Exercise series no. 3

Exercise 1

1. Verify the following De Morgan's theorems using a truth table :

   a. $\overline{A + B} = \overline{A}.\overline{B}$

   b. $\overline{A.B} = \overline{A} + \overline{B}$

2. Demonstrate that: $A + \overline{A}.B = A + B$ and $A.(\overline{A} + B) = A.B$

3. Simplify the following logic expressions:

   a. $\overline{A}.B + A.B$

   b. $(A + B).(A + \overline{B})$

   c. $A + A.B$

   d. $A.(A + B)$

   e. $\overline{A}.\overline{B} + \overline{A + B + C + D}$

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

   g. $(A \oplus B).B + A.B$

Exercise 2

Give the truth table of the following function and conclude:

$F(A, B) = \overline{A}.\overline{B} + \overline{A}.B + A.\overline{B}$

Exercise 3

Consider the following truth table for the function F(A,B,C):

A	B	C	F (A,B,C)
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

1. Write the function F in the disjunctive canonical form (1st canonical form) and then in the conjunctive canonical form (2nd canonical form).

2. Find the simplified sum of products (SOP) expression for the logic function F, using the Karnaugh map method.

3. Draw the logic diagram of the above simplified expression.

Exercise 4

Consider the following logic circuit:
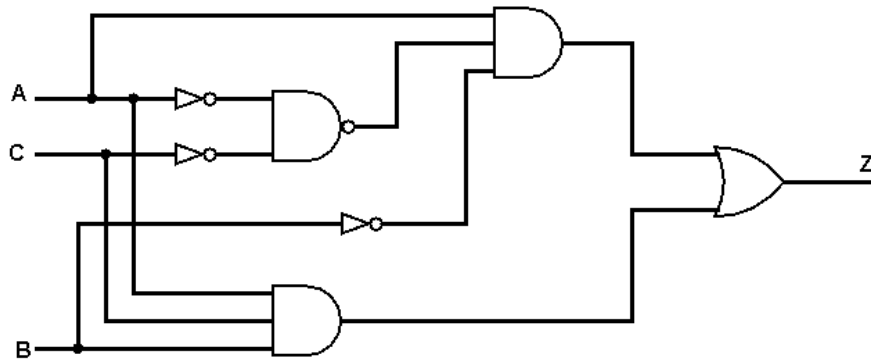
1. Derive a Boolean expression for Z.
2. Obtain the simplest Boolean expression for Z using Boolean theorem.
3. Draw the logic circuit of the above simplified expression.

Exercise 5

Simplify the following Boolean functions, using Karnaugh maps:

1. $F1\ (A, B, C) = A.\bar{B}.C + A.B.\bar{C} + A.B.C$
2. $F2\ (A, B, C) = \bar{A}.\bar{B}.\bar{C} + A.\bar{B} + A.B.C$
3. $F3\ (A, B, C) = \bar{A}.\bar{B} + \bar{A}.B.\bar{C} + \bar{B}.\bar{C} + A.\bar{B}.C$
4. $F4\ (A, B, C, D) = B.\bar{C}.\bar{D} + \bar{A}.B.\bar{D} + A.B.C.\bar{D}$
5. $F5\ (A, B, C, D) = \bar{A} + A.B + A.\bar{B}.C + A.\bar{B}.C.D$
6. $F6\ (A, B, C, D) = \bar{A}.\bar{B}.\bar{D} + \bar{A}.\bar{C}.\bar{D} + \bar{A}.B.C.\bar{D} + A.B.D + \bar{B}.\bar{C}.\bar{D} + A.\bar{B}.C.\bar{D}$