Open Source Software Lab

Lab Test 1

Thursday – 3 to 5 PM

Time Duration: 50 Minutes **Maximum Marks: 20 Marks**

Note:

• No extra time will be provided for form submissions. Any responses submitted after the deadline will not be accepted.

• Please create a Word document with your answers, along with screenshots of the output. Upload a word file on Google Classroom which contains the following:

- Link to your GitHub account
- Codes for questions 1 along with the URL of the repository

• Save your file using the following format: (Batch_Enrollment_StudentName_LabTest_1.docx)

Odd Numbered Systems

Q1. [CO 2, 20 Marks] You are tasked with analyzing the monthly rainfall data (in millimeters) of three different cities over a period of 6 months. Using NumPy and Matplotlib, write a Python program to store, analyze, and visualize the data.

Data Format:

- **Cities:** *'City X', 'City Y', 'City Z'*
- **Rainfall Data (in mm):**
  - City X: [100, 120, 85, 90, 110, 95]
  - City Y: [80, 75, 60, 95, 85, 90]
  - City Z: [150, 140, 135, 160, 155, 170]

Tasks to Implement:

1. **Store and Analyze Data (5 Marks):**
   - Use NumPy to store the rainfall data for all three cities.
   - Calculate the **total rainfall** for each city over the 6 months and display the results.
   - Calculate the **average monthly rainfall** for each city.
2. **Month-wise Analysis (5 Marks):**
   - Write a function that calculates the **average rainfall across all cities** for each month.
   - Display the monthly average rainfall for the 6 months.
3. **Visualizing Rainfall Trends (5 Marks):**
   - Create a **line plot** using Matplotlib that shows the monthly rainfall trend for each city over the 6 months.
   - Label the axes, provide a legend, and add a title to the plot to represent the rainfall trends clearly.

4. **Rainfall Distribution Comparison (5 Marks):**
    - Calculate the **range** of rainfall (difference between the highest and lowest recorded rainfall) for each city.
    - Create a **bar chart** using Matplotlib to visualize the range of rainfall for each city over the 6 months.

Even Numbered Systems

Q1. [CO 2, 20 Marks] A research team is studying the population growth of three different species of animals in a nature reserve over 10 years. The population count is recorded yearly for each species. You are required to write a Python program that stores, analyzes, and visualizes this population data using NumPy and Matplotlib.

Data:

You are provided with the following population data for the species over 10 years (in thousands):

- **Species:** *'Lions', 'Elephants', 'Zebras'*
- **Population Data (in thousands):**
    - Lions: [15, 16, 17, 20, 19, 21, 23, 24, 25, 27]
    - Elephants: [50, 52, 54, 53, 55, 56, 57, 59, 60, 62]
    - Zebras: [100, 98, 95, 97, 96, 94, 95, 93, 92, 90]

Tasks to Implement:

1. **Store and Analyze Population Data (5 Marks):**
    - Use NumPy to store the population data for all three species.
    - Write a function that calculates the **total population** for each species over the 10 years.
    - Calculate the **average yearly population growth** for each species and display the result.
2. **Yearly Growth Rate Calculation (5 Marks):**
    - Write a function to calculate the **year-over-year growth rate** (percentage change) for each species.
    - Display the growth rate for each species for each year.
3. **Visualize Population Trends (5 Marks):**
    - Use Matplotlib to create a **line plot** that shows the population trends for each species over the 10 years.
    - Label the axes, add a legend, and provide a title to represent the population trends clearly.
4. **Species Performance Analysis (5 Marks):**
    - Write a function that identifies which species has shown the **highest average growth rate** over the 10 years.
    - Create a **bar chart** using Matplotlib to compare the total population of each species at the end of the 10 years.