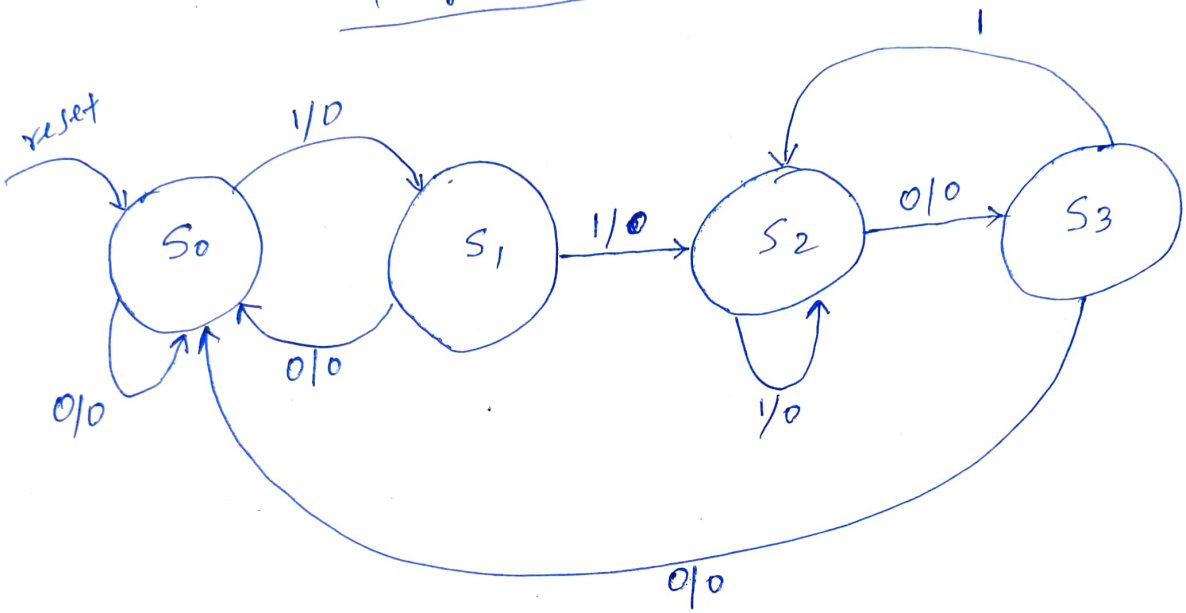
problem1_seqdet

mealy sequence detector

Goal: pattern 1101, overlap

FSM State Transition Diagram

mealy FSM (arcs indicates input/output)



FSM State Transition Table

Current State	input	Next state
S_0	0	S_0
S_0	1	S_1
S_1	0	S_0
S_1	1	S_2
S_2	0	S_3
S_2	1	S_2
S_3	0	S_0
S_3	1	S_1

State encoding

State	Encoding
S_0	00
S_1	01
S_2	10
S_3	11

we have used binary encoding over One-hot encoding because in one-hot encoding we need one designated bit for each state. which required more flip-flops.

→ FSM Encoded State Transition Table

Current state		Input	Next state	
S_1	S_0	X	S_1'	S_0'
0	0	0	0	0
0	0	1	0	1
0	1	0	0	0
0	1	1	1	0
1	0	0	1	0
1	0	1	0	0
1	1	0	0	1
1	1	1	1	1

Next-State & output logic

$$S_1' = (S_1 \cdot \bar{S_0} + \bar{S_1} \cdot S_0 \cdot X)$$

$$S_0' = \bar{S_1} \cdot \bar{S_0} \cdot X + (S_1 \cdot (\bar{S_0} \cdot \bar{X} + S_0 \cdot X))$$

$$\overset{or}{=} \bar{S_1} \cdot \bar{S_0} \cdot X + S_1 \text{ XNOR } X$$

Current state		Input	Output
S_1	S_0	X	Y
0	0	x	0
0	1	x	0
1	0	x	0
1	1	0	0
1	1	1	1

$$Y = S_1 \cdot S_0 \cdot X$$

Only high when Current state = S_3(11) & X = 1.