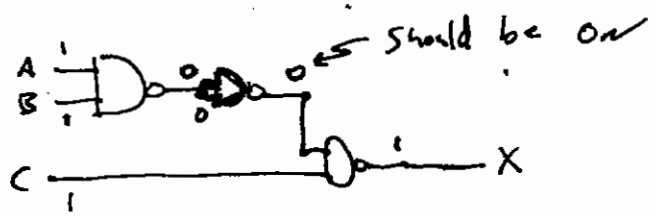
5-42



The NAND Gate at Pins 4, 5, + 6 IS NOT OUTPUTING THE CORRECT VALUE ⇒ EITHER THE IC IS BAD OR THERE IS A BAD CONNECTION BETWEEN PIN 3 AND PINS 4 & 5.

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HW 10 Problem 5-40 EE 313 2/3

Design a logic device that takes a 4 bit binary number as input and will drive a 7 segment display to display a Hexadecimal or BCD number. Start with a truth table and then use Karnaugh Maps to find the simplest logical expression for each LED of the display. The desired characters are shown in Figure 1 and the name of each segment is shown in Figure 2.

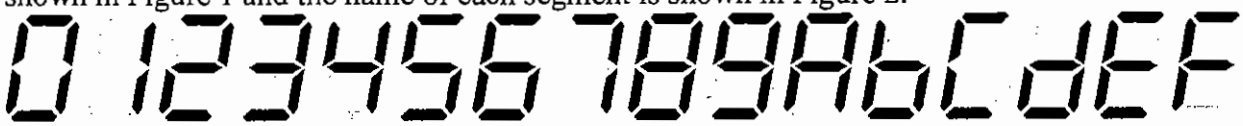


Figure 1 – Hexadecimal/BCD number representation using a 7 segment display.

Hex	x3	x2	x1	x0	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
A	1	0	1	0	1	1	1	0	1	1	1
B	1	0	1	1	0	0	1	1	1	1	1
C	1	1	0	0	1	0	0	1	1	1	0
D	1	1	0	1	0	1	1	1	1	0	1
E	1	1	1	0	1	0	0	1	1	1	1
F	1	1	1	1	1	0	0	0	1	1	1

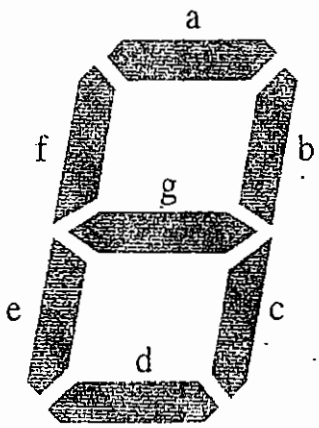
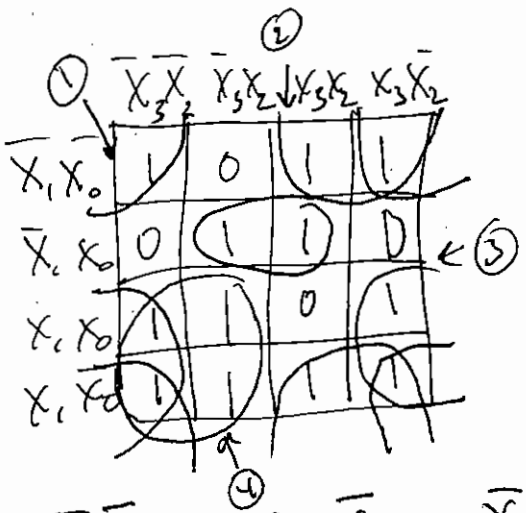


Figure 2- 7 Segment Display Names



$$a = \bar{X}_2\bar{X}_0 + X_3\bar{X}_0 + \bar{X}_2X_1 + \bar{X}_3X_1 + X_2\bar{X}_1X_0$$

b

X_1X_0 \ X_3X_2	00	01	11	10
00	1	1	1	0
01	1	0	1	1
11	1	1	0	0
10	1	0	1	0

$b = X_3X_2 + \bar{X}_3X_1X_0 + \bar{X}_3\bar{X}_1\bar{X}_0 + X_3X_2\bar{X}_0 + X_3\bar{X}_1X_0$

c

X_1X_0 \ X_3X_2	00	01	11	10
00	1	1	0	1
01	1	1	1	1
11	1	1	0	1
10	0	1	0	1

$c = \bar{X}_3\bar{X}_1 + \bar{X}_3X_0 + \bar{X}_1X_0 + \bar{X}_3X_2 + X_3\bar{X}_2$

d

X_1X_0 \ X_3X_2	00	01	11	10
00	1	0	1	1
01	0	1	1	1
11	1	0	0	1
10	1	1	1	0

e

X_1X_0 \ X_3X_2	00	01	11	10
00	1	0	1	1
01	0	0	1	0
11	0	0	1	1
10	1	1	1	1

f

X_1X_0 \ X_3X_2	00	01	11	10
00	1	1	1	1
01	0	1	0	1
11	0	0	1	1
10	0	1	1	1

g

X_1X_0 \ X_3X_2	00	01	11	10
00	0	1	0	1
01	0	1	1	1
11	1	0	1	1
10	1	1	1	1