INTERNATIONAL UNIVERSITY OF SARAJEVO

1. **Number systems**
    a. Convert the decimal number 44 into: binary, octal, hexadecimal
    b. Convert the unsigned binary number 10100111.110 into: decimal, octal, hexadecimal
    c. Convert the octal number 177 into: binary, decimal, hexadecimal
    d. Find the base X if the following is true: $123_{(X)}=63_{(15)}$

2. **Only in CS303 - Aliens come….**
    a. You meet an alien! He waves you with his four hands... and gives you 32 apples as a sign of his friendship. However, he says he gave you 20, not 32 apples!!! (But you are both right.) How many fingers does he have on each hand?
    b. He says he will be back in 100 (Earth) years! What (Earth) year will that be? It is 2019 now...

3. **Negative binary numbers, addition and subtraction**
    a. Express $(-55)_{10}$ in binary format using two's complement method.
    b. Perform subtraction using 2's complement of the subtrahend:
        i. 01111001 – 00110101
        ii. 11101101 – 01111011

4. **Logic gates**
    a. Obtain an expression for R from the diagram on the right:
    b. Make the truth table of the circuit!
    c. Give the truth table in form of a Karnaugh map and check whether the circuit is optimized!
    d. Sketch an alternative circuit that implements the same function as POS.
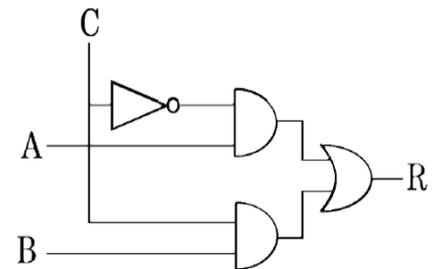
5. **Simplify the following Boolean functions to a minimum number of literals:**

    a. $(x + y)(x + y')$
    b. $xyz + x'y + xyz'$
    c. $(x + y)'(x' + y')$

6. There are three bits A, B and C that form a number from 0 to 7 (000=0, 001=1, 010=2, 011=3…). Design function F(A,B,C) that is logical "1" when the number is divisible by 3 without a remainder, otherwise "0".

    a. Make the truth table of the function F. Obtain the expression for the output F, first as a **sum of minterms**, and then as a **product of maxterms**!
    b. Try then to reduce the expression for F by using Karnaugh map!
    c. Show the result as POS and SOP! Finally, show that SOP = POS by Boolean algebra manipulation!