04.11.2016

Istanbul Technical University
Department of Computer Engineering

BLG 231E - Digital Circuits
Assignment 3

Due Date: 15.11.2016, **Monday,** 17.00.

- Please **write <u>neatly</u>**.
- 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:

- Please submit your solutions on a paper to the Digital Circuits Course Assignment Box at <u>the department secretary's office</u> (set of all prime implicants, prime implicant chart and simplification)
- Additionally, submit the circuit implemented with the simulation program (**.circ* file) to Ninova.

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

$$f(a,b,c,d) = \bigcup_1 (0,4,5,9,12,14) + \bigcup_0 (6,7,11,13,15)$$

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 that you obtained in the question **2** 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***". Explain the reasons for the output values generated by the input combinations in the set $\cup_\Phi$ *(Undetermined/do not care values).*

Reminder: You should **submit** your design **(**.circ file*)** through Ninova e-learning system.

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

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