

# Digital Systems

## Binary functions and Boole algebra

1. Verify the following equalities:

(a)  $(A + \overline{B} + A B) (A + \overline{B}) \overline{A} B = 0$

(b)  $\overline{A} B (\overline{D} + D \overline{C}) + (A + D \overline{A} C) B = B$

2. Using the Boole algebra theorems, simplify the following expressions:

(a)  $\overline{A + A \overline{B} + C D}$

(b)  $A \overline{B} \overline{C} + A \overline{B} \overline{C} D + A \overline{C}$

(c)  $\overline{X} (X + Y) + \overline{Z} + Z Y$

3. Given the function  $f = A B + \overline{A} B C (X + Y)$ , convert it to:

(a) a sum of products

(b) a product of sums

4. Create the truth tables for the following boolean functions:

(a)  $F_1(A, B, C) = \overline{A} B C + \overline{A} B \overline{C} + A C$

(b)  $F_2(A, B, C) = A (B + \overline{C}) (\overline{B} + C)$

(c)  $F_3(A, B, C) = \overline{A + (\overline{B} \overline{C} + B C)}$

5. Consider the following truth table for the function  $f(A, B, C)$

A	B	C	f
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	1

(a) Write the function in the first canonical form and simplify it;

(b) Write the function in the conjunctive canonical form and simplify it;

(c) Write the function using the decimal form(in both canonical forms)