Nile High Institute For
Engineering and Technology
Department: Communication
Level: 200
Type: Mid-Term

Course-Title: Digital & Logic Circuit
Course-Code: ELE 221
Date: /11/2015
Total Marks: 30 degree
Time allowed: 1 hour(s)

Question-1 (10 Points)

A. A **16-bit** register contains the following: **0111100101000101** Interpret the contents as:

- BCD number → 7945
- Binary number → 0111 1001 0100 0101

B. Simplify the following Boolean equation using Boolean theorems

$Y = \bar{A}\bar{B} + \bar{A}B\bar{C} + (\overline{A + \bar{C}})$

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

$$= \bar{A}(\bar{B} + B\bar{C}) + \bar{A}C = \bar{A}(\bar{B}+B)(\bar{B}+\bar{C}) + \bar{A}C$$

$$= \bar{A}\bar{B} + \bar{A}\bar{C} + \bar{A}C = \bar{A}\bar{B} + \bar{A}(C+\bar{C})$$

$$= \bar{A}\bar{B} + \bar{A} = \bar{A}(\bar{B}+1) = \bar{A}$$

C. Find the sum-of-product function of

$f(w,x,y,z) = wy + \bar{x}z + \bar{w}y\bar{z}$

$$= \sum(1,2,3,6,9,10,11,14,15)$$

$$= \bar{w}\bar{x}\bar{y}z + \bar{w}\bar{x}y\bar{z} + \bar{w}\bar{x}yz + \bar{w}xy\bar{z} + w\bar{x}\bar{y}z + w\bar{x}y\bar{z} + w\bar{x}yz + wxy\bar{z} + wxyz$$

Question-2 (10 Points)

A. Simplify the Boolean function ***F*** together with the don't care conditions ***d*** in (1) sum-of-products form

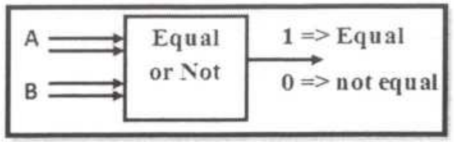
$F(w,x,y,z) = \sum(0,1,2,3,7,8,10)$

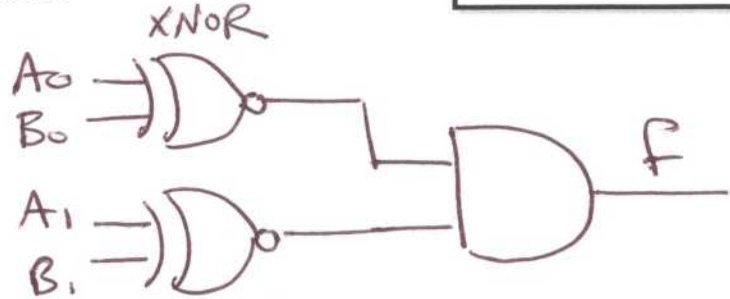
$d(w,x,y,z) = \sum(5,6,11,15)$

wx \ yz	00	01	11	10
00	1	1	1	1
01		X	1	X
11			X	
10	1		X	1

$F = \bar{X}\bar{Z} + \bar{W}Z$

B. Design a circuit to perform the comparison between two 2-bit numbers, if they are equal, the output will be one, otherwise the output will be zero



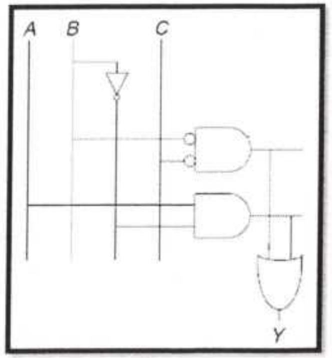


A_1A_0 \ B_1B_0	00	01	11	10
0 0	1			
0 1		1		
1 1			1	
1 0				1

$F = \bar{A}_1\bar{A}_0\bar{B}_1\bar{B}_0 + \bar{A}_1A_0\bar{B}_1B_0 + A_1A_0B_1B_0 + A_1\bar{A}_0B_1\bar{B}_0$

Question-3 (10 Points)

A. Find the expression for the Boolean function Y



$Y = A\bar{B} + \bar{B}\bar{C}$

B. Two 2-bit numbers are to be added. Design a circuit with the two numbers as inputs and their sum is the output

Best wishes
Dr. Mostafa Elhosseini

Q3-B

A_1	A_0	B_1	B_0	C_2	C_1	C_0
0	0	0	0	0	0	0
0	0	0	1	0	0	1
0	0	1	0	0	1	0
0	0	1	1	0	1	1
0	1	0	0	0	0	1
0	1	0	1	0	1	0
0	1	1	0	0	1	1
0	1	1	1	1	0	0
1	0	0	0	0	1	0
1	0	0	1	0	1	1
1	0	1	0	1	0	0
1	0	1	1	1	0	1
1	1	0	0	0	1	1
1	1	0	1	1	0	0
1	1	1	0	1	0	1
1	1	1	1	1	1	0

A_1A_0 \ B_1B_0	00	01	11	10
00				
01			1	
11		1	1	1
10			1	1

$$\Rightarrow C_2 = A_1B_1 + A_0B_1B_0$$

A_1A_0 \ B_1B_0	00	01	11	10
00			1	1
01		1		1
11	1		1	
10	1	1		

$$\Rightarrow C_1 = \overline{A_1}\,\overline{A_0}B_1 + \overline{A_1}B_1\overline{B_0} + A_1\overline{A_0}\,\overline{B_1} + A_1\overline{B_1}\,\overline{B_0} + \overline{A_1}\,\overline{A_0}\,\overline{B_1}B_0 + A_1A_0B_1B_0$$

A_1A_0 \ B_1B_0	00	01	11	10
00		1	1	
01	1			1
11	1			1
10		1	1	

$$C_0 = A_0\overline{B_0} + \overline{A_0}B_1$$