BIRZEIT UNIVERSITY

FACULTY OF INFORMATION TECHNLOGY

COMPUTER SYSTEMS ENGINEERING DEPARTMENT

DIGITAL ELECTRONICS AND COMPUTER ORGANIZATION LAB (ENCS 211)

Prelab - Experiment VI

Counters, Displays and Drivers

Prepared for: Ms. Bayan Nimer
Teaching Assistant: Mus'ab B'airat

Student Name: Baibers Qasem
Student Number: 1082092

Due to: 18-11-2013

1. Create the truth table describing the function of a BCD to seven-segment decoder.

The lower case letters, a-g, represent the segments on the display while the upper case letters A-D represent the BCD input. Observe that A is the lest-significant bit of the BCD input. The seven output of the decoder (a, b, c, d, e, f, g):

Num.	Inputs				Outputs						
	D	C	B	A	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	0	0	1	1

2. Make K-maps for each of the seven outputs. Reduce the K-maps to obtain a minimal sum of products expression for each segment.

a

DC \ BA	00	01	11	10
00	1	0	1	1
01	0	1	1	1
11	x	x	x	x
10	1	1	x	x

b

DC \ BA	00	01	11	10
00	1	1	1	1
01	1	0	1	0
11	x	x	x	x
10	1	1	x	x

c

DC \ BA	00	01	11	10
00	1	1	1	0
01	1	1	1	1
11	x	x	x	x
10	1	1	x	x

d

DC \ BA	00	01	11	10
00	1	0	1	1
01	0	1	0	1
11	x	x	x	x
10	1	0	x	x

e

DC \ BA	00	01	11	10
00	1	0	0	1
01	0	0	0	1
11	x	x	x	x
10	1	0	x	x

f

DC \ BA	00	01	11	10
00	1	0	0	0
01	1	1	0	1
11	x	x	x	x
10	1	1	x	x

g

DC \ BA	00	01	11	10
00	0	0	1	1
01	1	1	0	1
11	x	x	x	x
10	1	1	x	x

a=D+B+CA+C'A'

b=C'+BA+B'A'

c=B'+A+C

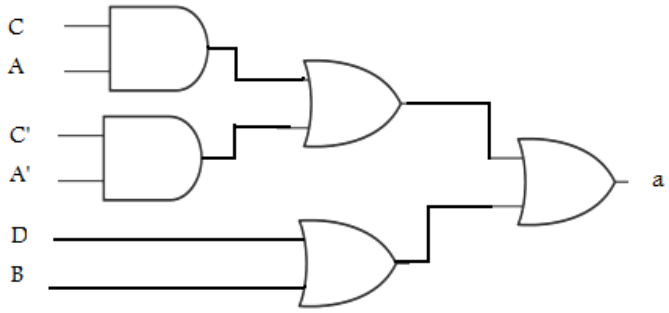
d=C'A'+C'B+BA'+CB'A

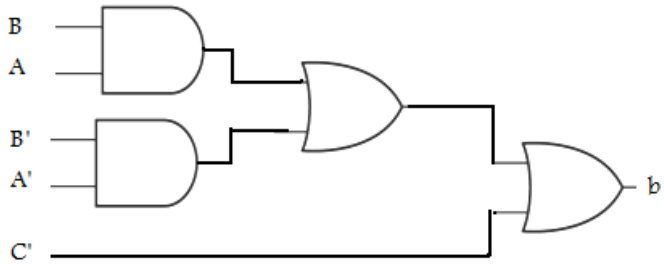
e=C'A'+BA'

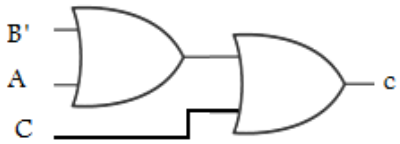
f=D+B'A'+CA'+CB'

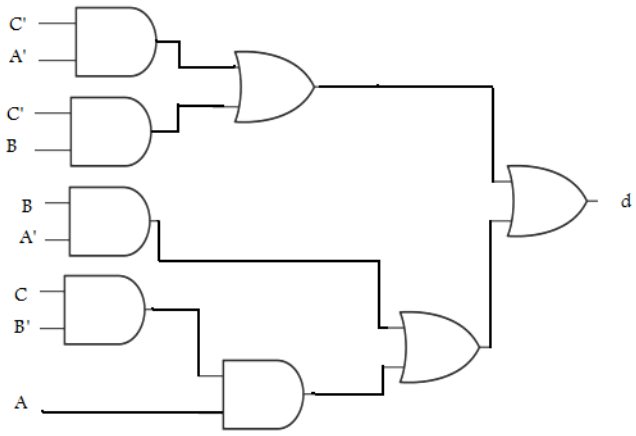
g=D+C'B+CA'+CB'

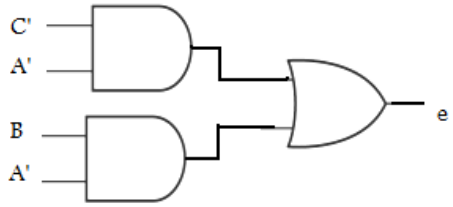
3. For each K-map, draw the gate level circuits that the equation represents.

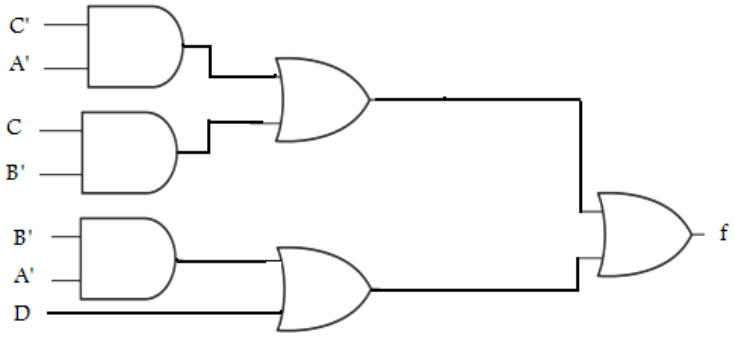


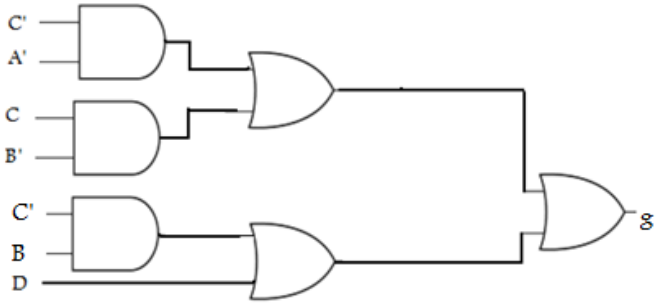







C'
A'
B
A'
e


C'
A'
C
B'
B'
A'
D
f


C'
A'
C
B'
C'
B
D
g

4. What is the appropriate display type (common anode/common cathode) that must be used with 7447 display decoder? Why?

I must use the cathode display type because the inputs of the display are logic high.

5. Why pin 12 must be connected to pin 1? What happen if we connect pin 1 to the clock and disconnect pin 12?

We connect pin 12 to pin 1 because this counter is a ripple counter, so the clock input (pin 1) must not be connected to the pulse directly it must be connected to pin 12:

Number	D	C	B	A
0	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
0	0	0	0	0

From this table we notice that B complements when A goes from 1 to 0 and D is 0 , so the clock input of B must be connected to Q(A) (pin12). If we connect pin 1 to the clock directly, Q(B) will complement every pulse and the sequence will be strange like the following :

Number	D	C	B	A
0	0	0	0	0
3	0	0	1	1
0	0	0	0	0
3	0	0	1	1
4	0	1	0	0
7	0	1	1	1
4	0	1	0	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
0	0	0	0	0