

## Exercise 2: Combinational logic circuits

The following two functions

a.) 
$$f(abcd) = \overline{\overline{a + b + c}} + d$$

b.) 
$$f(abc) = ab\bar{c} + \bar{a}\bar{b}c$$

should be implemented as:

1. a minimal, two-level system using only NAND gates, and
2. a system using the 74151 multiplexer (MUX).

It should be shown that both systems perform the same function. Please prepare truth tables (the teacher will use them during verification of the circuits).

The steps of the exercise:

1. Connect the NAND and MUX circuits performing the first function simultaneously.
2. Check the correctness of the system.
3. If the systems are performing the same function, only then you should ask the teacher for verification (lab only).
4. Then please proceed analogously with the implementation of the second function.

Content of the report:

On pages 1 and 2, please synthesize the functions a and b, respectively. Enter each function in the Karnaugh table, then minimize it. Based on the minimum form, implement the NAND system. Show how to obtain the multiplexer system (MUX).

Confirmation of task implementation in CAD (printouts of circuit diagrams and of their simulations) should be included in the report so that MUX and NAND versions can be compared easily.

Comments:

1. Use de Morgan's laws.
2. Please do not use the setter of logical values, when a certain input of the system should always be a constant value (0 or 1). In such case use the available values directly from the breadboard (red wire - value 1, black / blue wire - value 0).
3. For a given function, please display the output values of both systems (NAND and MUX) simultaneously on the LED display.