COMPUTER ARCHITECTURE
2020 - 2021

TD n°3

Exercise 1: use of truth tables.

In a brasserie you order a ham sandwich **or** a pâté sandwich **and** a glass of beer. The waiter listens to you distractedly because he is busy.

At first, he is sure of the place of the **or** and the **and** but he hesitates about the place of the brackets.

1. Write the corresponding propositional formula for each of the possible commands.
2. To be sure to satisfy the customer, it must satisfy both possible orders: write the corresponding propositional formula.

   Show with the help of a truth table that the latter is logically equivalent to bringing (a ham sandwich **or** a pâté sandwich) **and** a glass of beer.

In a second step the waiter also hesitates about the place of **or** and **and**.

3. Repeat questions (1) and (2) with logical equivalences.
4. Show that he can then just bring a ham sandwich **and** (a pâté sandwich **or** a glass of beer).

What should it provide as a minimum to satisfy the customer and answer all his hesitations?

Exercise 2: equation simplification.

We give the equation $t = x\overline{y} + z(\overline{x} + y)$.

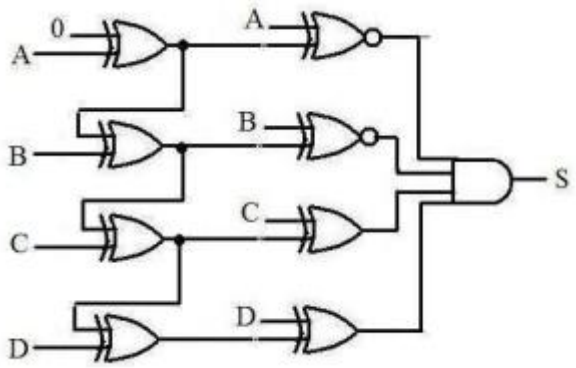
Start by rewriting this equation without parentheses, with three terms: build the truth table, then Karnaugh's rectangular table with **xy** on the one hand and **z** on the other hand.

Deduce the simplified form of **t**.

Exercise 3: about XOR gates

We give this logic circuit with four input bits A, B, C and D, and an output S.

Show that there are exactly two cases for the inputs leading to S = 1 at the output and give these two cases. To do this, add to the drawing below the results obtained at the output of each of the XOR gates in the diagram.



Exercise 4: construct a logical function.

Let an integer from 0 to 7 be represented by 3 bits $b_2b_1b_0$. Let F be the logic function whose inputs are these 3 bits, and which takes the value 1 if the input value is 0, 3, 4 or 7 (coded in binary), and 0 otherwise.

1. Give the truth table of F, write it in its canonical form and simplify the resulting expression.
2. Find the previous result by writing the Karnaugh table of F.
3. Draw the logic circuit calculating F, using only NAND gates.