COS132: 5th Practical: April 2023

Theme from Syllabus of the Week: **Non-Recursive Functions**

Scenario:

An undergraduate student of **E**lectronic **E**ngineering, *Emily Esterhuizen*, is currently learning that *Sheffer functions* are *universal* Boolean functions by means of which all other Boolean functions can be composed. Moreover, Emily has also already learned that the NAND function is indeed one of such Sheffer functions. Normally such Boolean functions are implemented in hardware (where they are also known as "gates"), but as an undergraduate student there is no way for Emily to make hardware gates. For this reason, Emily would like to *simulate* such gates in software, such that she will be able to study how such functional compositions are made and how they work. Unfortunately Emily is not very good at C++ programming, such that *she is hoping for your help* in this matter: she would like to see *how* the Boolean EXOR function can be *composed* entirely from NAND gates (which is certainly possible because NAND is a Sheffer function).

Your Task:

Help Emily Esterhuizen to implement in C++ the following **Requirements Specification**:

MAIN Program

- *declares* two *Boolean variables:* b1, b2
- *asks the user to input* truth-values for b1, b2
- *calls* the function ***my_EXOR_implementation*** with b1, b2 as its two *actual parameters*
- *outputs* the truth-value which ***my_EXOR_implementation*** returns.

Boolean Function *my_EXOR_implementation*(Boolean input1, Boolean input2)

- *must* return the correct truth-value of **EXOR(**input1,input2**)**
- *must* utilize for this purpose a correct combination of *several calls* to the underlying Sheffer function ***my_NAND_implementation***
- May **not** contain any **built-in logical** C++ operators **&&** (conjunction), || (disjunction), or **!** (negation)
- May **not** contain any mathematical-arithmetic operators (like **+** or **−**) for mimicking Boolean typed truth-values as numbers (0,1): the truth-values may **not** be represented numerically.
- May **not** contain any **if**-statements, **if-else**-statements, nor **switch-case** statements.

Boolean Function *my_NAND_implementation*(Boolean input1, Boolean input2)

- *must* return the correct truth-value of **NAND(**input1,input2**)**
- *must* utilize for this purpose a suitable algorithmic combination of *several* **if**-statements or **if-else**-statements,
- May **not** contain any **built-in logical** C++ operators **&&** (conjunction), || (disjunction), or **!** (negation)
- May **not** contain any mathematical-arithmetic operators (like **+** or **−**) for mimicking Boolean typed truth-values as numbers (0,1): the truth-values may **not** be represented numerically.

Advice:

If you do not know the truth-tables of EXOR and NAND, then look them up on the Internet.

Attention!

NULL Marks will be given to any submission that violates any of the given Requirements**!**
As always the submitted *file type must* be either ***.txt** or ***.cpp**

Deadline: Monday 17th of April!

And now: **HAPPY CODING :)**