Name: _____ **İTÜ ID:** _____ **Signature:** _____.

BLG202E – Midterm Exam Part 2
Spring 2021, Duration: 45 minutes

Instructions:

- *Do NOT communicate with other people, including your friends, classmates, and family members!*
- *This is an open-book exam.*
- *Give your answers in English.*
- *Use an A4 paper for each question.*
- *Write the question number, your Name and İTÜ ID on the top of each page and **sign all pages**.*
- *Scan or take photo of your answers and upload them on Ninova within a a pdf file **before the deadline**!*
- *There will be no extension for time without penalty. There will be a late submission option for10 mins where you will lose 3 points for each late minute. Your latest submission will be considered only.*

Question 3) **(25 points**)

You are asked to create a hypothetical floating point number system that stores 6 bit words. The first bit represents the sign of the number, the next two bits represents the exponent (e) last 3 bits represent the mantissa. The exponent is biased by one (actual exponent is e-1).

Assume that a mantissa of all zeros is reserved for number zero.

a) (**10 points**) What are the smallest and largest positive numbers that can be represented using this floating point system?

b) (**10 points**) Find the hypothetical floating point representation of $(13.25)_{10}$

c) (**5 points**) Compute the relative error (ϵ_a) of $(13.25)_{10}$ (Relative error can be computed using the following formula:|u-v|/|u| where u is the true number and v is the floating point representation)

Question 4) **(25 points**)

Let $f(x) = x^2 - 2x - 3$

a) Sort the convergence speed of Bisection, Newton, Secant methods (From Fastest to Slowest)

b) Apply bisection method on f(x) using a = 0, b = 5 for 3 iterations. Compute the relative error for bisection (ϵ_b).

c) Apply Newton method on f(x) starting $x_0 = 7$ for 3 iterations. Compute the relative error for Newton (ϵ_N).

d) Apply Secant method on f(x) using $x_0 = 7$ and $x_1 = 6$ for 3 iterations. Compute the relative error (ϵ_S).

e) Sort the relative error (ϵ_b), (ϵ_N) and (ϵ_S)