Bonus Assignment

Description

This assignment will cover all chapters presented in the course. Treat is as both a refresher and a way to work on what you might've not understood at the beginning.

The purpose of this assignment is to help you go over the previous taught material, go over concepts in programming, and do one last huzzah for the semester in chapter 7.

For full credit on this assignment (meaning the drop on another assignment), the following is required **in its entirety**:

- Create expected structure
- ensure there's a readme with instructions on how to compile
- every output for each question is correct

Constraints

Standard Structure

For this assignment, you will need the following structure:

```
src
        - main
                -- __init__.py
                -- bonus_assignment.py
        - test
                -- __init__.py
                -- bonus _ assignment.py
 requirements.txt
README.md
```

Please ensure your repository is named "cot-4500-bonus".

Compilation Instructions

Keeping true to adding industry likeness to each assignment, it is required that you need to include a README per repository. A README is a file used to describe a repo's purpose, include compilation purposes, or both. A proper README.md is typically filled out with sections, akin to an essay.

For this assignment, a README needs to be included and filled out. The amount of info you put into the README is up to you, but you will need the following at least:

- Mention of requirements.txt
  - No need to include this UNLESS you plan on using a library other than NumPy
- Mention of running python
  - Since we require instructions on to run, you will need to include the command to run the script from command line.

RESTRICTIONS

Please avoid using the scipy library for this assignment. You will need to be able to do the decomposition without the use of this external library.

Questions

1. The number of iterations it takes gauss-seidel to converge:
   a. Initial guess: [0, 0, 0]
   b. Tolerance: 1e-6
   c. Iterations: 50
   d. $\begin{matrix} 3 & 1 & 1 & 1 \\ 1 & 4 & 1 & 3 \\ 2 & 3 & 7 & 0 \end{matrix}$
2. The number of iterations it takes jacobi method to converge
   a. Initial guess: [0, 0, 0]
   b. Tolerance: 1e-6
   c. Iterations: 50
   d. $\begin{matrix} 3 & 1 & 1 & 1 \\ 1 & 4 & 1 & 3 \\ 2 & 3 & 7 & 0 \end{matrix}$
3. Determine the number of iterations necessary to solve $f(x) = x^3 - x^2 + 2 = 0$ using newton-raphson from the left side
   a. Tolerance: 1e-6
   b. Initial guess: 0.5
4. Using the divided difference method, print out the Hermite polynomial approximation matrix

x f(x)	f(x)	f'(x)
0	1	1.06
1	2	1.23

2	4	1.55

5. The final value of the **modified eulers method**
   a. Function: $y - t^3$
   b. Initial point: .5
   c. Iterations: 100
   d. Range: $0 < x < 3$

Expected Output

```
9

29

12

[[ 0.   1.   0.   0.   0.   0.  ]
 [ 0.   1.   1.06 0.   0.   0.  ]
 [ 1.   2.   1.   -0.06 0.   0.  ]
 [ 1.   2.   1.23 0.23 0.29 0.  ]
 [ 2.   4.   2.   0.77 0.27 -0.01 ]
 [ 2.   4.   1.55 -0.45 -1.22 -0.745]]

-32.46003
```