COMP 3350 Project #1

Possible points: 100

Due: September 4, 2020 11:59pm CST (Central Standard Time)

Goals:

- Get you familiar with data representation and simple logic operations for this course.

Requirements:

- Finish the questions section below. Points for each question included in parenthesis.
- Show your work to get full credit. **ZERO** point without steps for a result.
- Please start early. ZERO point for late submission. After the **11:59pm** on the due day, you can't submit your assignment anymore.
- Check deliverables section below. ZERO point for hand-written or scanned homework.

Deliverables:

- Save your solutions of questions as a **pdf** document. You can use this document as worksheet.
- Name document as a "**Firstname_Lastname.pdf**".
- Submit your "**Firstname_Lastname.pdf**" through the Canvas system. You do not need to submit hard copies.

Rebuttal period:

- You will be given a period of **3 business** days to read and respond to the comments and grades of your homework or project assignment. The TA may use this opportunity to address any concern and question you have. The TA also may ask for additional information from you regarding your homework or project.

Questions:

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

A. 0110 0001 1111 (61F)

B. 1000 1111 1100 (8FC)

C. 0001 0110 0100 0101 (1645)

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

Each time if binary numbers are represented in:

    a) Signed magnitude representation.

    b) One's complement representation.

    c) Two's complement representation.

A. Signed magnitude = 1100 1010

    i. Decimal = -74

    ii. One's Complement = 1011 0101

    iii. Two's Complement = 1011 0110

B. Signed magnitude = 1111 0010

    i. Decimal = -114

    ii. One's Complement = 1000 1101

    iii. Two's Complement = 1000 1110

C. Signed magnitude = 1000 0111

    i. Decimal = -7

    ii. One's Complement = 1111 1000

3. (36 points) Convert the following base 10 (decimal) values to binary numbers (8-bits):

Each binary result represented in:

    a) Signed magnitude representation.

    b) One's complement representation.

    c) Two's complement representation.

    (Answer 12 questions in total.)

A. -100_d

    i. Signed Magnitude = 1110 0100

    ii. One's Complement = 1001 1011

    iii. Two's Complement = 1001 1100

B. -16_d

    i. Signed Magnitude = 1001 0000

    ii. One's Complement = 1110 1111

    iii. Two's Complement = 1111 0000

C. -21_d

    i. Signed Magnitude = 1001 0101

    ii. One's Complement = 1110 1010

    iii. Two's Complement = 1110 1011

D. -0_d

    i. Signed Magnitude = 1000 0000

    ii. One's Complement = 1111 1111

    iii. Two's Complement = 0000 0000

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

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

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

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

1. 1000 ∧ 1110

   1000
   1110 (AND)
   1000

2. 1000∨1110

   1000
   1110 (OR)
   1110

3. (1000∧1110) ∨ (1001∧1110)

   1000   1001
   1110   (AND)   1110   (AND)
   1000   1000

   1000
   1000   (OR)
   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)

Signed Magnitude: 25 = 0001 1001 && -65 = 1100 0001

25 – 65 == -65 + 25

-65
 25 (+)
-40 (d)

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

Signed Magnitude: 25 = 0001 1001 && -65 = 1100 0001
One's Complement: 25 = 0001 1001 && -65 = 1011 1110
Two's Complement: 25 = 0001 1001 && -65 = 1011 1111

0001 1001
1011 1111 (+)
1101 1000

Two's Complement: -40 = 1101 1000
One's Complement: -40 = 1101 0111
Signed Magnitude: -40 = 1010 1000