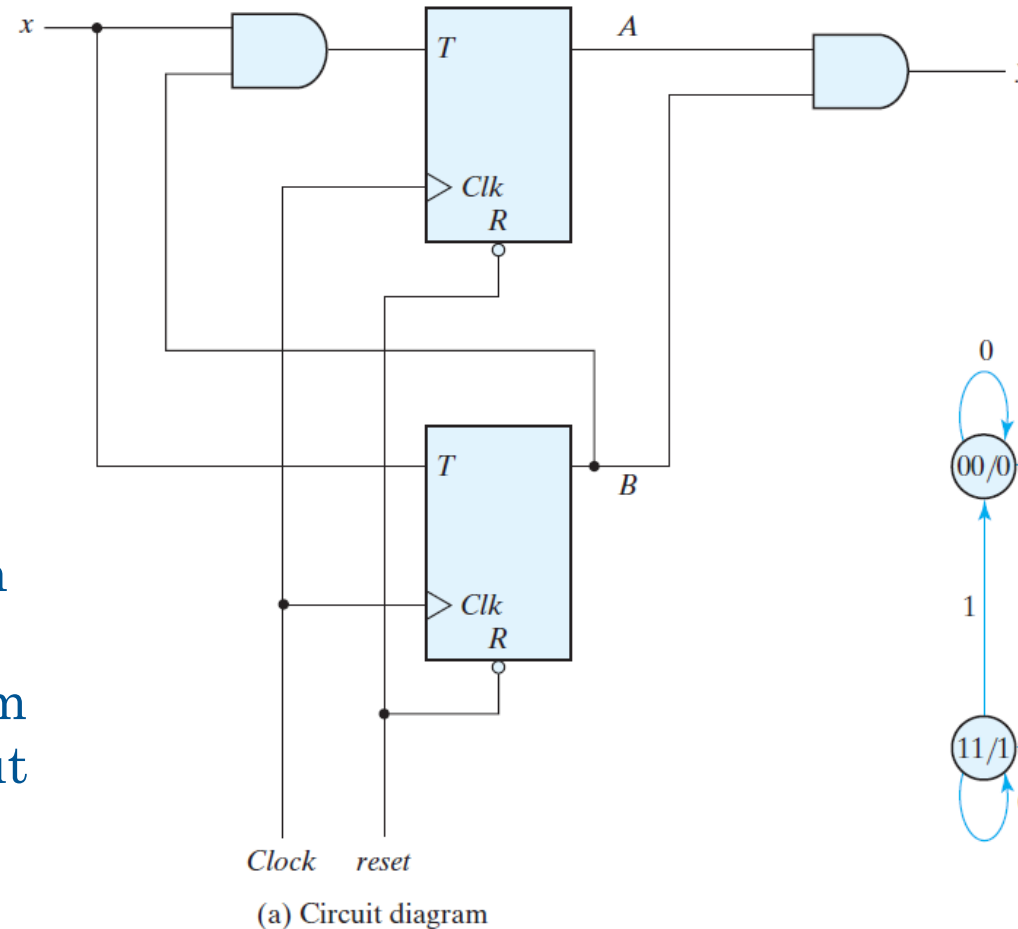
# Is it Moore or Mealy machine?

- Mealy machine.
- Output  $y$  is a function of both input  $x$  and the present state of  $A$  and  $B$ .
- The corresponding state diagram shows both the input and output values, separated by a slash along the directed lines between the states.



# Is it Moore or Mealy machine?

- Moore model.
- Output depends only on flip-flop values, and that makes it a function of the present state only.
- The input value in the state diagram is labeled along the directed line, but the output value is indicated inside the circle together with the present state.



# Synchronization issue

- In a **Moore model**, the outputs are synchronized with the clock, because they depend only on flip-flop outputs that are synchronized with the clock.
- In a **Mealy model**, the outputs may
  - change if the inputs change during the clock cycle.
  - have momentary false values because of the delay encountered from the time that the inputs change and the time that the flip-flop outputs change.
- To synchronize a Mealy circuit, the inputs must be synchronized with the clock and the outputs must be sampled immediately before the clock edge.