# Introduction to Computing: Homework 2

**Fall 2025**

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Due: Tuesday 9/16, 11:59pm

Instructions:
You may discuss the problem set solutions with your fellow classmates but the write up must be your own. Please use the TAs and the Instructor for help before you seek out a friend or classmate. Show your work. You may handwrite or type-write your answers . Submission is on Canvas as an upload of a **pdf** file.

1. (10 pts) Perform the following logical operations. Express your answers in hexadecimal notation.
   a. `xBEEF OR xDEAD`
   b. `x9876 XOR x9876`
   c. `xABEE NAND xAFEE`
   d. `xABCD XOR NOT(xFFFF)`
   e. `xFEED NOR NOT(xFACE)`

2. (10 pts) Consider the hexadecimal numbers: `x436F` and `xBB5A`. What values do they represent for each of the two data types shown? characters for ASCII, and both binary scientific notation and decimal value (rounded off to 4 decimal places) for floating point. If an ASCII character does not exist, fill it in with 'Ñ'.

| | x436F | xBB5A |
|---|---|---|
| ASCII String | | |
| 16-bit floating point with 1 sign bit, 6 exponent bits, and 9 fraction bits (default bias) | | |

3. (10 pts) Fill in the truth table for the equations given. One row is done as an example.
   `Q1 = (X'+(X.Y.Z))'`
   `Q2 = ((Y+Z).(X.Y.Z))'`

| X | Y | Z | Q1 | Q2 |
|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 1 |
| | | | | |

4. (15 pts) Given a 12-bit floating point number represented in the following format: 1 sign bit, 4 exponent bits, 7 fraction bits (assuming default bias)
    a. How do you represent 10.12 in the above format?
    b. What decimal number does the following floating-point number represent: `0 0110 1100100`?
    c. What is the smallest normalized number one can represent in this format?
    d. What is the smallest positive normalized number one can represent in this format?
    e. What is the smallest positive non-zero de-normalized number one can represent in this format?

5. (15 pts) Using Boolean algebra rules discussed in class, show that the following are true:
    a. A+(AB)' = 1
    b. XY+X'Z+YZ = XY+X'Z
    c. A'B+AB+A+AB' = A+B
    d. XZ+Z(X'+XY) = Z
    e. (A+B)'(C+D+E)'+(A+B)' = A'B'

6. (15 pts) Derive the **SOP** and **POS** forms of the boolean expression for **F(X, Y, Z)** using the following truth table. Simplify either of the obtained expressions as much as possible.

| X | Y | Z | **F(X, Y, Z)** |
|---|---|---|---|
| 0 | 0 | 0 | **0** |
| 0 | 0 | 1 | **1** |
| 0 | 1 | 0 | **0** |
| 0 | 1 | 1 | **1** |
| 1 | 0 | 0 | **1** |
| 1 | 0 | 1 | **0** |
| 1 | 1 | 0 | **1** |
| 1 | 1 | 1 | **0** |

7. (10 pts)
Given the following truth table, generate the gate-level logic circuit, using the implementation algorithm described in class:

| *A* | *B* | *C* | *Z* |
|---|---|---|---|
| 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 0 |
| 0 | 1 | 1 | 1 |
| 1 | 0 | 0 | 0 |
| 1 | 0 | 1 | 1 |
| 1 | 1 | 0 | 1 |
| 1 | 1 | 1 | 0 |

8. (15 pts) Give the outputs of the following Boolean Logic Gates and a one-line description of what the operation does in each case. As an example of what is being expected, the logic gate has been completed for you: