Assignment 1: Numpy

Basic NumPy Operations

1. Write a NumPy program to create a 1D array from a list [1, 2, 3, 4, 5].
2. Create a NumPy array of shape (3, 3) filled with zeros.
3. Create a NumPy array of shape (2, 4) filled with ones.
4. Generate an array of numbers from 10 to 50 with a step of 5.
5. Create an array of 10 evenly spaced values between 0 and 1.
6. Generate a 5x5 identity matrix.
7. Create an array of shape (3,3) with random values between 0 and 1.
8. Convert a Python list [10, 20, 30] into a NumPy array and print its type.
9. Create an array of 10 random integers between 1 and 100.
10. Generate a 4x4 array with random floating-point numbers.

Array Manipulation

11. Reshape a 1D array of 9 elements into a 3x3 matrix.
12. Flatten a 2D NumPy array into a 1D array.
13. Stack two NumPy arrays vertically.
14. Stack two NumPy arrays horizontally.
15. Concatenate two 1D NumPy arrays.
16. Split an array [1,2,3,4,5,6] into three equal parts.
17. Change the data type of a NumPy array from float to int.
18. Reverse a NumPy array.
19. Find the shape and size of a given NumPy array.
20. Create an array and find its transpose.

Mathematical Operations

21. Add two NumPy arrays element-wise.
22. Subtract two NumPy arrays element-wise.

23. Multiply two NumPy arrays element-wise.
24. Divide two NumPy arrays element-wise.
25. Compute the dot product of two matrices.
26. Find the sum of all elements in a NumPy array.
27. Compute the mean of an array.
28. Compute the median of an array.
29. Compute the standard deviation of an array.
30. Compute the variance of an array.

Indexing and Slicing

31. Extract the first row from a 2D NumPy array.
32. Extract the last column from a 2D NumPy array.
33. Extract all even elements from a NumPy array.
34. Replace all negative values in an array with zero.
35. Assign a new value to a specific index in a NumPy array.
36. Find the index of a specific value in a NumPy array.
37. Use boolean indexing to filter values greater than a given threshold.
38. Use slicing to extract a subarray from a 3x3 matrix.
39. Get the top 3 maximum values from an array.
40. Get the indices of all nonzero elements in an array.

Logical and Statistical Functions

41. Find the unique values in a NumPy array.
42. Count the occurrence of each unique value in a NumPy array.
43. Find the maximum and minimum values in a NumPy array.
44. Get the index of the maximum value in an array.
45. Get the index of the minimum value in an array.
46. Compute the cumulative sum of a NumPy array.

47. Compute the cumulative product of a NumPy array.
48. Check if a NumPy array contains any NaN values.
49. Replace NaN values with 0 in a NumPy array.
50. Count the number of nonzero elements in an array.

Broadcasting and Advanced Operations

51. Add a scalar value to all elements of an array.
52. Multiply an array by a scalar value.
53. Divide all elements of an array by a scalar.
54. Compute the exponential of all elements in an array.
55. Compute the natural logarithm of all elements in an array.
56. Compute the sine of all elements in an array.
57. Compute the cosine of all elements in an array.
58. Compute the square root of all elements in an array.
59. Compute the absolute value of all elements in an array.
60. Find the element-wise maximum of two arrays.

Sorting and Searching

61. Sort a NumPy array in ascending order.
62. Sort a NumPy array in descending order.
63. Sort a 2D NumPy array along a specific axis.
64. Find the k smallest values in a NumPy array.
65. Find the k largest values in a NumPy array.
66. Use argsort() to get the sorted indices of an array.
67. Search for a specific value in an array and return its index.
68. Find the first occurrence of an element greater than a given value.
69. Use where() to replace values based on a condition.
70. Count the occurrences of a specific value in an array.

Linear Algebra Operations

71. Compute the determinant of a square matrix.
72. Compute the inverse of a square matrix.
73. Compute the rank of a matrix.
74. Compute the eigenvalues of a matrix.
75. Compute the eigenvectors of a matrix.
76. Perform Singular Value Decomposition (SVD) on a matrix.
77. Solve a system of linear equations using NumPy.
78. Compute the Frobenius norm of a matrix.
79. Compute the trace of a matrix.
80. Perform Cholesky decomposition of a positive-definite matrix.

Random Number Generation

81. Generate a random integer between 10 and 50.
82. Generate an array of 5 random integers between 1 and 100.
83. Generate an array of random numbers following a normal distribution.
84. Generate a 3x3 matrix with random values between -1 and 1.
85. Shuffle the elements of a NumPy array randomly.
86. Set a random seed and generate the same random numbers.
87. Sample 5 random elements from a given array.
88. Generate a random permutation of numbers from 0 to 9.
89. Generate a 2D array of random integers with a specific shape.
90. Create a random matrix and compute its covariance.

Advanced NumPy Features

91. Use vectorize() to apply a function to each element of an array.
92. Use apply_along_axis() to apply a function along a specific axis.

93. Create a structured array with named columns.

94. Save a NumPy array to a .npy file and reload it.

95. Save a NumPy array to a CSV file.

96. Load a NumPy array from a CSV file.

97. Convert a NumPy array to a Pandas DataFrame.

98. Convert a Pandas DataFrame to a NumPy array.

99. Create a masked array with missing values.

100. Use np.meshgrid() to create coordinate grids.