

**Retake exam DITE:** Tuesday, March 11, 2014 -- 14:00 to 17:00h

**Task I:** Convert the following numbers from the given base to the other listed bases in the table.

Decimal	Binary	Octal	Hexadecimal
10.3125	?	?	?
?	11100101.101	?	?
?	?	623.5	?
?	?	?	A4D7.C

**Important:** Show and explain the conversion procedures you use and not only the final result.

**Task II:** A combinational circuit is defined by the following three Boolean functions:

$$F1 = (X+Z)' + XYZ$$

$$F2 = (X+Z)' + X'YZ$$

$$F3 = (X'+Z)' + XY'Z$$

Design the circuit with a single 3-to-8 Decoder and external NOR gates.

**Task III:** Simplify the Boolean function  $F(w,x,y,z) = \sum m(0,3,5,7,11,13)$  which has the don't-care conditions  $d(w,x,y,z) = \sum m(4,6,14,15)$  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 NOR**. Also, draw the combinational logic circuit corresponding to the function **using only 2-input NOR gates**.

**Important:** Show all prime implicants and essential prime implicants as well as explain all the steps you do to simplify and represent function **F**.

**Task IV:** Design a Sequence Recognizer circuit that recognizes the occurrence of the sequence of bits "101", regardless of where it occurs in a longer sequence. This circuit has one input **X** and one output **Z**. An arbitrary long input sequence of bits enters the circuit via input **X**. Output **Z** equals to **0** when the previous three input bits to the circuit were **101**. Otherwise, **Z** equals to **1**.

Implement the circuit described above under the following conditions:

1. The Sequence Recognizer circuit **must be Moore Finite State Machine**;
2. Use **only** NAND gates and SR Flip-Flops.

**Important:** Show and explain all the steps you do to design and implement the Sequence Recognizer circuit.