

Retake exam DITE: Wednesday, March 14, 2018 -- 14:00 to 17:00h

Task I (4 points): Convert the following numbers from the given base to the other listed bases in the table.

Decimal	Binary	Octal	Hexadecimal
10.3125	?	?	?
?	10011101.101	?	?
?	?	623.5	?
?	?	?	7AFD.6

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

Task II (6 points): Implement one JK flip-flop using the following components: one T flip-flop, one Multiplexer 4-to-1, and one XOR gate.

Important: Show and explain all the steps you do to implement the JK flip-flop.

Task III (5 points): Simplify the Boolean function $F(W,X,Y,Z) = \sum m(1,2,4,5,6,8,9)$ which has the don't-care conditions $d(W,X,Y,Z) = \sum m(10,11,15)$ 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 3-input NAND 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 (5 points): Design a Sequence Recognizer circuit that recognizes the occurrence of the sequence of bits "110", 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 1 when the previous three input bits to the circuit were 110. Otherwise, Z equals to 0.

Implement the circuit described above under the following conditions:

1. The Sequence Recognizer circuit **must be Moore Finite State Machine**;
2. Use **only** NOR gates and SR Flip-Flops.

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

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