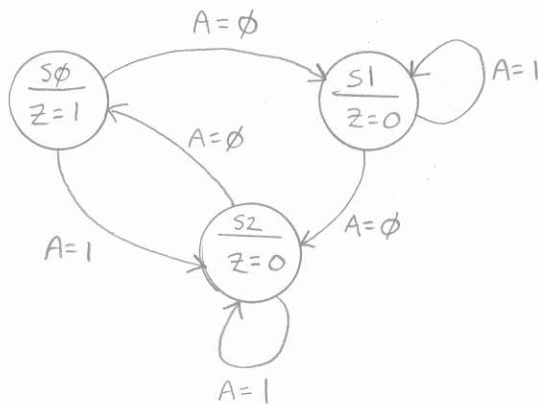


Analysis of Clocked Sequential Circuits

Extend design/analysis techniques for counters to arbitrary finite state machines, where the sequence of states isn't fixed.

- State Graph:
- a) Circles contain each state
 - b) Circles contain outputs for each state
 - c) Arrows indicate transitions between states at active ^{clock} edges
 - d) Arrow labels indicate input values which initiate transition

Ex:



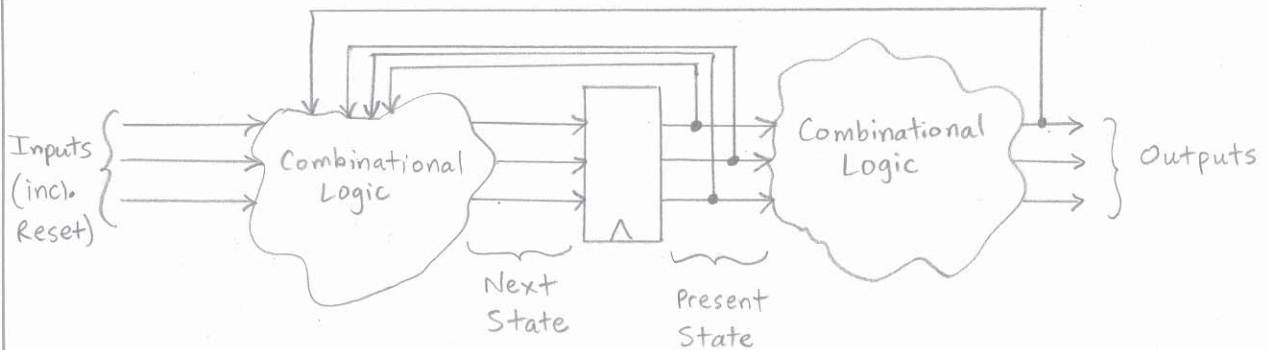
State Table: Write out present state, next state, inputs, and outputs in tabular form.

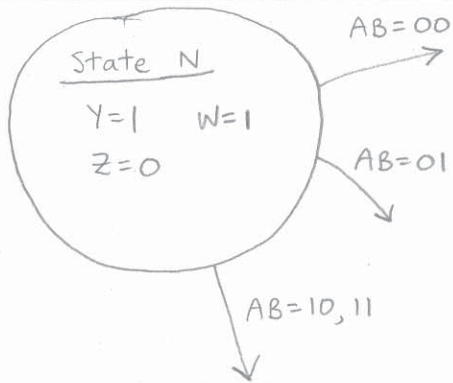
Ex:

| Present State | Next State | | Present Output (Z) |
|---------------|------------|-----|--------------------|
| | A=0 | A=1 | |
| S0 | S1 | S2 | 1 |
| S1 | S2 | S1 | 0 |
| S2 | S0 | S2 | 0 |

Two classes of finite state machine (FSM):

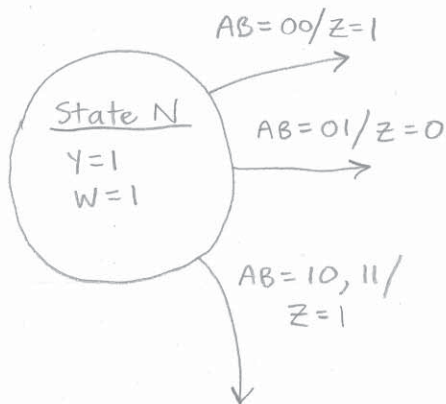
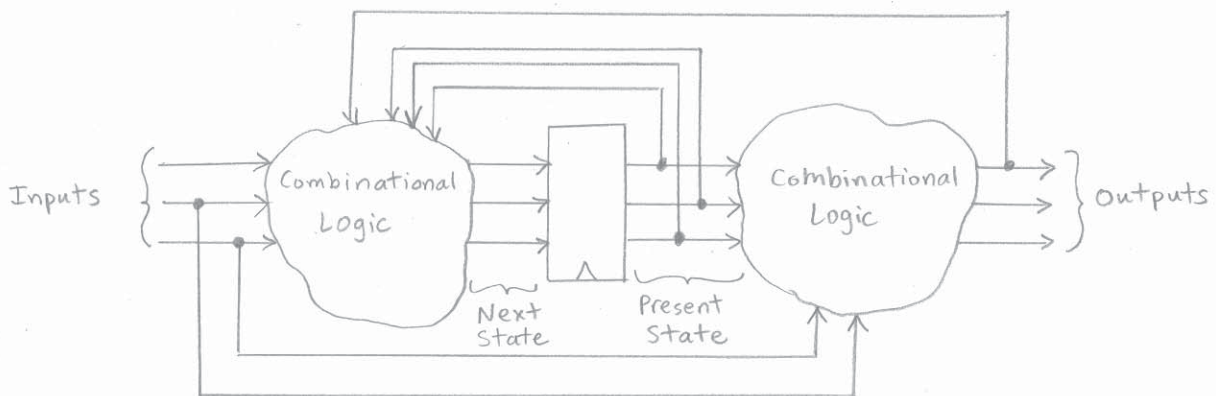
Moore Machine: Outputs are a function of present state only





- Specific outputs associated with each state
- Transitions are a function of the inputs
- Next state a function of inputs and present state

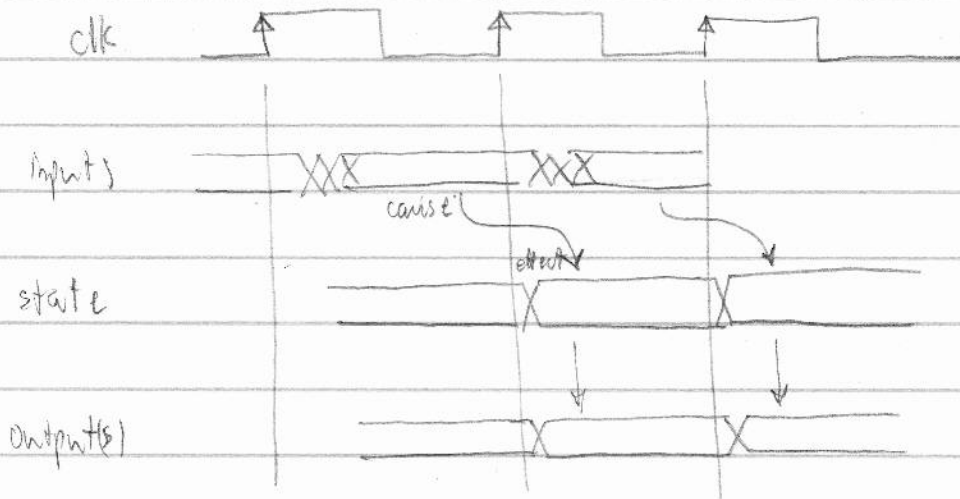
Mealy Machine: Outputs are a function of present state and inputs



Main difference between Moore and Mealy: timing from input(s) to output(s)

- 1.) Moore: outputs change only on state transitions \Rightarrow no input-related hazards, outputs delayed relative to inputs
- 2.) Mealy: outputs change on input changes and state changes \Rightarrow no one cycle delays, possible input-related glitches.

Ex: Moore



Ex: Mealy

