Digital Logic

2024 Fall Assignment 1

- Write neatly and submit a PDF file to Blackboard before deadline.
- Write down ALL procedures. Only presenting the final answer will lead to a zero, even the answer is correct.
- Box or underline your final answers when applicable.

1. (18 points 12+6) Complete the following questions

a) Convert the decimal number 123.4 to base 7, base 12, and base 16, retain maximum two digits after the radix point if necessary (no need to round).

b) Find the 10's complement of $(791)_{11}$

2. (8 points) Prove $A \oplus B = (AB+A'B')'$

3. (16 points 8+8) Simplify the following Boolean expressions to a minimum number of literals using algebraic method:

a) (a + b + c')(a'b' + c)

b) (a + c)(a' + b + c)(a' + b' + c)

4. (16 points 8+8) Simplify the following three-variable Boolean functions algebraically to simplest standard form:

a) $F_1(A,B,C) = \Sigma(0, 1, 2, 3, 5)$

b) $F_2(A,B,C) = \Pi(3, 5, 6, 7)$

5. (18 points 8+10) Express the Boolean expression bd' + acd' + ab'c + a'c' in the following forms algebraically:

a) sum of minterms form with Σ

b) product of maxterms form with Π (The direct conversion between sum of minterm and product of maxterm is not allowed)

6. (24 points 8+8+8) Using a Karnaugh map, simplify the following functions, make sure you clearly circle the adjacent squares in the map.

a) $F_1(A,B,C,D) = \Sigma(0, 2, 3, 6, 7, 10, 11, 12, 13, 15)$ into sum of product form

b) $F_2(A,B,C,D) = \Sigma(1, 9, 10, 12, 13, 14) + d(4, 5, 8)$ into product of sum form

c) $F_3(W,X,Y,Z) = \Pi(0, 2, 6, 11, 13, 14, 15) + d(1, 3, 9, 10, 12)$ into product of sum form