

TD Series N°. 2 Combinatorial and Sequential Logic

Exercise 1;

Draw the electrical circuits (electrical diagrams) of the following logical expressions:

$$S = a.\bar{b}.c + a.\bar{c}$$

$$S = a.x.(a.c + b.\bar{d})$$

$$\begin{cases} X = (a + \bar{b} + c).d \\ M = x \end{cases}$$

Exercise 2:

Prove that the NAND logic gate is universal, that is to say that it is capable to realize the three main operations of Boolean algebra (the inverse, the product and the logical sum).

Exercise 3:

- Establish the truth and Karnaugh tables of a completely defined logical function F with four variables taking the state 1 for combinations presenting a majority of 1.
- Give its numerical and canonical algebraic expressions.

Exercise 4:

In a brick factory, a quality control is carried out according to four criteria:

- Weight (W)
- Length (L)
- Width (d)
- Height (H)

We set the status to 0 if the dimensions are incorrect and we set the status to 1 if the dimensions are correct. This allows us to classify the bricks into three categories (qualities):

Quality A (good): (W) and at least two dimensions are correct.

Quality B (average): (W) alone is incorrect or the weight is correct and at least two dimensions are incorrect.

Quality C (bad: rejected): (W) is incorrect as well as one or more dimensions.

- Determine the simplified logical equations of such an installation.