

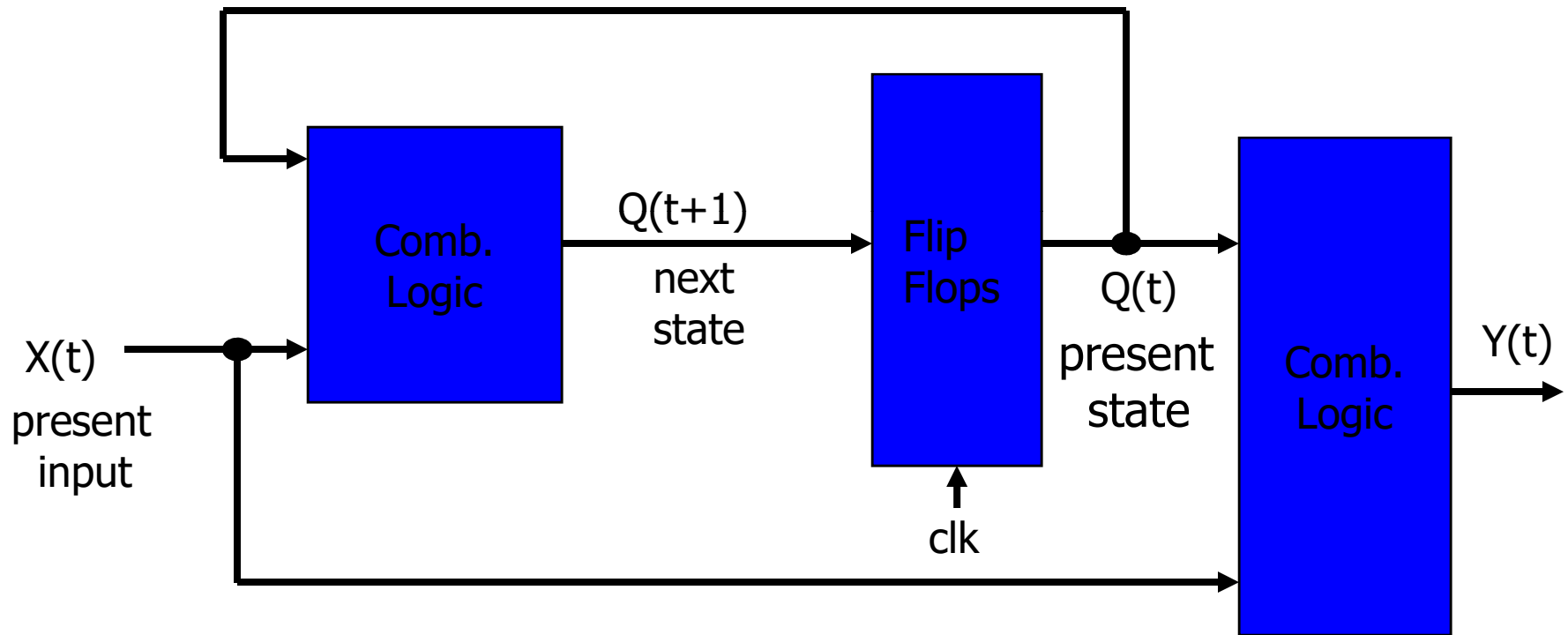
# **BASIC FSM STRUCTURES**

## **Overview**

- Finite state machines
  - I. Mealy machine
  - II. Moore machine

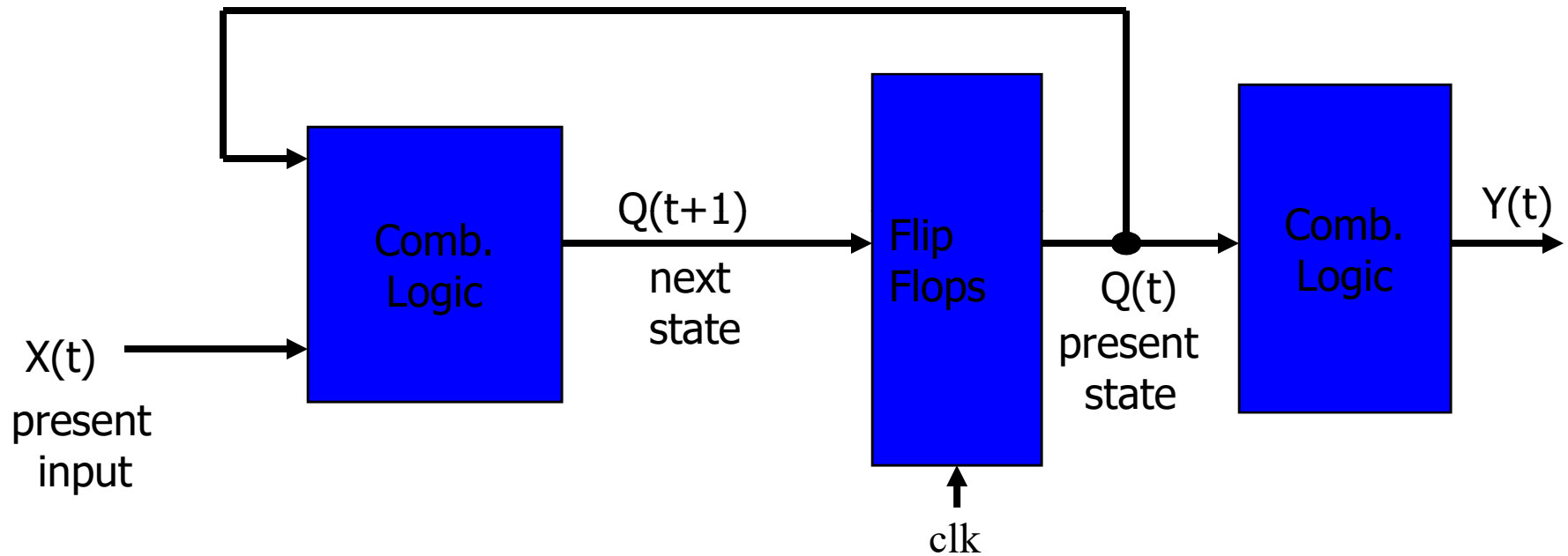
## Mealy Machine

- Output based on state and present input



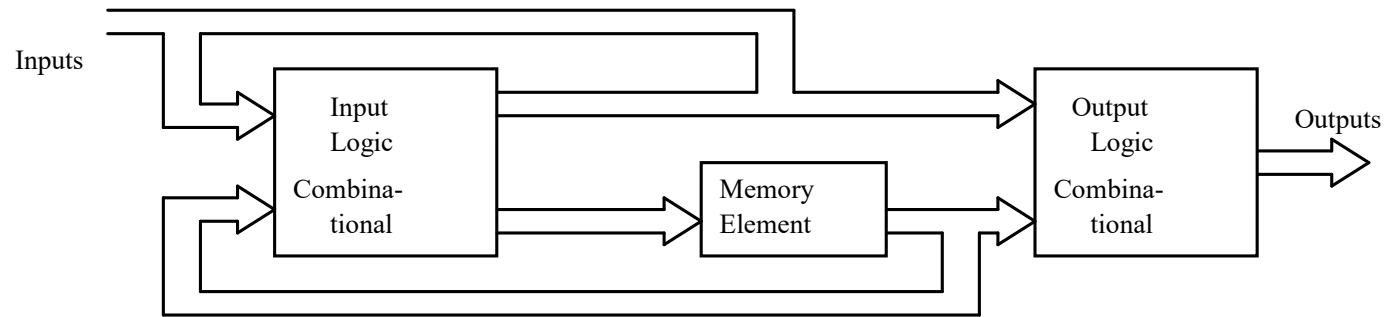
## Moore Machine

- Output based on state only

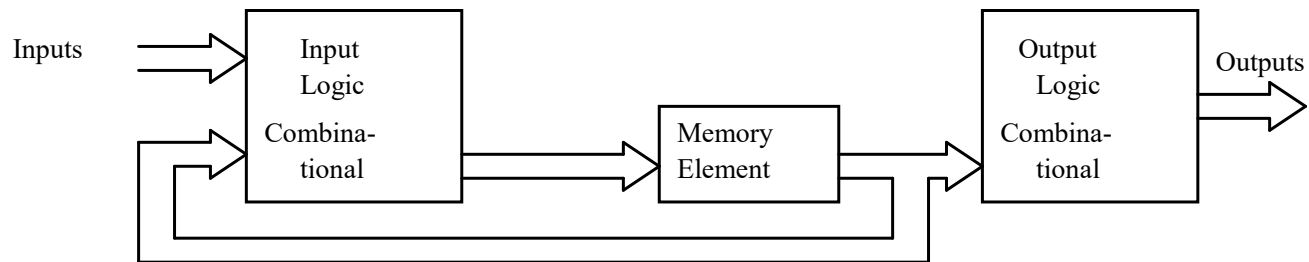


# Mealy versus Moore

Mealy Model

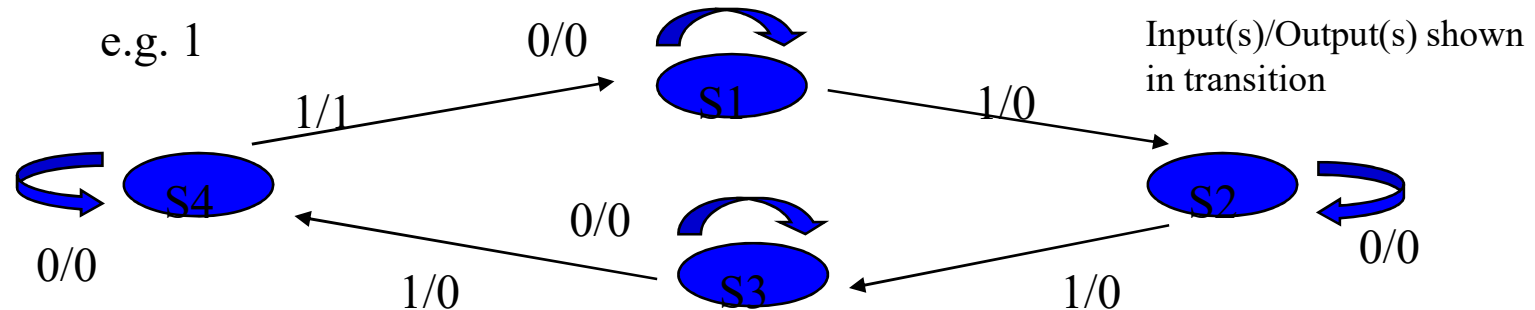


Moore Model



## State Diagram with One Input & One Mealy Output

- Mano text focuses on **Mealy** machines
- State transitions are shown as a function of inputs and current outputs.



## State Diagram with One Input & a *Moore* Output

- Moore machine: outputs only depend on the current state
- Outputs **cannot** change during a clock pulse if the input variables change
- Moore Machines usually have more states.
- No direct path from inputs to outputs
- Can be more reliable

## Clocked Synchronous State-machine Analysis – next class

Given the circuit diagram of a state machine:

- 1 Analyze the combinational logic to determine flip-flop input (excitation) equations:  $D_i = F_i(Q, \text{inputs})$ 
  - The input to each flip-flop is based upon current state and circuit inputs.
- 2 Substitute excitation equations into flip-flop characteristic equations, giving transition equations:  $Q_i(t+1) = H_i(D_i)$
- 3 From the circuit, find output equations:  $Z = G(Q, \text{inputs})$ 
  - The outputs are based upon the current state and possibly the inputs.



Cont..

- 4 Construct a state transition/output table from the transition and output equations:
  - Similar to truth table.
  - Present state on the left side.
  - Outputs and next state for each input value on the right side.
  - Provide meaningful names for the states in state table, if possible.
- 5 Draw the state diagram which is the graphical representation of state table.

## Summary

- Flip flops contain state information
- State can be represented in several forms:
  - State equations
  - State table
  - State diagram
- Possible to convert between these forms

Cont..

- Circuits with state can take on a finite set of values
  - Finite state machine
- Two types of “machines”
  - Mealy machine
  - Moore machine

THANK YOU