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Sign :-

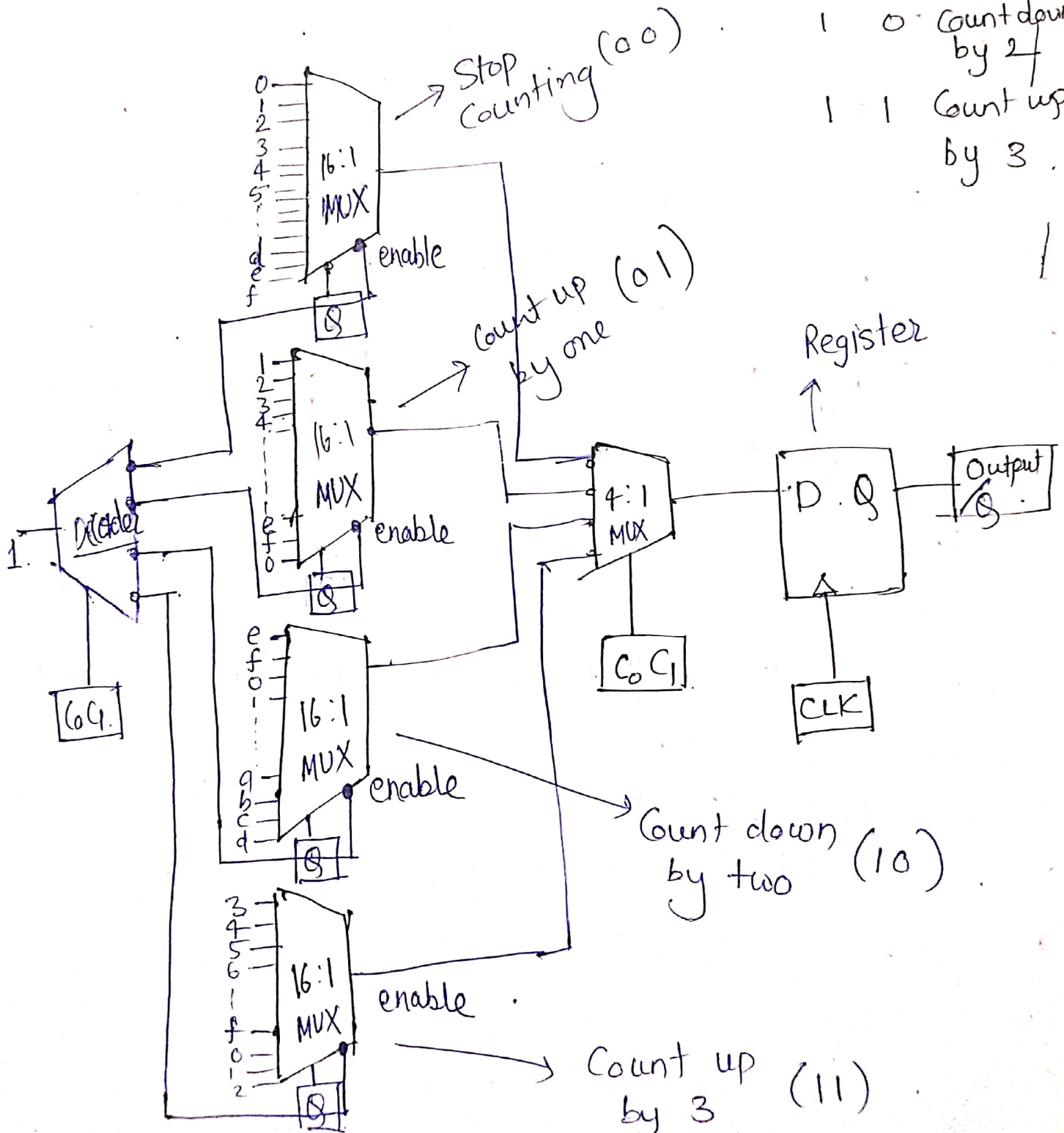
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Date :- 29/04/2020.

CS226 - Switching Theory Lab - 11

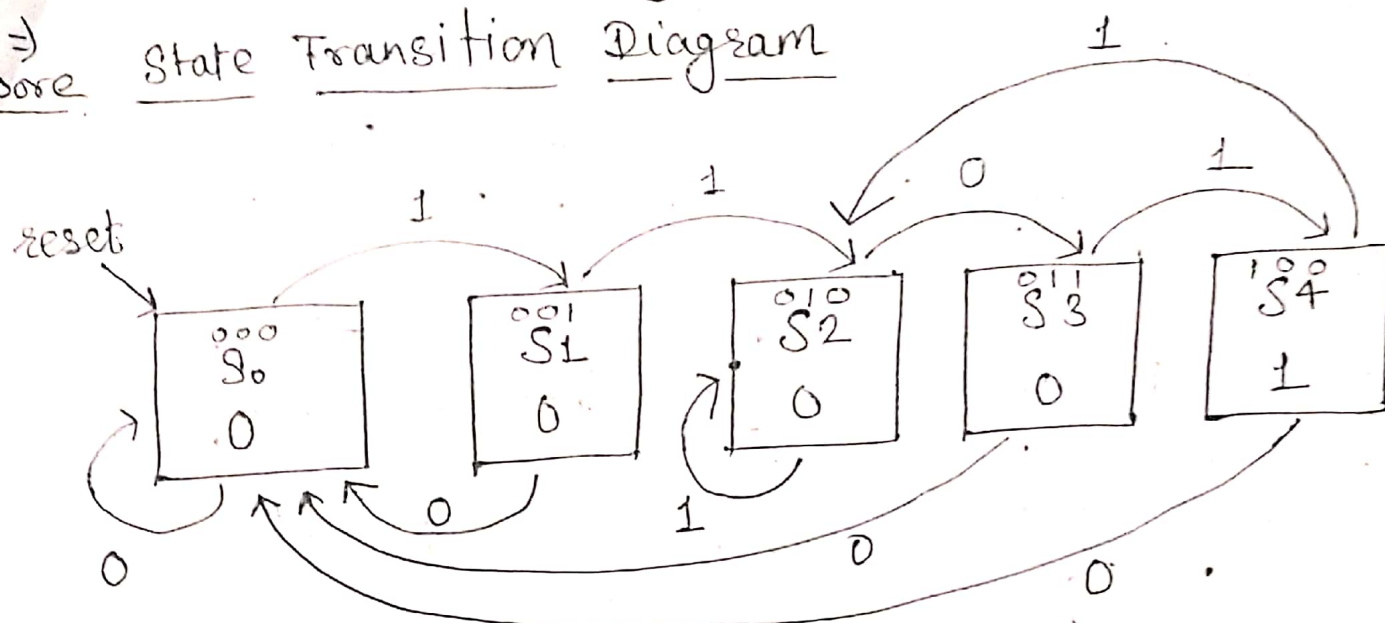
Q.1) Design using muxes and registers.

C_0	C_1	Operat
0	0	Stop Counting
0	1	Count up by 1
1	0	Count down by 2
1	1	Count up by 3



Q.2) Design Moore and Mealy FSMs that detects 1101.

⇒ Moore State Transition Diagram



T-ff Moore FSM detector (1101).

Current State			Inputs	Next State			Flipflop Inputs			Output
C_2	C_1	C_0	I_0	N_2	N_1	N_0	T_2	T_1	T_0	O_0
0	0	0	0	0	0	0	0	0	0	0
0	0	0	1	0	0	1	0	0	1	0
0	0	1	0	0	0	0	0	0	1	0
0	0	1	1	0	1	0	0	1	1	0
0	1	0	0	0	1	1	0	0	1	0
0	1	0	1	0	1	0	0	0	0	0
0	1	1	0	0	0	0	0	1	1	0
0	1	1	1	1	0	0	1	1	1	0
1	0	0	0	0	0	0	1	0	0	1
1	0	0	1	0	1	0	1	1	0	1

$C_2 C_1 \backslash C_0 I_0$ 00 01 11 10

00	0	0	0	0
01	0	0	1	0
11	x	x	x	x
10	1	1	x	x

$$T_2 = C_2 + C_0 C_1 I_0$$

$C_2 C_1 \backslash C_0 I_0$ 00 01 11 10

00	0	0	1	0
01	0	0	1	1
11	x	x	x	x
10	0	1	x	x

$$T_1 = C_1 C_0 + C_0 I_0 + C_2 I_0$$

$C_2 C_1 \backslash C_0 I_0$ 00 01 11 10

00	0	1	1	1
01	1	0	1	1
11	x	x	x	x
10	0	0	x	x

$$T_0 = C_0 + \bar{C}_2 \bar{C}_1 I_0 + C_1 \bar{I}_0$$

$C_2 C_1 \backslash C_0 I_0$ 00 01 11 10

00	0	0	0	0
01	0	0	0	0
11	x	x	x	x
10	1	1	x	x

$$O_0 = C_2$$

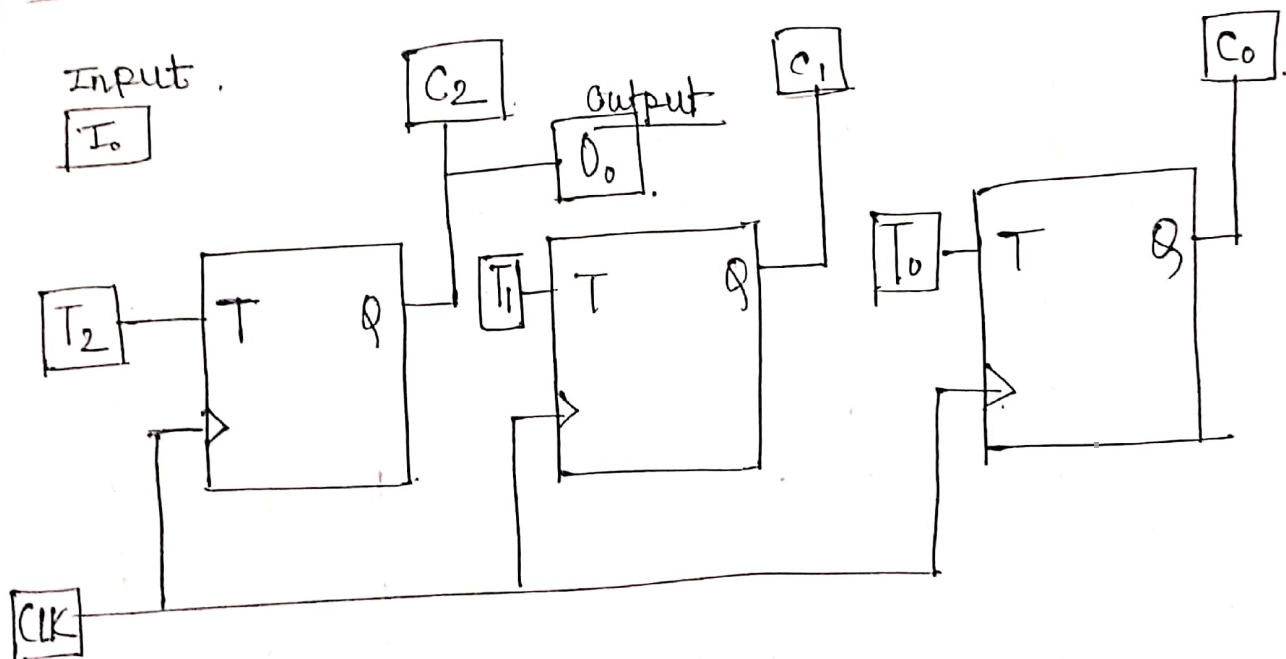


Fig. 1101 Moore FSM detector using T-ff.

Output is 1 if it detects 1101.

JK-ff Moore FSM detector (1101)

Current State			Inputs	Next State			flipflop Inputs				Output
C_2	C_1	C_0	I_0	N_2	N_1	N_0	$J_2 K_2$	$J_1 K_1$	$J_0 K_0$	O_0	
0	0	0	0	0	0	0	0 X	0 X	0 X	0	
0	0	0	1	0	0	1	0 X	0 X	1 X	0	
0	0	1	0	0	0	0	0 X	0 X	X 1	0	
0	0	1	1	0	1	0	0 X	1 X	X 1	0	
0	1	0	0	0	1	1	0 X	X 0	1 X	0	
0	1	0	1	0	1	0	0 X	X 0	0 X	0	
0	1	1	0	0	0	0	0 X	X 1	X 1	0	
0	1	1	1	1	0	0	1 X	X 1	X 1	0	
1	0	0	0	0	0	0	X 1	0 X	0 X	1	
1	0	0	1	0	1	0	X 1	1 X	0 X	1	

$C_2 \backslash C_1 I_0$	00	01	11	10
00	0	0	0	0
01	0	0	1	0
11	X	X	X	X
10	X	X	X	X

$$J_2 = C_1 C_0 I_0$$

$C_2 \backslash C_1 I_0$	00	01	11	10
00	X	X	X	X
01	X	X	X	X
11	X	X	X	X
10	1	1	X	X

$$K_2 = 1$$

$C_2 \backslash C_1 I_0$	00	01	11	10
00	0	0	1	0
01	X	X	X	X
11	X	X	X	X
10	0	1	X	X

$$J_1 = C_2 I_0 + C_0 I_0$$

$C_2 \backslash C_1 I_0$	00	01	11	10
00	X	X	X	X
01	0	0	1	1
11	X	X	X	X
10	X	X	X	X

$$K_1 = C_0$$

$C_2 \backslash C_1 I_0$	00	01	11	10
00	0	1	X	X
01	1	0	X	X
11	X	X	X	X
10	0	0	X	X

$$J_0 = C_1 I_0 + C_2 I_0$$

$C_2 \backslash C_1 I_0$	00	01	11	10
00	X	X	1	1
01	X	X	1	1
11	X	X	X	X
10	X	X	X	X

$$K_0 = 1$$

$$\text{Output } (O_0) = C_2$$

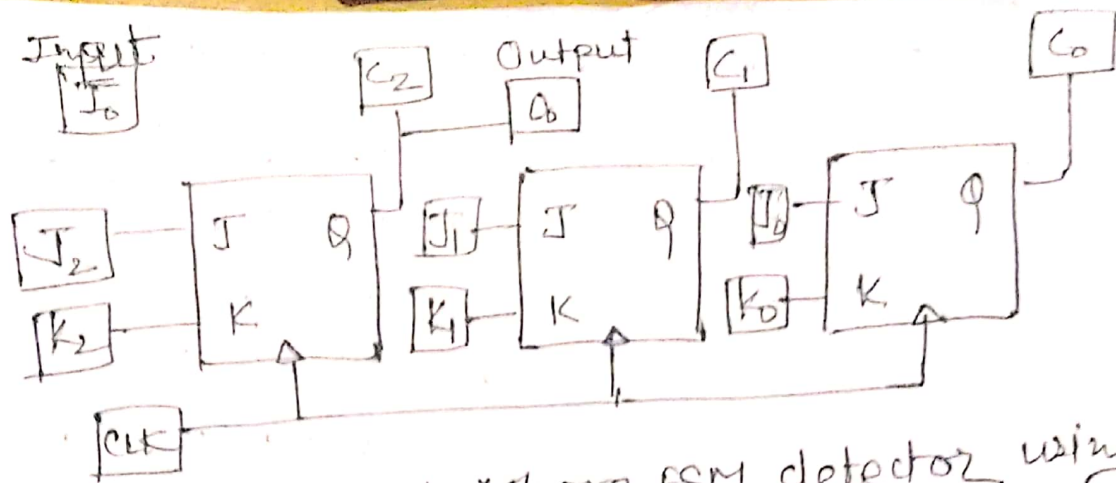
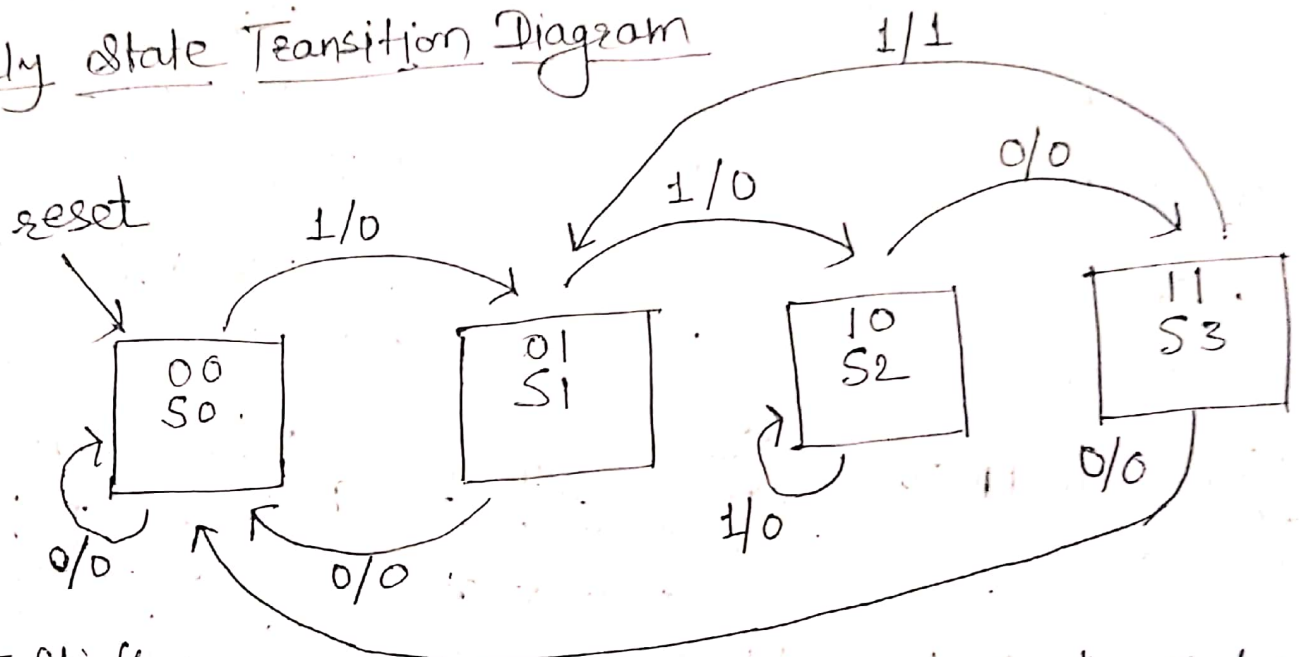


Fig. 1101 Moore FSM detector using JK-FF.
Output is 1 if it detects 1101.

Mealy State Transition Diagram



<u>T-flipflop</u>		Inputs I_0	Next State		flipflop Inputs		Output O_0
Current State	State		N_1	N_0	T_1	T_0	
C_1	C_0						
0	0	0	0	0	0	0	0
0	0	1	0	1	0	1	0
0	1	0	0	0	0	1	0
0	1	1	1	0	1	1	0
1	0	0	1	1	0	1	0
1	0	1	1	0	0	0	0
1	1	0	0	0	1	1	0
1	1	1	0	1	1	0	1

$C_1 C_0 \backslash I_0$	0	1
00	0	0
01	0	1
10	1	1
11	0	0

$$T_1 = C_1 C_0 I_0 + C_1 I_0$$

$C_1 C_0 \backslash I_0$	0	1
00	0	1
01	1	1
11	1	0
10	1	0

$$T_0 = C_1 \bar{I}_0 + \bar{C}_1 C_0 + \bar{C}_1 I_0$$

$C_1 C_0 \backslash I_0$	0	1
00	0	0
01	0	0
11	0	1
10	0	0

$$O_0 = C_1 C_0 I_0$$

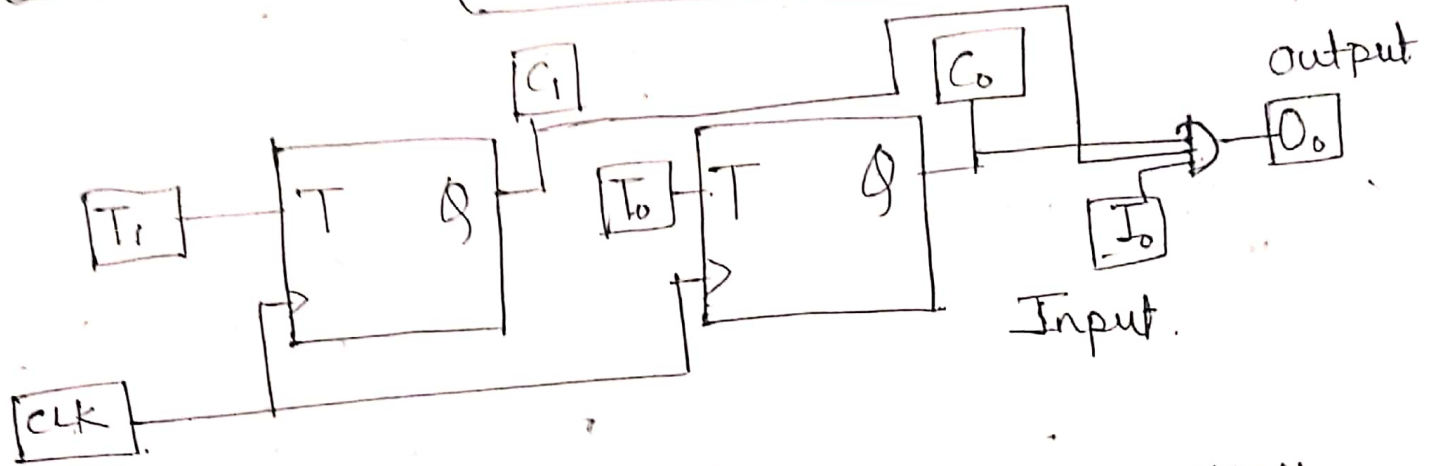


Fig. -1101 Mealy FSM detector using T flipflop.

<u>Jk. ff</u>		Inputs I_0	Next State		Flipflop Inputs				Output O_0
Current State			N_1	N_0	J_1	K_1	J_0	K_0	
C_1	C_0								
0	0	0	0	0	0	X	0	X	0
0	0	1	0	1	0	X	1	X	0
0	1	0	0	0	0	X	X	1	0
0	1	1	1	0	1	X	X	1	0
1	0	0	1	1	X	0	1	X	0
1	0	1	1	0	X	0	0	X	0
1	1	0	0	0	X	1	X	1	0
1	1	1	0	1	X	1	X	0	1

$C_0 \backslash I_0$	0	1
00	0	0
01	0	1
11	X	X
10	X	X

$$J_1 = C_0 I_0$$

$C_0 \backslash I_0$	0	1
00	X	X
01	X	X
11	1	1
10	0	0

$$K_1 = C_0$$

$C_0 \backslash I_0$	0	1
00	0	1
01	X	X
11	X	X
10	1	0

$$J_0 = \bar{C}_1 I_0 + \bar{I}_0 C_1$$

$$J_0 = C_1 \oplus I_0$$

$C_0 \backslash I_0$	0	1
00	X	X
01	1	1
11	1	0
10	X	X

$$K_0 = \bar{C}_1 + \bar{I}_0$$

$$O_0 = C_1 C_0 I_0$$

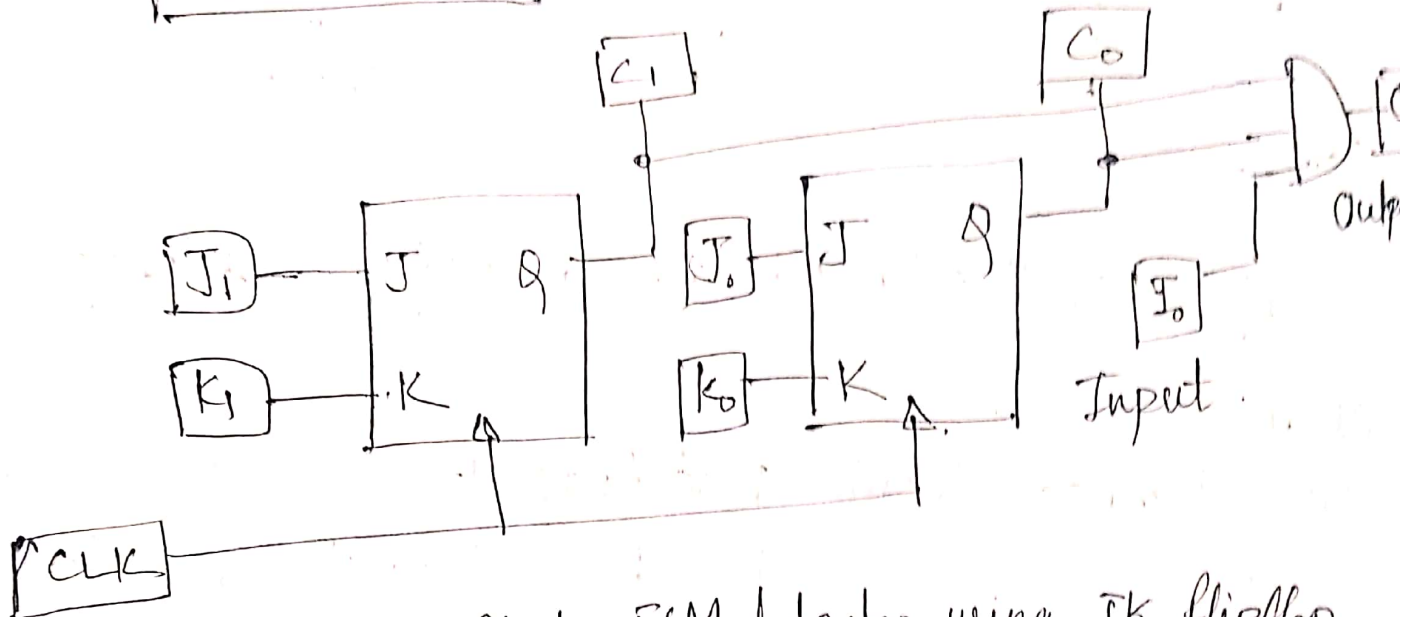


Fig. 1101 Mealy FSM detector using JK flipflop.

Q3) Average Temperature Calculator

Input Temperature .

