Rakshak Software Programming Exercises

March 17, 2025

1 Conditionals and Loops

1.1 Exercise 1: FizzBuzz Implementation

Write a Python program that prints the numbers from 1 to 100. But for multiples of three, print `Fizz` instead of the number, and for the multiples of five, print `Buzz`. For numbers which are multiples of both three and five, print `FizzBuzz`.

1.2 Exercise 2: Prime Numbers within a Range

Develop a Python function that takes two integers as input and returns a list of all prime numbers between those two numbers (inclusive). Utilize loops and conditional statements to determine prime numbers.

2 NumPy Implementation

2.1 Exercise 3: Matrix Operations

Create two 3×3 NumPy arrays, A and B, with random integer values between 1 and 10. Perform the following operations:

- Addition of matrices A and B.
- Element-wise multiplication of A and B.
- Compute the dot product of A and B.
- Calculate the determinant of matrix A.

2.2 Exercise 4: Statistical Analysis

Generate a NumPy array of 1000 random numbers drawn from a normal distribution with a mean of 50 and a standard deviation of 5. Compute the following statistics:

- Mean
- Median
- Standard deviation
- Variance
- 25th and 75th percentiles

3 Matplotlib Implementation

3.1 Exercise 5: Data Visualization

Using Matplotlib, create the following visualizations:

- A line plot representing the function $f(x) = x^2$ for x ranging from -10 to 10.
- A scatter plot of 100 random points with x-coordinates drawn from a uniform distribution between 0 and 1, and y-coordinates drawn from a normal distribution with a mean of 0.5 and a standard deviation of 0.1.
- A histogram of 500 random numbers drawn from an exponential distribution with a rate parameter (λ) of 1.

4 Pandas Implementation

4.1 Exercise 6: DataFrame Manipulation

Create a Pandas DataFrame containing the following data:

Name	Age	Salary
Alice	28	70000
Bob	34	80000
Charlie	25	50000
Diana	42	110000
Ethan	30	75000

Perform the following operations:

- Add a new column, `Tax`, which is 20% of the `Salary`.
- Filter the DataFrame to include only employees aged 30 and above.
- Compute the average salary of employees aged below 30.
- Sort the DataFrame by `Salary` in descending order.

5 Time Series

5.1 Exercise 7: Time Series Analysis

Using Pandas, perform the following tasks:

- Create a time series representing daily temperatures (in Celsius) for the month of January 2025. Assume the temperature follows a sinusoidal pattern with an average of 15°C and an amplitude of 10°C.
- Plot the time series using Matplotlib.
- Compute a 7-day rolling average of the temperature and plot it on the same graph.
- Identify the days when the temperature was above 20°C.