COMP278 MIDTERM

NAME _____

Complete this exam within 50 minutes. Write legibly and check your work. Good luck!

1. Binary arithmetic (20%)

Perform the following basic arithmetic operations.

(1) $(10010011)_2 + (11010101)_2$.

(2) $(100010110)_2 - (1110010)_2$.

2. Number representation (20%)

Convert the following numbers to the specified bases:

(1) $(33662575655)_8$ in binary.

(2) The number above, $(33662575655)_8$, in hexadecimal.

(3) $(170)_{10}$ in binary.

(4) The number above, $(170)_{10}$, in octal.

3. Combinational circuit design (60%)

Given a 4-bit binary number A, design a circuit that outputs whether the number of bits set to 1 equals the number of bits set to 0. For example, 0010 has three bits set to 0 and one bit set to 1. Thus, for 0010, the circuit outputs 0 to indicate the number of 0 bits is not equal to the number of 1 bits.

(1) Draw the **truth** table for this circuit.
   Label inputs as: A_3, A_2, A_1, A_0. Label the output as: f.

(2) Write the Boolean expression for f, and simplify it.

(3) Implement the circuit with a 4-1 MUX. Label input and selector lines.