

Examination: 02.10.2009

Name: _____

Student card number: _____

Assignment 1

Present 5 different ways to describe the following logical operation: the output signal F is a logic one only if the logical input signals A and B have different logic values.

Assignment 2

Design a state machine, i.e., a synchronous sequential logic, which has an output signal $Ax2$, which is a logic one during one clock cycle if the input signal A, which is synchronous to the clock signal, is a logic one during two consecutive clock cycles, but no longer than that. Present:

- timing diagram
- state diagram
- necessary actions to produce the logic diagram
- logic diagram with 2 D-flip-flops and enough combinational logic gates
- implement the same logical function with a shift register and combinational logic gates.

Assignment 3

- Convert a binary number 101111010 to a decimal system number.
- Convert a decimal number 623 to a binary number.
- How many bits are needed to describe decimal number range 0.012 ... 1.200?
- Binary numbers $A = 110100$ and $B = 101101$. How much is $A + B$, $A - B$ and $A * B$ in binary form? Describe each phase of the calculation in binary form?
- How many Full-Adders are needed to implement the sum $A + B$ of the previous question d)?

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Assignment 4

R and C of the oscillator in the block diagram below is defined so that its frequency is f hertz (Hz).

- a) Draw wave forms in signal nodes 1, 2, 3 4 and 5 in the paper f as a unit.
- b) If the frequency in node 1 is 24 kHz, how much is the frequency in nodes 2, 3 4 and 5?

Note that $T = (1/f)$ seconds (s).

