November 19, 2021

Istanbul Technical University
Department of Computer Engineering

# BLG 231E - Digital Circuits
# Assignment 3

**Due Date:** Thursday, December 2, 2021, 23:59.

Please **write and draw neatly.**
Please prepare your homework using a computer. Points will be taken off for handwritten submissions.
**Consequences of plagiarism:** Any cheating will be subject to disciplinary action.
**No late submissions** will be accepted.
**Submissions:** Submit your solution PDFs to Ninova. Please **write your full name** (first name and last name) **and Student ID** inside the box below.

If you have any questions, please send an e-mail to teaching assistant **Esin Ece Aydın** (aydinesi16@itu.edu.tr).

| | |
|---|---|
| Student ID | |
| Full Name | |

The incompletely specified logic function $f(a, b, c, d)$ is given below:

$$f(a, b, c, d) = \cup_1(2,\ 6,\ 8,\ 9,\ 10,\ 11,\ 12,\ 14,\ 15) + \cup_\Phi(1,\ 5)$$

**1.** Using the two methods listed below, find the set of all prime implicants in SOP form:
   a. A Karnaugh map (20 points)

   b. The Quine-McCluskey method (30 points)

**2.** Build the prime implicant chart using the cost criteria given below, then simplify it to obtain the minimal covering sum with the lowest cost. Demonstrate and explain each step of the simplification. Provide the total cost, and the expression for the function with the lowest cost. (50 points)

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