



CS2008 Numerical Computing Assignment 1 Spring 2024

Instructions

1. **Plagiarized work will result in zero marks.**
2. **No retake or late submission will be accepted.**
3. The submission should be a **SINGLE UNZIPPED NOTEBOOK** submitted on Google Classroom.
4. This notebook should **properly document** what you did? How you did it? And the source-code for each part as well as the generated outputs.
5. Your submission file should be according to the following **format: id_section_A2** e.g., i22123456_A_A2. (Note: A2 in the end denotes Assignment 2).

Description

In this assignment, your goal is to solve a system of linear equations $AX=b$, using naive method, as well as by using NumPy and SciPy for banded matrix of various dimensions as listed in the table below. Keep lower bandwidth (l) equal to 40 & the upper bandwidth (u) equal to 20.

Matrices Dimensions	Execution-Time		
	$X=A^{-1}b$	NumPy	Scipy
$A_{(10 \times 10)} X = b_{(10 \times 1)}$?	?	?
$A_{(100 \times 100)} X = b_{(100 \times 1)}$?	?	?
$A_{(1000 \times 1000)} X = b_{(1000 \times 1)}$?	?	?
$A_{(10000 \times 10000)} X = b_{(10000 \times 1)}$?	?	?
$A_{(100000 \times 100000)} X = b_{(100000 \times 1)}$?	?	?

1. [20 marks] Solve by finding inverse of the matrix A and then multiplying it by the vector \mathbf{b} to get the solution.
2. [20 marks] Solve these systems using NumPy's `linalg.solve` module and record the empirical time it takes to produce the solution.
3. [20 marks] Convert the banded matrix A into the form Ab and use SciPy's `linalg.solve_banded` to solve the system $AX=b$. Note down the empirical time it takes to produce a solution.
4. [20 marks] Plot your experiment using a ***suitable*** plot by using `matplotlib`. Properly label this plot so that it is self-readable.
5. [20 marks] Provide a conclusion of your experiment based on the results you measured.