Lab Assignment 6 (02/02/2023)

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Tasks:

1. Compute polynomial function using numpy Gauss Elimination (numpy.linalg) and plot it using matplotlib.

   X = [x1, x2, x3, x4] = [-0.1, -0.02, 0.02, 0.1]

   Y = cos(X)

   P(x) = ax^3 + bx^2 + cx + d

   For the four x points, the polynomial function can be written in the matrix form as

   [x1^3, x1^2, x1, 1][a] = [y1] = [cos(x1)]

   [x2^3, x2^2, x2, 1][b] = [y2] = [cos(x2)]

   [x3^3, x3^2, x3, 1][c] = [y3] = [cos(x3)]

   [x4^3, x4^2, x4, 1][d] = [y4] = [cos(x4)]

   Tasks for the above problem:

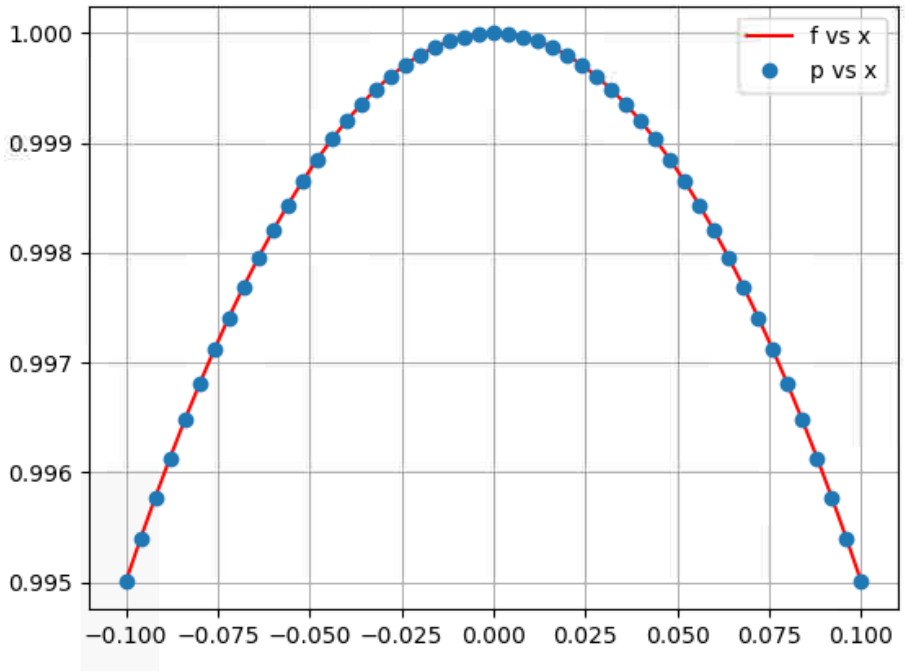
   - Write a program to compute the a, b, c, and d using the Gauss Elimination method (numpy linalg function).
   - Write a program to plot the (x,f(x),x,p(x))
2. Using Gaussian-Elimination to solve the linear system given in class and compare to the results obtained by numpy.linalg.solve.
3. Submit source codes and screenshots.
4. Push the code to GitHub.
5. File transfer and Up-to-date in Nova cluster

Submission Files and Results:

1. I utilized the gauss_elimination provided in the class and developed code for polynomial problem described above. Submitted the code. Here is the screenshot.

```
(base) ubuntu@ubuntu-vm:~/Documents/chandanaWorkspace/CPRE 525 Spring 2023/CPRE525Spring2023/5. Lab Assignme
nt 6$ python3 mylinalg.py
My gauss elimination result:  [-1.11022302e-12 -4.99566811e-01  2.31296463e-15  9.99999833e-01]
Numpy gauss elimination result:  [-1.15771891e-12 -4.99566811e-01  2.40548232e-15  9.99999833e-01]
Error between my gauss elimination and numpy gauss elimination is  [ 4.74958871e-14  0.00000000e+00 -9.25176
836e-17  0.00000000e+00]
```

Here is the plot generated for **f vs x** & **p vs x**. For the clear illustration purpose, I created a variable named resoultionLinespace and adjusted it accordingly.



I have submitted two files.

- Mylinalg.py -> While using the gauss_elimination method, I made it in two possible ways (i) I placed the gauss_elimination function inside the file, (ii) imported the gauss_elimination function and commented it to avoid ambiguity. Any one of it can be utilized inside mylinalg.py file as needed.
- Included gauss_eliminated.py, which was provided in the class, and modified into the function-style for modularity and ease of use.

2. Push the code to GitHub
    a. Git status check

```
(base) ubuntu@ubuntu-vm:~/Documents/chandanaWorkspace/CPRE 525 Spring 2023/CPR
E525Spring2023$ git status
On branch main
Your branch is up to date with 'origin/main'.

Changes to be committed:
  (use "git restore --staged <file>..." to unstage)
        new file:   5. Lab Assignment 6/gauss_elimination_cpre525.py
        new file:   5. Lab Assignment 6/mylinalg.py

Changes not staged for commit:
  (use "git add <file>..." to update what will be committed)
  (use "git restore <file>..." to discard changes in working directory)
        modified:   5. Lab Assignment 6/gauss_elimination_cpre525.py
        modified:   5. Lab Assignment 6/mylinalg.py

Untracked files:
  (use "git add <file>..." to include in what will be committed)
        4. Lab Assignment 5/4. Lab Assignment 5 Submission.pdf
        5. Lab Assignment 6/__pycache__/
```

    b. Git add and git status

```
(base) ubuntu@ubuntu-vm:~/Documents/chandanaWorkspace/CPRE 525 Spring 2023/CPR
E525Spring2023$ git add .
(base) ubuntu@ubuntu-vm:~/Documents/chandanaWorkspace/CPRE 525 Spring 2023/CPR
E525Spring2023$ git status
On branch main
Your branch is up to date with 'origin/main'.

Changes to be committed:
  (use "git restore --staged <file>..." to unstage)
        new file:   4. Lab Assignment 5/4. Lab Assignment 5 Submission.pdf
        new file:   5. Lab Assignment 6/__pycache__/gauss_elimination_cpre525.
cpython-310.pyc
        new file:   5. Lab Assignment 6/gauss_elimination_cpre525.py
        new file:   5. Lab Assignment 6/mylinalg.py
```

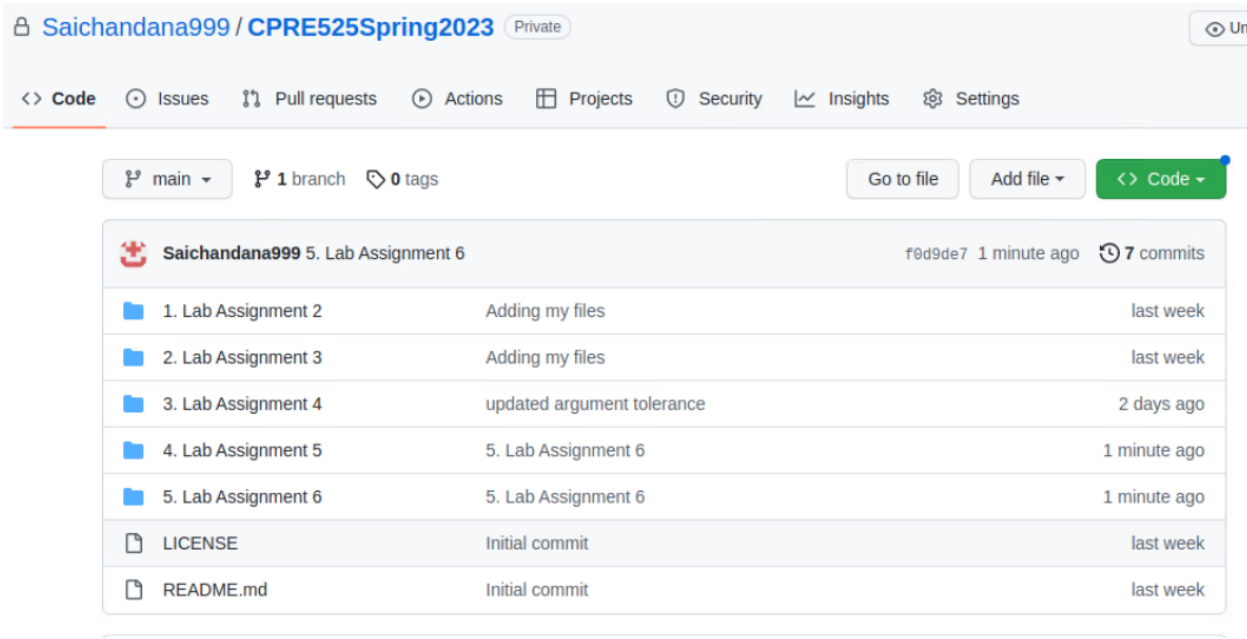
    c. Git committed the files

```
(base) ubuntu@ubuntu-vm:~/Documents/chandanaWorkspace/CPRE 525 Spring 2023/CPR
E525Spring2023$ git commit -m '5. Lab Assignment 6'
[main f0d9de7] 5. Lab Assignment 6
 4 files changed, 134 insertions(+)
 create mode 100644 4. Lab Assignment 5/4. Lab Assignment 5 Submission.pdf
 create mode 100644 5. Lab Assignment 6/__pycache__/gauss_elimination_cpre525.
cpython-310.pyc
 create mode 100644 5. Lab Assignment 6/gauss_elimination_cpre525.py
 create mode 100644 5. Lab Assignment 6/mylinalg.py
```

    d. Git push

```
(base) ubuntu@ubuntu-vm:~/Documents/chandanaWorkspace/CPRE 525 Spring 2023/CPR
E525Spring2023$ git push
Username for 'https://github.com': Saichandana999
Password for 'https://Saichandana999@github.com':
Enumerating objects: 11, done.
Counting objects: 100% (11/11), done.
Delta compression using up to 8 threads
Compressing objects: 100% (9/9), done.
Writing objects: 100% (9/9), 1.32 MiB | 3.46 MiB/s, done.
Total 9 (delta 2), reused 0 (delta 0), pack-reused 0
remote: Resolving deltas: 100% (2/2), completed with 1 local object.
To https://github.com/Saichandana999/CPRE525Spring2023.git
   af20ef0..f0d9de7  main -> main
```

e. Final GitHub repository



3. Files transferred and up-to-date in Nova cluster.