NumPy Functions

1. 2D Array Operations

- **Array Creation and Manipulation:**

    o np.array() - Creates a NumPy array.

    o Array indexing/slicing operations:

        ▪ Examples: [1:4,:], [:,0:3].

- **Display:**

    o print() - Displays output.

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2. Basic Matrix Operations

- **Element-wise Operations:**

    o np.add() - Adds two matrices.

    o np.subtract() - Subtracts two matrices.

    o np.multiply() - Multiplies matrices element-wise.

    o np.divide() - Divides matrices element-wise.

- **Matrix Multiplication:**

    o np.dot() - Performs matrix multiplication.

- **Transpose and Diagonal Operations:**

    o .transpose() - Transposes a matrix.

    o np.trace() - Calculates the sum of diagonal elements.

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3. Advanced Matrix Operations

- **Random Matrix Generation:**

    o np.random.randint() - Generates a random integer matrix.

- **Matrix Properties and Calculations:**

    o np.linalg.det() - Calculates the determinant.

    o np.linalg.inv() - Calculates the inverse.

    o np.linalg.matrix_rank() - Computes the matrix rank.

    o np.linalg.eig() - Calculates eigenvalues and eigenvectors.

- **Reshaping:**
    - .flatten() - Converts a matrix to a 1D array.

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4. Singular Value Decomposition (SVD)

- np.linalg.svd() - Performs Singular Value Decomposition.
- np.zeros() - Creates a matrix of zeros.
- np.fill_diagonal() - Fills diagonal elements.
- .dot() - Performs matrix multiplication (used for reconstruction).
- .shape - Retrieves the dimensions of a matrix.

Matplotlib Functions

1. Scatter Plots

- plt.scatter() - Creates a scatter plot.
- **Plot Customization:**
    - plt.xlabel() - Sets x-axis label.
    - plt.ylabel() - Sets y-axis label.
    - plt.title() - Sets plot title.
    - plt.legend() - Adds a legend.
    - plt.show() - Displays the plot.

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2. Bar Graphs and Histograms

- plt.bar() - Creates a bar graph.
- plt.hist() - Creates a histogram.
- **Figure Management and Customization:**
    - plt.figure() - Creates a new figure.
    - plt.title() - Sets the title.
    - plt.xlabel() - Sets x-axis label.
    - plt.ylabel() - Sets y-axis label.
    - plt.show() - Displays the plot.

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Common Module Imports

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import numpy as np # For numerical operations

import matplotlib.pyplot as plt # For plotting

Key NumPy Function Categories

1. **Array Creation:**

   o   np.array() - Creates arrays.

   o   np.zeros() - Creates arrays of zeros.

   o   np.random.randint() - Creates random arrays.

2. **Linear Algebra (np.linalg):**

   o   np.linalg.det() - Determinant of a matrix.

   o   np.linalg.inv() - Inverse of a matrix.

   o   np.linalg.matrix_rank() - Rank of a matrix.

   o   np.linalg.eig() - Eigenvalues and eigenvectors.

   o   np.linalg.svd() - Singular Value Decomposition.

3. **Basic Operations:**

   o   np.add() - Adds arrays.

   o   np.subtract() - Subtracts arrays.

   o   np.multiply() - Multiplies arrays element-wise.

   o   np.divide() - Divides arrays element-wise.

   o   np.dot() - Performs matrix multiplication.

Key Matplotlib Function Categories

1. **Plot Types:**

   o   plt.scatter() - Scatter plots.

   o   plt.bar() - Bar graphs.

   o   plt.hist() - Histograms.

2. **Plot Customization:**

- plt.xlabel() - Sets x-axis label.

- plt.ylabel() - Sets y-axis label.

- plt.title() - Sets title.

- plt.legend() - Adds legend.

- plt.figure() - Creates a new figure.

- plt.show() - Displays the plot.