

Laboratory Assignment 0: Introduction to Python, and code management

CE334 MODERN METHODS IN GEOINFORMATICS

2025-26 II

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Introduction

This lab introduces you to the fundamentals of Python programming, providing a foundation for doing scientific computation. Additionally, you will gain hands-on experience in version control using GitHub, an essential tool for managing and collaborating on software projects effectively.

1 Git and GitHub

Git is a distributed version control system used to locally track changes in computer files. Its primary purpose is to manage any changes made in projects over a given period of time and push-pull changes from remote repositories like GitHub, BitBucket and GitLab. It helps to coordinate work among members of a project team and tracks progress over time. GitLab, GitHub and BitBucket provide services that allow to host your project on a remote repository and have additional features to help in software development life cycle and continuous integration and deployment.

GitHub is a platform and cloud-based service for software development and version control using Git, allowing developers to collaborate, store and manage their code. It provides the distributed version control of Git plus access control, bug tracking, software feature requests, task management, continuous integration, and wikis for every project.

Getting Started

1. Create an account on GitHub and sign in.
2. Send your username to kamooshsb24@iitk.com.
3. Go to <https://colab.research.google.com/>
4. Start a new notebook and write your code.
5. Go to the File option and click "Save a copy in GitHub"
6. Provide your GitHub credentials, commit your changes, and save the code in the repository named `CE334-Name_Roll_Lab_No.`

2 Scientific Computation with Python

Exercises

1. Create a row and column vector using the input method and manually.
2. Create a matrix (5×5) using the input method as well as manually, and save it as *a*.
3. Get the 3rd row out of the matrix.

4. Get the 4th column out of the matrix.
5. Sort the matrix row-wise and column-wise.
6. Apply a **for** loop on the matrix *a*: if an element is greater than 2, multiply the element by 10, and call it *b*.
7. Add matrices *a* and *b*.
8. Subtract matrix *b* from *a*.
9. Multiply matrix *a* by *b* element-wise and using matrix multiplication.
10. Divide each element of matrices *a* and *b* by 18.
11. Find the inverse, rank, condition number, singular value decomposition, and the norm of matrices *a* and *b*.
12. Find the norm, inner product, and outer product of the column vector.
13. Write a function called **derivative** which takes input parameters *f(x)*, *a*, *method* (forward, backward, and central), and *h* (step size) (with default values **method**='central' and *h* = 0.01). The function should return the corresponding difference formula for the derivative of the function at *a* with step size *h*. Test your function on e^x and $\cos x$ at $x = 0.5$.
14. Download the Automatic Weather Station AWS Data. Read the .csv file using the **Pandas** library as a **DataFrame**.

Submission Guidelines

- Python is the main programming language for the course.
- Assignment will have to be submitted on or before the assigned deadline, failing which no points will be awarded for that particular assignment.
- All submissions will be via GitHub.
- Plagiarism of any form is strictly prohibited. If you are found guilty of it, you will be given zero marks. Repeated offenders will be reported to the institute authorities.
- All the programs that are submitted must have comments in them to describe the program. Programs without comments will be penalized with -10% of the total marks.

References

Wes, M. (2012). *Python for data analysis* (1st ed.). O'Reilly Media, Inc.