COMP 3350 Project #1

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***Questions:***

1. (9 points) Convert the following unsigned base 2 numbers (binary) to base 16 numbers (hexadecimal):

A. 0110 0001 1111 = (2^2 + 2^1) (2^0) (2^3 +2^2 + 2^1 + 2^0) = 6 1 15 = 61F

B. 1000 1111 1100 = (2^3) (2^3 +2^2 + 2^1 + 2^0) (2^3 + 2^2) = 8 15 12 = 8FC

C. 0001 0110 0100 0101 = (2^0) (2^2 + 2^1) (2^2) ( 2^2 + 2^0) = 1 6 4 5 = 1645

2. (27 points) Convert the following signed base 2 numbers (binary) to base 10 numbers (decimal):

A. 1100 1010

a. - (0100 1010) = - ( 2^6 + 2^3 + 2^1) = -(64 + 8 + 2) = -74  
 b. - (0011 0101) = - (2^5+2^4+2^2+2^0) = -(32+16+4+1)= -53  
 c. – (0011 0110) = - (2^5+2^4+2^2+2^1) = -(32+16+4+2) = -(54) = -54

B. 1111 0010

a. -114  
 b. -13  
 c. -14

C. 1000 0111   
  
 a. -7  
 b. -120  
 c. -121

3. (36 points) Convert the following base 10 (decimal) values to two’s complement (8-bits):

A. -100d :

a)  
100 / 2 = 50 r 0   
50 / 2 = 25 r 0  
25 / 2 = 12 r1  
12 / 2 = 6 r 0  
6 / 2 = 3 r 0  
3 / 2 = 1 r 1  
1 / 2 = 0 r 1  
  
01100100   
11100100 (flip)

b)   
100 / 2 = 50 r 0   
50 / 2 = 25 r 0  
25 / 2 = 12 r1  
12 / 2 = 6 r 0  
6 / 2 = 3 r 0  
3 / 2 = 1 r 1  
1 / 2 = 0 r 1  
  
01100100  
10011011

c)  
100 / 2 = 50 r 0   
50 / 2 = 25 r 0  
25 / 2 = 12 r1  
12 / 2 = 6 r 0  
6 / 2 = 3 r 0  
3 / 2 = 1 r 1  
1 / 2 = 0 r 1  
  
01100100  
10011011 + 1 = 10011100

B. -16d = a) 10010000 b) 11101111 c) 11110000

C. -21d = a) 00010101 b) 11101010 c) 11101011

D. -0d = a) 10000000 b) 111111111 c) 00000000

4. (4 points) What is the range of:

A. An unsigned 7-bit number? 0 - 127

B. A signed 7-bit number? -64 - 63

5. (12 points) Provide the answer to the following problems (∧ = AND, ∨ = OR )

1. 1000 ∧ 1110 = 1000
2. 1000∨1110 = 1110
3. (1000∧1110) ∨ (1001∧1110) = (1000) or (1000) = 1000

6. (9 points) Please demonstrate each step in the calculation of the arithmetic operation 25 - 65. (both 25 and 65 are signed decimal numbers)   
  
25 = 0001 1001  
-65 = -(0100 0001) = 1011 1110 +1 = 1011 1111  
  
0001 1001  
1011 1111 +  
1101 1000

7. (3 points) Mathematically the answer in Q6 is -40d. Please verify your answer in Q6 using a conversion of 2’s and decimal numbers.

1101 1000  
00000001 -  
1101 0111 = -(0010 1000) = -(2^5+2^3) = -(32 + 8) = -(40) = -40