

Task 1 : Convert the following binary numbers into decimal

a) 1011110 (unsigned)

$$1011110 = 1*2^6 + 0*2^5 + 1*2^4 + 1*2^3 + 1*2^2 + 1*2^1 + 0*2^0 = 64 + 16 + 8 + 4 + 2 = 94$$

b) 1110001 (signed)

Since this is a signed binary number, its MSB(Most Significant Bit) tells us its sign i.e(if it is 0 → positive, 1 → negative.)

Using provided reasoning, we will make the first summand negative.

$$1110001 = -1*2^6 + 1*2^5 + 1*2^4 + 0*2^3 + 0*2^2 + 0*2^1 + 1*2^0 = -64 + 32 + 16 + 1 = -15$$

Task 2 : Convert the following binary number to hexadecimal

Remark: In order to eliminate human errors, it is best advised to use decimal numbers when converting to and fro numerical systems as the decimal system is the most common and is readable.

a) 1101101

$$1101101 = 1*2^6 + 1*2^5 + 0*2^4 + 1*2^3 + 1*2^2 + 0*2^1 + 1*2^0 = 109$$

Note : In hexadecimal notation, we will use numbers 0 → 15 where starting from 10 we will depict them as Latin letters (A = 10 , B = 11 , C = 12 , D = 13 , E = 14 , F = 15), as well as we will begin the hexadecimal number with (0x) the x refers to hexadecimal.

$$109 = 6*16^1 + 13*16^0 = 0x6D$$

b) 1111110

$$1111110 = 1*2^6 + 1*2^5 + 1*2^4 + 1*2^3 + 1*2^2 + 1*2^1 + 0*2^0 = 126$$

$$126 = 7*16^1 + 14*16^0 = 0x7E$$

Task 3 : Convert hexadecimal numbers into binary

a) 0xB9

$$0xB9 = 11*16^1 + 9*16^0 = 176 + 9 = 185$$

$$185 = 1*2^7 + 0*2^6 + 1*2^5 + 1*2^4 + 1*2^3 + 0*2^2 + 0*2^1 + 1*2^0 = 10111001$$

b) 0xE17

$$0xE17 = 14*16^2 + 1*16^1 + 7*16^0 = 3584 + 16 + 7 = 3607$$

$$3607 = 1*2^{11} + 1*2^{10} + 1*2^9 + 0*2^8 + 0*2^7 + 0*2^6 + 0*2^5 + 1*2^4 + 0*2^3 + 1*2^2 + 1*2^1 + 1*2^0$$

$$= 111000010111$$

c) 0xACDC

$$0xACDC = 10*16^3 + 12*16^2 + 13*16 + 12 = 44,268$$

$$44,268 = 1*2^{15} + 0*2^{14} + 1*2^{13} + 0*2^{12} + 1*2^{11} + 1*2^{10} + 0*2^9 + 0*2^8 + 1*2^7 + 1*2^6 + 1*2^5 +$$

$$0*2^4 + 1*2^3 + 1*2^2 + 0*2^1 + 0*2^0 =$$

$$= 1010110011101100$$

Task 4 : Convert decimal into binary

a) $256 = 1*2^8 + 0*2^7 + 0*2^6 + 0*2^5 + 0*2^4 + 0*2^3 + 0*2^2 + 0*2^1 + 0*2^0 =$

$$= 100000000$$

b) $3767 = 1*2^{11} + 1*2^{10} + 1*2^9 + 0*2^8 + 1*2^7 + 0*2^6 + 1*2^5 + 1*2^4 + 0*2^3 + 1*2^2 + 1*2^1 + 1*2^0$

$$= 111010110111$$

Task 5 : Find Two's compliment

a) -17

We know that we can find -n by finding n and inverting all 0's and 1's and adding 1 for any $n \in \mathbb{Z}$.

$$17 = 0*2^5 + 1*2^4 + 0*2^3 + 0*2^2 + 0*2^1 + 1*2^0 = 010001$$

Two's compliment would be = 101110

$$-17 = 101110 + 1 = 101111$$

b) -123

$$123 = 0*2^7 + 1*2^6 + 1*2^5 + 1*2^4 + 1*2^3 + 0*2^2 + 1*2^1 + 1*2^0 =$$

$$= 01111011$$

Two's compliment would be = 10000100

$$-123 = 10000100 + 1 = 10000101$$

Task 6 : Drawing Truth Tables

a) Function := !p && q

p	q	F
0	0	0
0	1	1
1	0	0
1	1	0

b) Function := (x&& y) || y

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

c) Function := (a || (!b && c)) || !b)

a	b	c	F
0	0	0	1
1	0	0	1
0	1	0	0
0	0	1	1
1	1	0	1
1	0	1	1
0	1	1	0
1	1	1	1

Task 7 : Flowchart

Link to my flow chart : <https://app.diagrams.net/?src=about#Hmohamed-hs%2FENGs-110%2Fmain%2FUntitled%20Diagram.drawio>

alt image:

