



Istanbul Technical University
Department of Computer Engineering

13.11.2015

BLG 231E - Digital Circuits Assignment 3

Due Date: 19.11.2015, Thursday, 17.00.

- Please **write neatly**.
- If you are not preparing your homework in a computer, please show complement of a symbol by putting a **dash** over the symbol (e.g. do not use x' use \bar{x}).
- **Consequences of plagiarism:** Disciplinary regulations of The Council of Higher Education and of the university are applied.
- **No late submissions** will be accepted.

Submissions:

1. Please submit your solutions on a paper to the Digital Circuits Course Assignment Box at the department secretary's office (set of all prime implicants, prime implicant chart and simplification)
2. Additionally submit the circuit implemented with the simulation program (*.circ file) to Ninova. If the solution on a paper is not submitted the implementation will not be accepted.

1. Find **all** prime implicants of the following function by using Karnaugh Maps.

$$f(a,b,c,d) = \cup_0(1,3,6,7,9,12,13) + \cup_1(0,2,4,8,15)$$

Note that undefined points in the function (f) are considered as undetermined "don't care".

2. Create the prime implicant chart according to the given cost criteria and simplify it. Explain **each** step of the simplification. Write the expression of the function with the least cost and give the total cost.

Cost criteria: 2 units for each variable and 1 unit for each complement.

3. Implement the expression in the question 2 by using only two-input **NOR** gates. Do not use unnecessary gates.

4. Realize the circuit you have designed in the question 3 by using the digital circuit simulator "**logisim**". Analyse the output of the circuit and explain the behaviour of the circuits for the input points \cup_ϕ .

Reminder: You should submit your design (*.circ file) through ninova submission system.

You could download **logisim** from the link given below:

<http://www.cburch.com/logisim/download.html>