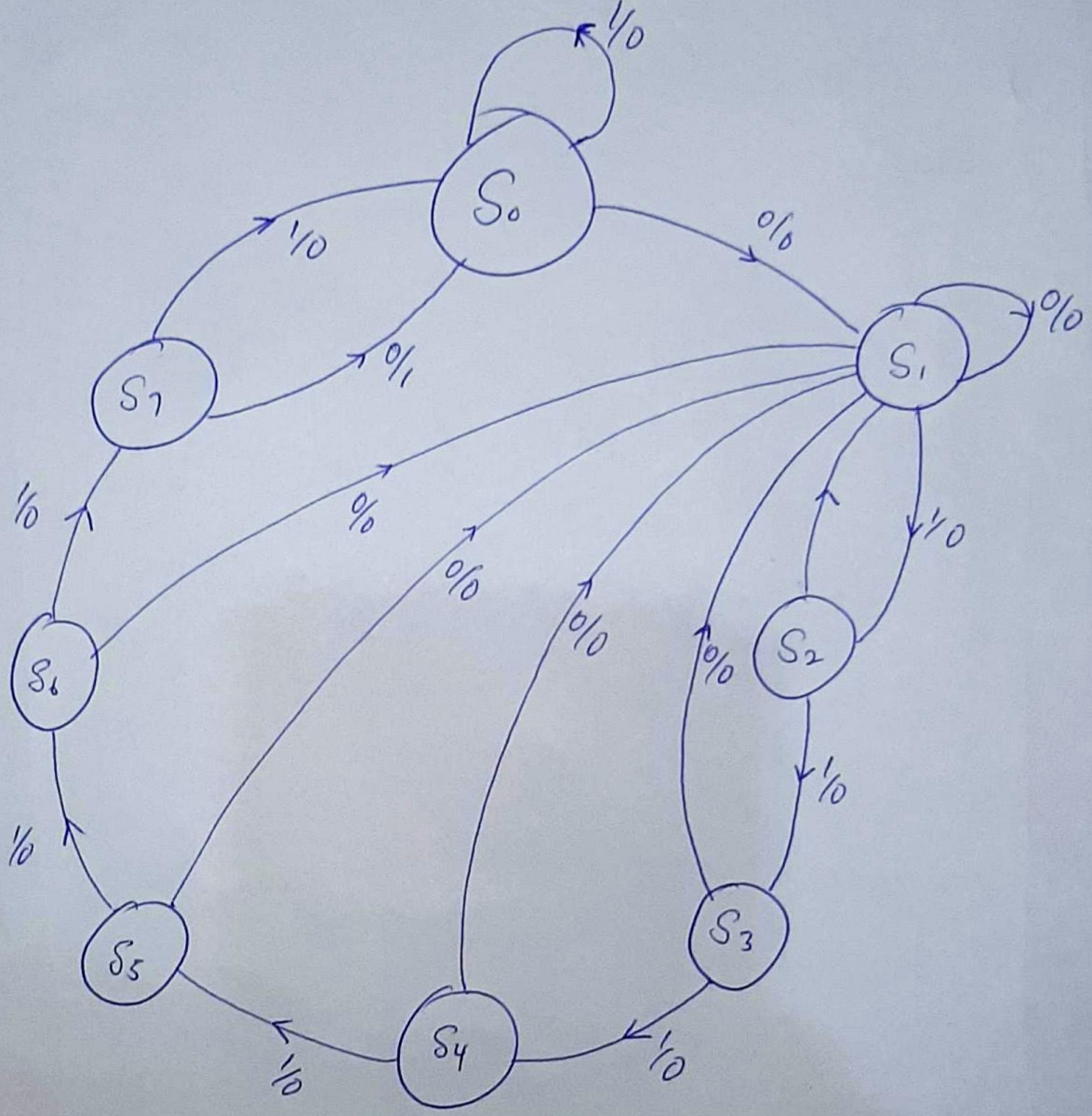
AL HASSAN ISSIFU - 52222021

STATE DIAGRAMS



JK EXCITATION TABLE

PS	NS	JK
0	0	0x
0	1	1x
1	0	x1
1	1	x0

STATE TABLE

State	Previous state	Next state		Output (Y)	
		x = 0	x = 1	x = 0	x = 1
	$Q_2\ Q_1\ Q_0$	$Q_2\ Q_1\ Q_0$	$Q_2\ Q_1\ Q_0$	y	y
S_0	0 0 0	0 0 1	0 0 0	0	0
S_1	0 0 1	0 0 1	0 1 0	0	0
S_2	0 1 0	0 0 1	0 1 1	0	0
S_3	0 1 1	0 0 1	1 0 0	0	0
S_4	1 0 0	0 0 1	1 0 1	0	0
S_5	1 0 1	0 0 1	1 1 0	0	0
S_6	1 1 0	0 0 1	1 1 1	0	0
S_7	1 1 1	0 0 0	0 0 0	1	0

KARNAUGH MAPS

J_2 map

Q_2Q_1 \ Q_0X	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_1 map

Q_2Q_1 \ Q_0X	00	01	11	10
00	0	0	1	0
01	X	X	X	X
11	X	X	X	X
10	0	0	1	0

J_0 map

Q_2Q_1 \ Q_0X	00	01	11	10
00	1	0	X	X
01	1	1	X	X
11	1	1	X	X
10	1	1	X	X

K_2 map

Q_2Q_1 \ Q_0X	00	01	11	01
00	X	X	X	X
01	X	X	X	X
11	1	0	1	1
10	1	0	0	1

K_1 map

Q_2Q_1 \ Q_0X	00	01	11	10
00	X	X	X	X
01	1	0	1	1
11	1	0	1	1
10	X	X	X	X

K_0 map

Q_2Q_1 \ Q_0X	00	01	11	10
00	X	X	1	0
01	X	X	1	0
11	X	X	1	0
10	X	X	1	0

EQUATIONS

$$J_0 = \bar{x} + Q_1 + Q_2$$

$$J_1 = Q_0 x$$

$$J_2 = Q_1 Q_0 x$$

$$K_0 = x + Q_2 Q_1$$

$$K_1 = \bar{x} + Q_0$$

$$K_2 = \bar{x} + Q_1 Q_0$$

~~$y = Q_2 Q_1 Q_0 0$~~

$$y = Q_2 Q_1 Q_0 \bar{x}$$

DECADE COUNTER DESIGN

Clock pulse	Q_3	Q_2	Q_1	Q_0
Initially	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
10 (recycle)	0	0	0	0

→ Q_1 changes when $Q_0 = 1$ and $Q_3 = 0$

→ Q_2 changes when Q_0 and Q_1 are both 1

→ Q_3 toggles if Q_0, Q_1, Q_2 are all 1 or $Q_3, Q_0 = 1$

$$J_1 = K_1 = Q_0 \bar{Q}_3$$

$$J_2 = K_2 = Q_0 Q_1$$

$$J_3 = K_3 = Q_0 Q_3 + Q_0 Q_1 Q_2$$

SEVEN SEGMENT DISPLAY DRIVER EQUATIONS

$$a = Q_3 + Q_1 + Q_2 Q_0 + \overline{Q_2}\,\overline{Q_0}$$

$$b = \overline{Q_2} + \overline{Q_1}\,\overline{Q_0} + Q_1 Q_0$$

$$c = Q_2 + \overline{Q_1} + Q_0$$

$$d = \overline{Q_2}\,\overline{Q_0} + Q_1 \overline{Q_0} + Q_2 \overline{Q_1} Q_0 + \overline{Q_2} Q_1 + Q_3$$

$$e = \overline{Q_2}\,\overline{Q_0} + Q_1 \overline{Q_0}$$

$$f = Q_3 + \overline{Q_2}\,\overline{Q_0} + Q_2 \overline{Q_1} + Q_2 \overline{Q_0}$$

$$g = Q_3 + Q_2 \overline{Q_1} + \overline{Q_2} Q_1 + Q_1 \overline{Q_0}$$