

BLG202E –Final Exam Part A

Spring 2023, Duration: 30 minutes exam + 10 minutes for uploading

Instructions:

- Do NOT communicate with other people, including your friends, classmates, and family members! Do NOT use any online tool such as <https://chat.openai.com/>.
- 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 ITÜ 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 pdf file **before the deadline!**
- There will be no extension for time without penalty. There will be a late submission option for 5 mins where you will lose 10 points.

ANSWER ONLY ONE OPTION FROM THE FOLLOWING QUESTIONS:

Question 1)

OPTION 1

Consider the following points on the graph of a function $f(x)$.

x	$x_0 = 1$	$x_1 = -1$	$x_2 = 2$	$x_3 = -2$	$x_4 = 0$
y	3	7	7	3	5

- (a) (15 pts) Find the least degree polynomial interpolating above points and the value of $f[1, -1, 2, -2, 0]$?
- (b) (10 pts) What is the value of

$$\sum_{i=0}^4 f(x_i) \prod_{j=0 \text{ and } j \neq i}^4 \frac{3 - x_j}{x_i - x_j}$$

OPTION 2

Given the following data points $(x_0 = -2, y_0 = -27)$, $(x_1 = 0, y_1 = -1)$, $(x_2 = 1, y_2 = 0)$ and $(x_3 = 3, y_3 = 1)$

- a) (15 points) Find the Lagrange Polynomials.
- b) (10 points) Find the Lagrange interpolation function and find $f(3)$.

QUESTION 2)**OPTION 1**

(25 pts) By using (extended) Newton divided difference method find the $p[0, 0, 1, 1, 1]$ where

$$p(0) = 2, p'(0) = -7, p(1) = -4, p'(1) = 4, p''(1) = 0$$

OPTION 2

Given the following data points $(x_0 = 1, y_0 = 1)$, $(x_1 = 3, y_1 = 3)$, $(x_2 = 5, y_2 = 7)$

- a) (15 points) Construct interpolation function using Newton's divided difference formula.
- b) (10 points) Assume that you have a new observation $(x_3 = 6, y_3 = 8)$ update your interpolation function using this new data point.