



Istanbul Technical University
Department of Computer Engineering

October 15, 2021

BLG 231E - Digital Circuits

Assignment 1

Due Date: Thursday, October 21, 2021, 23:59.

- Please **write and draw neatly** **INSIDE THE BOXES** provided for your solution.
- 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 e-mail teaching assistant Neşe Güneş (nese.gunes@itu.edu.tr).

Student ID	
Name/Surname	

Part 1 – Computer Arithmetic

1. a) Using signed-2's-complement representation, convert the decimal numbers (-122) and (-6) to 8-bit binary integers. Show ALL work.

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b) Carry out the **binary operations** given below, and explain your answers using terms such as *carry*, *borrow*, and *overflow*. To interpret the results, use only binary numbers.

i. $(-122) + (-6)$

ii. $(-122) - (-6)$

Part 2 – Boolean Algebra

2. Simplify each Boolean expression using algebraic manipulation (axioms and theorems). Show ALL work. **Show the steps** of the simplification, and **write which axiom/theorem you used in each step** next to the simplification.

i. $(\bar{x} + \bar{y})(\bar{x} + y)$

ii. $\bar{x} \bar{y} \bar{z} + x \bar{y} + \bar{x} \bar{y} z$

iii. $(\bar{x} + \bar{y} + z)(x + y + \bar{z})$

iv. $\overline{(\bar{x} + \bar{y})} (x + y)$