

HACETTEPE UNIVERSITY
DEPARTMENT OF COMPUTER ENGINEERING
BBM231 LOGIC DESIGN

Homework 1 (For all sections)

Assigned : 22.10.2018

Due : 05.11.2018

Hand in your homework solutions in class.

QUESTIONS:

Q1. Convert the following decimal values to

8-bit Signed magnitude : $(+24)_{10} = (0001_1000)_2$ $(-24)_{10} = (1001_1000)_2$

8-bit 1's complement : $(+24)_{10} = (0001_1000)_2$ $(-24)_{10} = (1110_0111)_2$

8-bit 2's complement : $(+24)_{10} = (0001_1000)_2$ $(-24)_{10} = (1110_1000)_2$

Q2. You are given the numbers: 01010000 and 11101111. What are the values of these number in decimal if they are represented by:

Signed magnitude : $(01010000)_2 = (+80)_{10}$ $(11101111)_2 = (-111)_{10}$

One's complement : $(01010000)_2 = (+80)_{10}$ $(11101111)_2 = (-16)_{10}$

Two's complement : $(01010000)_2 = (+80)_{10}$ $(11101111)_2 = (-17)_{10}$

Q3. After converting to 8-bit binary, subtract the following numbers using complements:

$(+20)_{10} = (0001_0100)_2$ $(+15)_{10} = (0000_1111)_2$

$(-20)_{10} = (1110_1100)_2$ $(-15)_{10} = (1111_0001)_2$

20-15=?

15-20=?

$$\begin{array}{r} 0001_0100 \\ + 1111_0001 \\ \hline 0000_0101 \text{ (+5)} \end{array}$$

$$\begin{array}{r} 0000_1111 \\ + 1110_1100 \\ \hline 1111_1011 \text{ (-5)} \end{array}$$

Q4. Reduce the following Boolean expressions to the indicated number of literals:

a. $F = A'C' + ABC + AC'$ (to three literals)

$$A'C' + ABC + AC' = C' + ABC = (C + C')(C' + AB) = AB + C'$$

b. $F = A'B(D' + C'D) + B(A + A'CD)$ (to one literal)

$$\begin{aligned} A'B(D' + C'D) + B(A + A'CD) &= B(A'D' + A'C'D + A + A'CD) \\ &= B(A'D' + A + A'D(C + C')) = B(A + A'(D' + D)) = B(A + A') = B \end{aligned}$$

c. $F = ABCD + A'BD + ABC'D$ (to two literals)

$$ABCD + A'BD + ABC'D = ABD + A'BD = BD$$

Q4. You are given the function $F(x,y,z) = xy + xy' + y'z$.

- Fill the truth table.
- Write the function in sum-of-minterms form.
- Write the function in product-of-maxterms form.

x	y	z	F
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	1

b) $F = x'y'z + xy'z' + xy'z + xyz' + xyz = \sum(1,4,5,6,7)$

c) $F = (x+y+z)(x+y'+z)(x+y'+z') = \prod(0,2,3)$

Q6. Express the following function as a sum-of-minterms and as a product-of-maxterms:

$$F(A,B,C,D) = B'D + A'D + BD$$

A	B	C	D	F	m
0	0	0	0	0	0
0	0	0	1	1	1
0	0	1	0	0	2
0	0	1	1	1	3
0	1	0	0	0	4
0	1	0	1	1	5
0	1	1	0	0	6
0	1	1	1	1	7
1	0	0	0	0	8
1	0	0	1	0	9
1	0	1	0	0	10
1	0	1	1	1	11
1	1	0	0	0	12
1	1	0	1	1	13
1	1	1	0	0	14
1	1	1	1	1	15

$F = \sum(1,3,5,7,11,13,15)$

$F = \prod(0,2,4,6,8,9,10,12,14)$