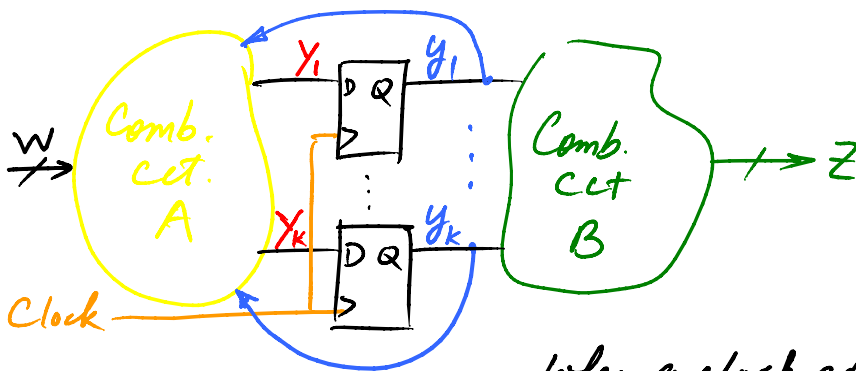


Finite State Machine (FSM)

Defn: an FSM is a sequential circuit, that has input(s) W .
f.f's called Y and output(s) Z .



The FSM has a state at any given clock cycle which is represented by $y_1 \dots y_k$ values.

The next state $y_1 \dots y_k$

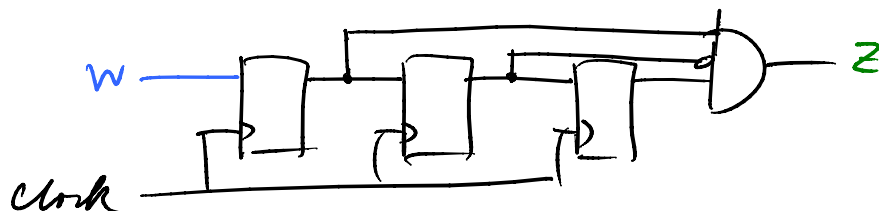
When a clock edge \downarrow occurs is dependent on values of input(s) W , as well as the present (current) state $y_1 \dots y_k$.

Design example:

— We need to design a FSM that controls a machine which receives a status signal (W) and produces an error signal (Z) when ever a pattern of 101 in three successive clock cycles has occurred. That is Z should be set to "1" in the next clock cycle and then set back to "0" afterward.

Clock cycle:	1	2	3	4	5	6	7	8	9	...
W :	0	0	1	1	0	1	0	1	1	...
Z :	0	0	0	0	0	0	1	0	1	...

By inspection:

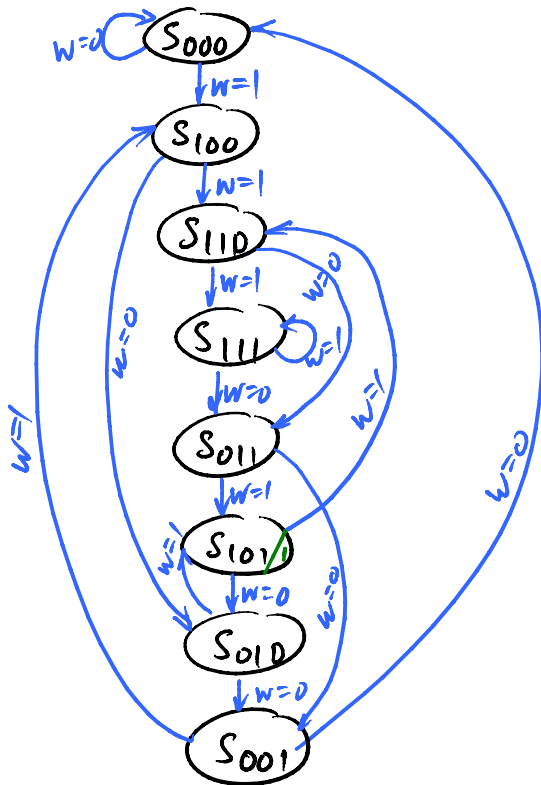


Design Procedure for FSM

1. Draw State Diagram (from your imagination)
2. Draw State Table
3. Choose the # of FF's ($\geq \log_2(\text{\# of states})$), also choose valuations of FF's to represent each state (state codes)
4. Draw State-assigned Table (using FF's codes)
5. Derive Comb. log A, and Comb. log B.
6. Draw the FSM ckt.

back to '101' pattern example

1. State Diagram (based on the input information (w)).



2. State Table

Present state	Next state		Output Z
	w=0	w=1	
S000	S000	S100	0
S001	S000	S100	0
S010	S001	S101	0
S011	S001	S101	0
S100	S010	S110	0
S101	S010	S110	1
S110	S011	S111	0
S111	S011	S111	0

3. Choose # of FF's. $\Rightarrow 3$

$$y_2 y_1 y_0 = 000 \text{ for } S000$$

$$y_2 y_1 y_0 = 001 \text{ for } S001$$

4. Draw state-assigned table

Present S. $y_2 y_1 y_0$	Next state		Output z
	$W=0$ $y_2 y_1 y_0$	$W=1$ $y_2 y_1 y_0$	
0 0 0	0 0 0	1 0 0	0
0 0 1	0 0 0	1 0 0	0
0 1 0	0 0 1	1 0 1	0
0 1 1	0 0 1	1 0 1	0
1 0 0	0 1 0	1 1 0	0
1 0 1	0 1 0	1 1 0	0
1 1 0	0 1 1	1 1 1	1
1 1 1	0 1 1	1 1 1	0

5. Derive Comb. ckt A.
and Comb. ckt B

normally

$y_2 y_1 y_0$	$W y_2$	00	01	11	10
00	0	0	1	1	1
01	0	0	1	1	1
11	0	0	1	1	1
10	0	0	1	1	1

$$y_2 = W$$

$$y_1 = y_2$$

$$y_0 = y_1$$

$$z = y_2 \bar{y}_1 y_0$$

6. Draw FSM ckt

