Homework 1
CPE221

Instructor: Rahul Bhadani

Due: January 17, 2025, 11:59 PM
100 points

You are allowed to use a generative model-based AI tool for your assignment. However, you must submit an accompanying reflection report detailing how you used the AI tool, the specific query you made, and how it improved your understanding of the subject. You are also required to submit screenshots of your conversation with any large language model (LLM) or equivalent conversational AI, clearly showing the prompts and your login avatar. Some conversational AIs provide a way to share a conversation link, and such a link is desirable for authenticity. Failure to do so may result in actions taken in compliance with the plagiarism policy.

Additionally, you must include your thoughts on how you would approach the assignment if such a tool were not available. Failure to provide a reflection report for every assignment where an AI tool is used may result in a penalty, and subsequent actions will be taken in line with the plagiarism policy.

Submission instruction:

Upload a .pdf on Canvas with the format {firstname.lastname}_CPE221_hw01.pdf. For example, if your name is Sam Wells, your file name should be sam.wells_CPE221_hw01.pdf. If there is a programming assignment, then you should include your source code along with your PDF files in a zip file {firstname.lastname}_CPE221_hw01.zip. Your submission must contain your name, and UAH Charger ID or the UAH email address. Please number your pages as well.

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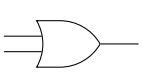
1 Range (5 points)

What range of numbers can be represented in 7 bits? Provide a range for signed and unsigned numbers.



2 2s Complement (5 points)

Represent 65000 and -4473 as signed 16-bit numbers (2s complement representation).

3 Decimal to Unsigned Binary (10 points)

Convert the decimal number 87433 to unsigned binary in two ways: (a) convert directly to binary; (b) convert first to hexadecimal and then from hexadecimal to binary. Which method is faster?

4 Decimal to Binary (20 points)

Convert decimal +1943 and +12437 to binary, using signed-2's complement representation and enough digits to accommodate the numbers. Then perform the binary equivalent of (+1943) + (-12437), (-1943) + (+12437), and (-1943) + (-12437). Convert the answers back to decimals and verify that they are correct.

5 Signed 2's Complement (10 points)

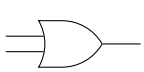
The following numbers are represented in a signed 2-s complement. What is their value in decimal?

1. 1101 1110 0010
2. 0101 1101 1010
3. 0011 1110 1111
4. 1111 1111 1111

6 Conversion (20 points)

Convert from one base to another:

1. $(527)_{10} \rightarrow (?)_{16}$



2. $(34F)_{16} \rightarrow (?)_2$
3. $(11001001)_2 \rightarrow (?)_{16}$
4. $(66)_{10} \rightarrow (?)_2$
5. $(33)_8 \rightarrow (?)_{10}$

Show your work. For hexadecimal, you can assume that $A = 10, B = 11, C = 12, D = 13, E = 14, F = 15$.

7 Complements (30 points)

1. If $X = 00110$, $Y = 11100$ are represented in 5-bit signed 2's complement form, then what's their sum $X + Y$ in 6-bit signed 2's complement representation? Verify your answer as well.
2. What's the smallest integer that can be represented by an 8-bit number in 2's complement form? Show your work.
3. What's 16-bit 2's complement representation for the decimal number -28?