

DLD Project

Alarm Clock

* 4-bit up counter (synchronous) working for the clock

Present State				Next State				J _D	K _D	J _C	K _C	J _B	K _B	J _A	K _A
Q _D	Q _C	Q _B	Q _A	Q _D ⁺	Q _C ⁺	Q _B ⁺	Q _A ⁺								
0	0	0	0	0	0	0	1	0	x	0	x	0	x	1	x
0	0	0	1	0	0	1	0	0	x	0	x	1	x	x	1
0	0	1	0	0	0	1	1	0	x	0	x	x	0	1	x
0	0	1	1	0	1	0	0	0	x	1	x	x	1	x	1
0	1	0	0	0	1	0	1	0	x	x	0	0	x	1	x
0	1	0	1	0	1	1	0	0	x	x	0	1	x	x	1
0	1	1	0	0	1	1	1	0	x	x	0	x	0	1	x
0	1	1	1	1	0	0	0	1	x	x	1	x	1	x	1
1	0	0	0	1	0	0	1	x	0	0	x	0	x	1	x
1	0	0	1	0	0	0	0	x	1	0	x	0	x	x	1
1	0	1	0	0	0	0	0	x	1	0	x	x	1	0	x
1	0	1	1	0	0	0	0	x	1	0	x	x	1	x	1
1	1	0	0	0	0	0	0	x	1	x	1	0	x	0	x
1	1	0	1	0	0	0	0	x	1	x	1	0	x	x	1
1	1	1	0	0	0	0	0	x	1	x	1	x	1	0	x
1	1	1	1	0	0	0	0	x	1	x	1	x	1	x	1

kmaps for the up counter

(For J_D K_D)

Q _B Q _A	00	01	10	11
Q _D Q _C 00	0	0	0	0
01	0	0	1	0
11	X	X	X	X
10	X	X	X	X

$$J_D = Q_C Q_B Q_A$$

Q _B Q _A	00	01	11	10
Q _D Q _C 00	X	X	X	X
01	X	X	X	X
11	1	1	1	1
10	1	1	1	1

$$K_D = Q_C + Q_A + Q_B$$

(For J_C And K_C)

Q _B Q _A	00	01	11	10
Q _D Q _C 00	0	0	1	0
01	X	X	X	X
11	X	X	X	X
10	0	0	0	0

$$J_C = Q_A Q_B \overline{Q_D}$$

Q _B Q _A	00	01	11	10
Q _D Q _C 00	X	X	X	X
01	0	0	1	0
11	1	1	1	1
10	X	X	X	X

$$K_C = Q_A Q_B + Q_D$$

$Q_B Q_A$	00	01	11	10
00	0	1	X	X
01	0	1	X	X
10	0	0	X	X
11	0	0	X	X

$$J_B = \bar{Q}_D Q_A$$

$Q_B Q_A$	00	01	11	10
00	X	X	1	0
01	X	X	1	0
11	X	X	1	1
10	X	X	1	1

$$K_B = Q_A + Q_D$$

$Q_D Q_C$	00	01	11	10
00	X	1	1	X
01	X	1	1	X
11	X	1	1	X
10	X	1	1	X

$$K_A = 1$$

$Q_D Q_C$	00	01	11	10
00	1	X	X	1
01	1	X	X	1
11	0	X	X	0
10	1	X	X	0

$$J_A = \bar{Q}_D + \bar{Q}_C + \bar{Q}_B$$

Logic diagram

$$a = A + c + BD + \bar{B}\bar{D}$$

$$b = \bar{B} + cD + \bar{C}\bar{D}$$

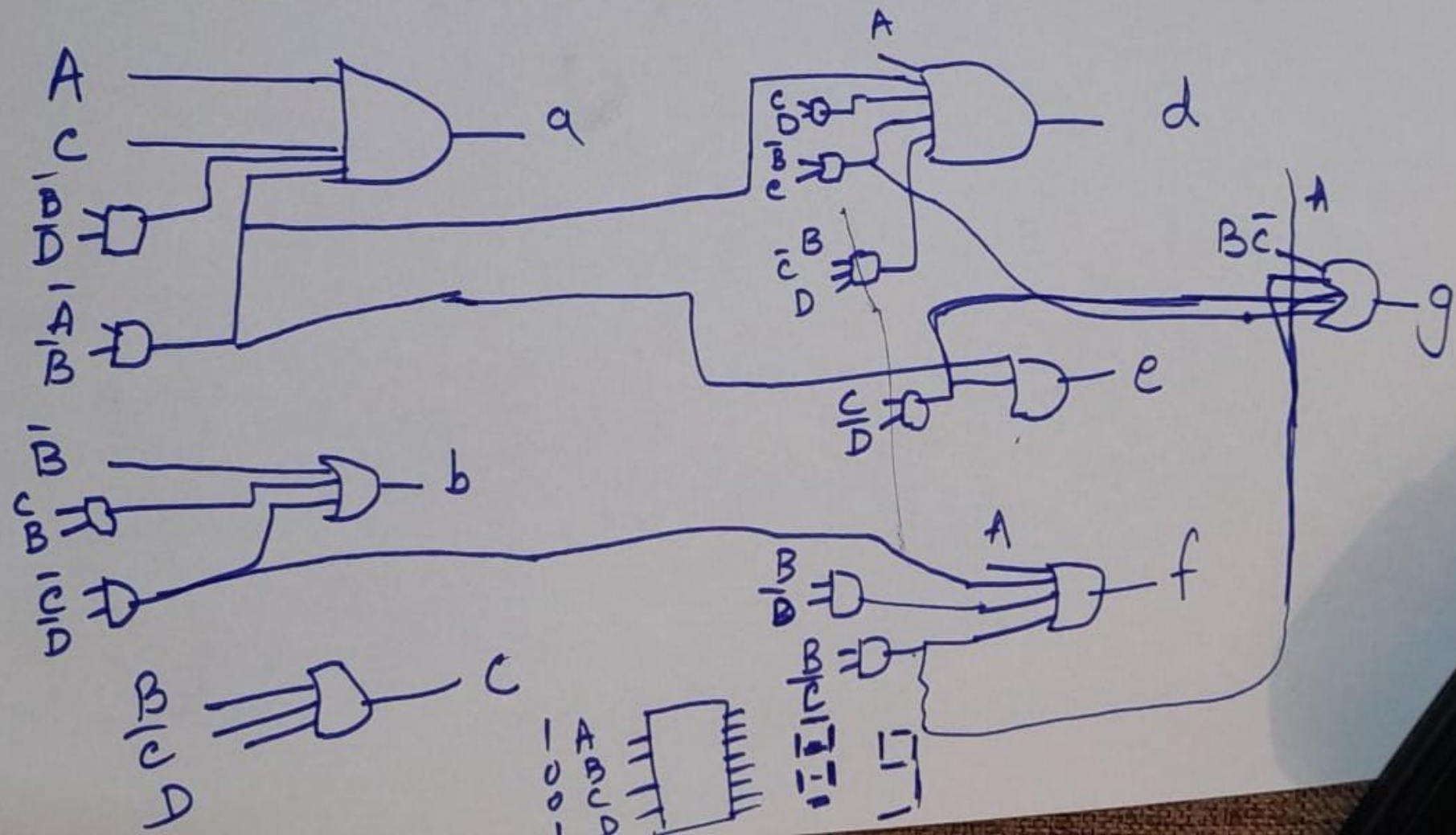
$$c = B + \bar{C} + D$$

$$d = A + \bar{B}\bar{D} + c\bar{D} + \bar{B}c + B\bar{C}D$$

$$e = \bar{B}\bar{D} + c\bar{D}$$

$$f = A + \bar{C}\bar{D} + B\bar{D}$$

$$g = A + B\bar{C} + \bar{B}C + c\bar{D}$$



7 segment display

	A	B	C	D	a	b	c	d	e	f	g
(0)	0	0	0	0	1	1	1	1	1	1	0
(1)	0	0	0	1	0	1	1	0	0	0	0
(2)	0	0	1	0	1	1	0	1	1	0	1
(3)	0	0	1	1	1	1	1	1	0	0	1
(4)	0	1	0	0	0	1	1	0	0	1	1
(5)	0	1	0	1	1	0	1	1	0	1	1
(6)	0	1	1	0	1	0	1	1	1	1	1
(7)	0	1	1	1	1	1	1	0	0	0	0
(8)	1	0	0	0	1	1	1	1	1	1	1
(9)	1	0	0	1	1	1	1	1	0	1	1

AB \ CD	00	01	11	10
00	1	0	1	1
01	0	1	1	
11	X	X	X	X
10	1		X	X

$$a = C + A + \bar{B}\bar{D} + BD$$

AB \ CD	00	01	11	10
00	1	1	1	1
01	1	0	1	0
11	X	X	X	X
10	1	1	X	X

$$b = \bar{B} + CD + \bar{C}\bar{D}$$

c)

AB \ CD	00	01	11	10
00	1	1	1	0
01	1	1	1	1
11	X	X	X	X
10		1	X	X

$$c = \bar{A} + \bar{B} + \bar{C} + D$$

d)

AB \ CD	00	01	11	10
00	1	0	1	1
01	0	1	0	1
11	X	X	X	X
10	1	1	X	X

$$d = \bar{B}\bar{D} + A + CD$$

e)

AB \ CD	00	01	11	10
00	1	0	0	1
01	0	0	0	1
11	X	X	X	X
10	1	0	X	X

$$e = \bar{B}\bar{D} + \bar{C}\bar{D}$$

f)

AB \ CD	00	01	11	10
00	1	0	0	0
01	1	1	0	1
11	X	X	X	X
10	1	1	X	X

$$f = A + \bar{C}\bar{D} + B\bar{D} + B\bar{C}$$

g)

AB \ CD	00	01	11	10
00	0	0	1	1
01	1	1	0	1
11	X	X	X	X
10	1	1	X	X

$$g = A + B\bar{C} + \bar{B}C + C\bar{D}$$