

SERIE 1

Exercise 1 : Give the truth table and logic diagram for each of the following functions

$$F1 = \overline{A}B + A\overline{B} \quad F2 = AB + \overline{A}\overline{B} \quad F3 = (B + \overline{C})(A + BD) \quad F4 = (\overline{A}\overline{B} \oplus C) + \overline{A}\overline{B}\overline{C}$$

Exercise 2 : Transform the following expressions using Morgan's law

$$Z1 = \overline{a.b + \overline{c}\overline{d} + \overline{e}.f} \quad Z2 = \overline{a.b.\overline{c} + \overline{d} + \overline{e}f.g}$$

Exercise 3

A. Demonstrate

$$1. \overline{x \oplus y} = \overline{x} \overline{y} + xy \quad 2. x + xy = x \quad 3. x(x+y) = x \quad 4. (x + \overline{y})y = xy \quad 5. x + \overline{x}y = x + y$$

B. Algebraically simplify the following functions

$$Z1 = \overline{A}B\overline{C} + ABC + ABC$$

$$Z2 = A\overline{B} + \overline{A}\overline{B} + \overline{A}B$$

$$Z3 = \overline{A}\overline{B}\overline{C} + \overline{A}B\overline{C} + ABC + A\overline{B}\overline{C} + A\overline{B}C$$

Exercise 4: Find the first and second canonical forms of the following functions:

$$F1 = AB + \overline{B}C + A\overline{C}$$

$$F2 = \overline{A}B\overline{C} + A\overline{B}C + AB + A(B + \overline{A}C)$$

Exercise 5 : Algebraically find the first canonical form of the following functions

$$F1 = AB + \overline{A}C + \overline{B}\overline{C}$$

$$F2 = \overline{A}\overline{B}C + \overline{A}\overline{C} + A$$

$$F3 = ABD + \overline{A}\overline{B}C + CD$$

Exercise 6: Simplify the following expressions using Karnaugh's method:

$$F1 = a.b\overline{c} + \overline{a}.\overline{b}.c + a.\overline{b}\overline{c} + a.\overline{b}.c$$

$$F2 = a.b.c + \overline{a}.b.c + \overline{a}.\overline{b}.c + a.b.\overline{c}$$

$$F3 = \overline{a}\overline{b}c\overline{d} + \overline{a}b\overline{c}\overline{d} + a\overline{b}c\overline{d} + \overline{a}\overline{b}\overline{c}\overline{d} + a b \overline{c} \overline{d} + \overline{a} b . c . d + a . \overline{b} \overline{c} \overline{d}$$

$$F4 = \overline{a}\overline{b}\overline{c}\overline{d} + \overline{a}\overline{b}\overline{c}d + \overline{a}\overline{b}c\overline{d} + \overline{a}\overline{b}cd + a b \overline{c} \overline{d} + abcd + a \overline{b} \overline{c} \overline{d}$$

$$+ a \overline{b} c d + a \overline{b} c \overline{d}$$

$$F5 = \overline{a}\overline{b}\overline{c}\overline{d} + \overline{a}\overline{b}c\overline{d} + a b \overline{c} \overline{d} + a \overline{b} \overline{c} \overline{d} + a b c \overline{d} + a \overline{b} c \overline{d}$$

Exercise 7: Using Karnaugh's method, simplify the function given in its decimal representation as follows

$$F = \{0, 1, 4, 5, 10, 13, 15\} + \emptyset \{2, 7, 12, 14\}$$

Exercise 8

A security lock can be opened using four keys A, B, C and D. The operation of the lock is defined as follows:

$S(A, B, C, D) = 1$ if at least two keys are used

$S(A, B, C, D) = 0$ if not

The use of keys A and D at the same time is not defined.

➤ Give the corresponding truth table

Exercise 9

There are three switches I, J, K and a 4-segment display A, B, C and D.

- When all the switches are OFF, all 4 segments are lit.
- When exactly 1 switch is ON, no matter which one, only segment B is lit.
- When exactly 2 switches are ON, segments B and D are lit. A and C are off.
- Finally, when all 3 switches are ON, segments B, C and D are lit. A is off.

a) Draw up the four truth tables for this problem (one for each segment).

b) Find the logical equations

