CENG216 – Numerical Computation
Homework 2

April 18, 2024

Due Date: May 2 16:59, 2024

Exercise 1. Systems of Equations (50 pts)

John goes to the deli shop to buy three different types of cheese (white cheese, cheddar, and mozzarella). Each type of cheese has a standard portion and each standard portion weighs a different amount of kilograms. Two portions of white cheese weigh one more kilogram than a single portion of cheddar. Initially, John buys two portions of white cheese, two portions of cheddar, and a single portion of mozzarella. This makes the total weight of the basket four kilograms. Then, he decides to buy two more portions of mozzarella and this makes the total weight of the basket six kilograms.

a. Indicating the individual weights of portions of cheese types as x, y, and z; write down the system of linear equations representing the constraints John has experienced during his shopping time.

b. Determine whether this system of equations has a swamping problem or not. Explain your reasoning.

c. Solve the system using PA = LU factorization and write down the individual portion weights of each cheese type.

d. Determine whether this system of equations is ill-conditioned or not by calculating the relative forward error, relative backward error, and error magnification factor. Assume the approximated weight of each cheese type as 1 kilogram for error calculations.

Exercise 2. Interpolation (50 pts)

a. Using linear and cubic splines, find necessary equations to plot four certain digits separately on a coordinate system. These four digits should be selected from your student IDs. Make sure you select exactly four digits

that are different from each other. You should plot these digits on the Area I (top-right area) of the coordinate system. Also, you are expected to determine the points of each spline by yourselves to calculate their equations. Show your calculations for each spline of each digit separately on your handwritten papers.

b. Afterwards, use your calculated spline values equations on matplotlib library of Python and plot these digits separately. You can only use Python programming language. You should only use your spline equations with matplotlib instead of spline points.

Important Notes

1. For exercise 2.b, you should only submit a single **.py file**. It should be named as StudentID_HW2.py
2. For the remaining exercises, you are expected to submit the **hard copies** of your homeworks.
3. This is individual homework. Any collaboration between homeworks is not allowed and will be considered as cheating.