DEPARTMENT OF MECHANICAL & AEROSPACE ENGINEERING UNIVERSITY AT BUFFALO MAE 476/576 Mechatronics Spring 2003

Mini Assignment 4 – Solution

1. Design a Gray Code to BCD converter by the following procedures:

a. Write down the truth table of the converter.

Binary Coded Decimal (BCD) is a way to store the decimal numbers in binary form. The number representation requires 4 bits to store every decimal digit (from 0 to 9). Since there are 10 different combinations of BCD, we need at least a 4-bit Gray Code to create sufficient number of these combinations.

The truth table is:

Decimal	Gray Code				BCD			
	A	В	C	D	W	X	Y	Z
0	0	0	0	0	0	0	0	0
1	0	0	0	1	0	0	0	1
2	0	0	1	1	0	0	1	0
3	0	0	1	0	0	0	1	1
4	0	1	1	0	0	1	0	0
5	0	1	1	1	0	1	0	1
6	0	1	0	1	0	1	1	0
7	0	1	0	0	0	1	1	1
8	1	1	0	0	1	0	0	0
9	1	1	0	1	1	0	0	1
10	1	1	1	1	D	D	D	D
11	1	1	1	0	D	D	D	D
12	1	0	1	0	D	D	D	D
13	1	0	1	1	D	D	D	D
14	1	0	0	1	D	D	D	D
15	1	0	0	0	D	D	D	D

b. Apply Karnaugh Map to look for the minimized logic expression.

Karnaugh Map for W:

			,		4	
		00	01	11	10	
	00	0	0	1	D	
	01	0	0	1	D	
С	11	0	0	D	D	
	10	0	0	D	D	·
·	'		[3	-	•

Minimal Expression for W:

W = A

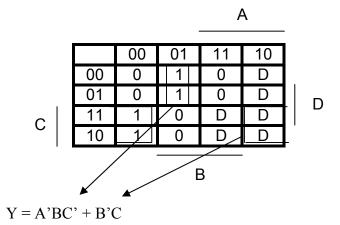
Karnaugh Map for X:

				<i>F</i>	4	
		00	01	11	10	
	00	0	1	0	D	
	01	0	1	0	D	D
С	11	0	1	D	D	
	10	0	1	D	D	·
·					-	•
			E	3		

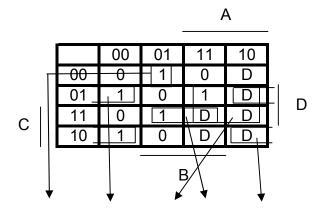
Minimal Expression for X:

X = A'B

Karnaugh Map for Y:



Karnaugh Map for Z:



$$Z = A'BC'D' + B'C'D + AD + BCD + B'CD'$$

c. Implement the logic gates by using Circuit Maker.

