CMPEN 271_Homework #5

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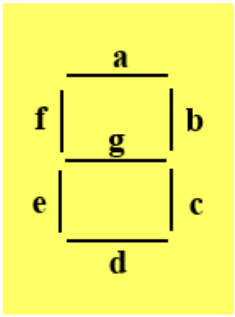
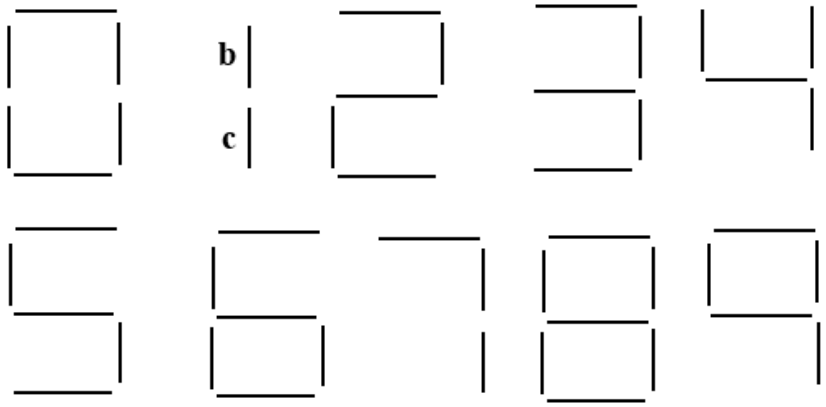
Homework Description:

BCD-to7-segment (HW #5)

Design a minimum **BCD to 7-segment LED display decoder circuit**. The input is a 4-bit BCD value, and there are 7 outputs – one output for each segment of the 7-segment display. The circuit should generate the appropriate display on the 7-segment display for each input BCD value. If the output for a given display segment is 1, then assume the display segment will be illuminated, otherwise the segment will be dark. Use output labels as provided below. Include truth table, K-maps, circuit.



7-segment LED display.



See MultiSim example

Solution:

For a 4-bit BCD value: 0000, 0001, 0010, 0011, 0100, 0101, 0110, 0111, 1000, 1001. These nine number matches 0 to 9 which are what 7-segment LED display can do. The four bits can be represented by A, B, C, D.

Based on the feature of 7-segment LED display, there are seven letters using: a, b, c, d, e, f, g.

The first step is making a truth table.

Truth table:

Msb lsb

A	B	C	D		a	b	c	d	e	f	g
0	0	0	0		1	1	1	1	1	1	0

0	0	0	1		0	1	1	0	0	0	0
0	0	1	0		1	1	0	1	1	0	1
0	0	1	1		1	1	1	1	0	0	1
0	1	0	0		0	1	1	0	0	1	1
0	1	0	1		1	0	1	1	0	1	1
0	1	1	0		1	0	1	1	1	1	1
0	1	1	1		1	1	1	0	0	0	0
1	0	0	0		1	1	1	1	1	1	1
1	0	0	1		1	1	1	1	0	1	1

K-map:

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

	C'D'	C'D	CD	CD'
A'B'	1	0	1	1
A'B	0	1	1	1
AB	x	x	x	X
AB'	1	1	x	x

b = B' + C'D' + CD

	C'D'	C'D	CD	CD'
A'B'	1	0	1	1
A'B	1	0	1	0
AB	x	x	x	X
AB'	1	1	x	x

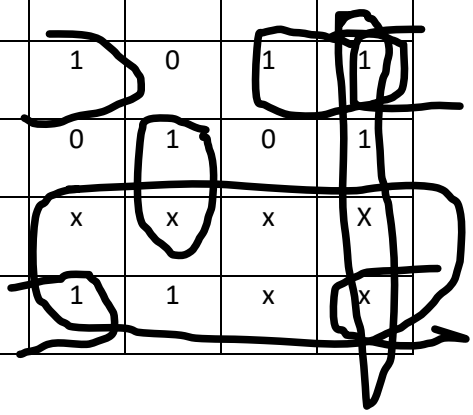
c = B + C' + D

	C'D'	C'D	CD	CD'
A'B'	1	1	1	0
A'B	1	1	1	1
AB	x	x	x	X

AB’	1	1	x	x

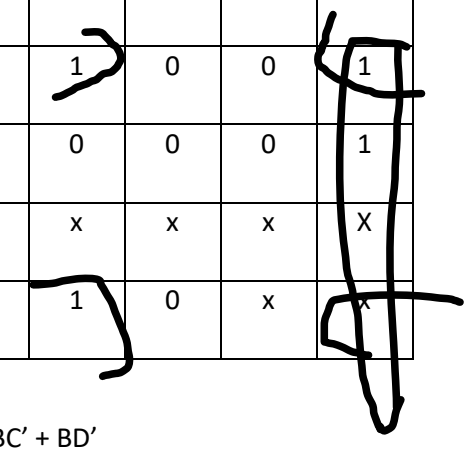
d = B’D’ + CD’ + BC’D + B’C + A

	C’D’	C’D	CD	CD’
A’B’	1	0	1	1
A’B	0	1	0	1
AB	x	x	x	X
AB’	1	1	x	x



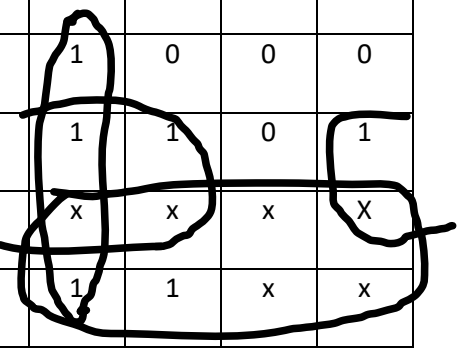
e = B’D’ + CD’

	C’D’	C’D	CD	CD’
A’B’	1	0	0	1
A’B	0	0	0	1
AB	x	x	x	X
AB’	1	0	x	x



f = A + C’D’ + BC’ + BD’

	C’D’	C’D	CD	CD’
A’B’	1	0	0	0
A’B	1	1	0	1
AB	x	x	x	X
AB’	1	1	x	x



g = A + BC’ + B’C + CD’

	C’D’	C’D	CD	CD’
A’B’	0	0	1	1
A’B	1	1	0	1
AB	x	x	x	X
AB’	1	1	x	x

Circuit: