USTHB FI 2023-2024
1st Year Computer Science.
Module: STRM1 **Serie N°2**

Exercise 1 :

1. Establish the truth tables for the following functions:
   - ✓ F1 = (X +Y)($\bar{X}$ +Y + Z)
   - ✓ F2 = ($\bar{X}$Y + X$\bar{Y}$) $\bar{Z}$ + ($\bar{X}$ $\bar{Y}$ + XY)Z

2. Demonstrate the following equivalences using truth tables:

   X + YZ= (X+Y)(X+Z)
   $(\bar{X} + Y)(X + Z)(Y + Z) = (\bar{X} + Y)(X + Z)$

Exercise 2 :

1. Simplify the following expressions algebraically:

   - ✓ (x+ $\bar{y}$ + x $\bar{y}$)(xy + $\bar{x}$ z + yz)
   - ✓ (x + y +z)($\bar{x}$ + y + z) +xy + yz
   - ✓ abcd + abchg + $\bar{d}$hg+abcdefh.
   - ✓ a$\bar{c}$de + $\bar{d}$ + $\bar{e}$ + c

2. Prove the following equality algebraically:

   - ✓ A $\bar{B}$ + $\bar{A}$ $\bar{C}$ $\bar{D}$+ $\bar{A}$ $\bar{B}$D + $\bar{A}$ $\bar{B}$C $\bar{D}$ = $\bar{A}$ $\bar{C}$ $\bar{D}$ + $\bar{B}$
   - ✓ A.B+$\bar{A}$.C +B.C=A.B+$\bar{A}$.C
   - ✓ AB + ACD + $\bar{B}$D =AB+ $\bar{B}$D
   - ✓ AB + $\bar{B}$C = (A + $\bar{B}$)(B + C)

Exercise 3 :

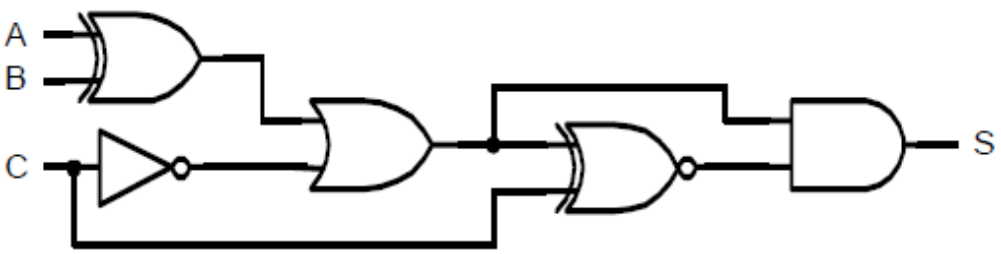
Simplify using De Morgan's theorem:

$$S = \overline{(x+\overline{y+z})(x+\overline{\bar{y}\,\bar{z}}) + \bar{x}\,\bar{y}(\bar{z}t + tz)}$$

$$T = \overline{\overline{(a\,\bar{b})}\,\overline{(b + c + \bar{d})} + \overline{bc}}$$

Exercise 4 :

1. Draw up the truth table for the circuit below.
2. Extract the equation of S from the truth table.



Exercise 5 :

Simplify the functions given by the Karnaugh maps. Create circuits using only NAND gates, then only NOR gates:

ab / cd	00	01	11	10
00	1	1	1	
01		1	1	
11		1	1	
10	1	1	1	1

ab / cd	00	01	11	10
00	1			1
01		1	1	
11		1	1	
10	1			1

ab / cd	00	01	11	10
00	1			1
01	1	1		1
11		1	1	
10	1		1	1

ab / cd	00	01	11	10
00		X	X	1
01		1	1	1
11		1	1	
10		1	1	

ab / cd	00	01	11	10
00	1			1
01	X	1	1	1
11	X	1	1	X
10	X			

ab / cd	00	01	11	10
00	1	1		1
01	1	1	X	1
11	1	1		1
10	X	X		

Exercise 6 :

Use the Karnaugh maps to simplify the following functions, then create the corresponding circuits using NOR or NAND gates.

F(a, b, c)= Π(0, 1, 2, 3, 4, 7)

G(a, b, c, d)=∑(2, 6, 7, 10, 11, 12, 14)

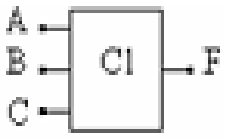
Exercise 7 :

1. Let F be a function consisting only of NOR functions:

$$F= \overline{\overline{(x+y+z)} + (\overline{x+y+\bar{z}}) + \overline{\bar{x}+y+z)}}$$

Give the truth table, the first canonical form and the corresponding function composed only of NAND.

2. Let F(A,B,C) be a function defined as follows:



- F(A,B,C) = 1 if $(ABC)_2$ contains an odd number of 1's;
- F(A,B,C) = 0 else.

a) Establish the truth table for F.
b) Give the algebraic equation of F.
c) Draw the C1 circuit diagram of function F with the minimum number of logic gates.