Midterm exam DITE: Wednesday, October 25, 2017 -- 10:00 to 13:00h

Task I (6 points): Simplify the Boolean function **F**(W,X,Y,Z) = ∑m(1,2,4,5,6,8,9) which has the don't-care conditions **d**(W,X,Y,Z) = ∑m(10,11,14,15) by finding all prime implicants and essential prime implicants and applying the selection rule. Note that function **F** has ***don't care*** conditions **d** that you have to take into account when simplifying function **F**. After you have simplified the function, represent it using the logic basis NAND. Also, draw the combinational logic circuit corresponding to the function using only NAND gates.
Note: Show all prime implicants and essential prime implicants

Task II (4 points): A combinational circuit is defined by the following three Boolean functions:
F1 = (X+Z)' + XYZ
F2 = X'Z' + X'YZ
F3 = XY'Z + (X+Z)'
Design the circuit with a single 4-to-1_3-line Multiplexer and one XOR gate.

Task III (4 points): A combinational circuit is defined by the following two Boolean functions:
A1 = (X'+Z')' + XYZ
A2 = (X+Z)' + X'YZ
Design the circuit with a single 3-to-8 Decoder and external NOR gates.

Task IV (6 points): Design a combinational logic circuit with 4 inputs that generates a 1 when the number of 0s on the inputs equals the number of 1s or the number of 0s on the inputs equals to 1. Use only 2-input NOR gates to implement the circuit.
Note: During the design you must simplify the circuit using K-map

Important: For all four tasks above do not forget to show how you obtained the results, step by step!

The exam grade is equal to the obtained number of points divided by 2!