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| **COLLEGE OF STATISTICS & ACTUARIAL SCIENCES**  **UNIVERSITY OF THE PUNJAB, LAHORE** | | |
| Class: **BS Statistics** | | LAB: **NumPy** |
| Module Leader: **Dr.** **Hakeem-ur-Rehman** | Module: **Python for Data Analysis** | |

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**Basics of NumPy**

**Question 1:** Import the NumPy library and create a NumPy array containing the integers from 1 to 10. Print the array.

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| arr = np.arange(1,11)  print(arr)  print(type(arr)) |

**Question 2:** Create a 3x3 NumPy array filled with zeros and print it.

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| ar1 = np.zeros([3,3])  ar1 |

**NumPy Array Operations**

**Question 3:** Create two NumPy arrays of the same shape and perform element-wise addition on them.

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| a = np.array([2,3,4,5,6])  b = np.array([1,4,6,8,0])  c = a+b  print(c) |

**Question 4:** Create a NumPy array with values from 1 to 10 and calculate the mean, median, and standard deviation of the values.

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| arrr = np.arange(1,11)  mn = np.mean(arrr)  sd = np.std(arrr)  med = np.median(arrr)  print(f'mean is {mn}, standard deviation is {sd}, median is {med}') |

**Indexing and Slicing**

**Question 5:** Create a NumPy array containing the integers from 1 to 20. Slice it to print the even numbers from the array.

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| ab = np.arange(1,21)  print(ab)  c = ab[ab%2==0]  print(c) |

**Question 6:** Create a 2D NumPy array and print the last row and last column of the array.

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| ac = np.array([[2,3,4],[2,3,6],[4,5,7]])  print(ac)  lastRow = ac[-1,:]  lastColumn = ac[:,-1]  print(f'last row is {lastRow}, last Column is {lastColumn}') |

**NumPy Functions**

**Question 7:** Create a NumPy array with random integers between 1 and 100. Find the maximum and minimum values in the array.

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| ran = np.random.random((1,100))  minimum = ran.min()  minimum  maximum = ran.max()  maximum  print(f'Minimum value is{minimum}, Maximum Vales is {maximum}') |

**Question 8:** Create a NumPy array and find the unique values in the array.

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| av = np.array([2,3,5,7,8,90,3])  c = np.unique(av)  print(c) |

**NumPy Matrix Operations**

**Question 9:** Create two NumPy matrices and perform matrix multiplication on them.

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| array1 = np.array([2,3,4,5,6])  array2 = np.array([4,5,6,7,8])  multiply = array1 \* array2  print(multiply) |

**Question 10:** Create a square NumPy matrix and calculate its determinant.

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| sq = np.array([[2,3],[3,5]])  det = np.linalg.det(sq)  print(f'determinant of square matrix is {det}') |

**NumPy Broadcasting**

**Question 11:** Create a NumPy array and add a scalar to all its elements.

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| arr1 = np.array([1,2,3,5,7,9])  scalar = 3  result = scalar + arr1  print(result) |

**Question 12:** Create a 2D NumPy array and add a 1D array to each row.

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| a = np.array([1,2,3])  b = np.array([(5,2,3), (4,5,6)])  c = a+b  print(c) |

**NumPy Statistics**

**Question 13:** Generate a NumPy array of random integers and calculate the mean, median, standard deviation, and variance of the values.

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| ran = np.random.random((1,100))  mn = ran.mean()  med = np.median(ran)  sd = ran.std()  var = ran.var()  print(f'Random integers array mean is {mn}, median is {med}, standard devivation is {sd}, varinace is {var} ') |

**Question 14:** Create a NumPy array and find the 75th percentile and cumulative sum of the values.

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| arr = np.array([2,3,5,7,8,9])  per = np.percentile(arr,75)  per  comp = np.cumsum(arr)  comp  print(f'75th Percentile of array is {per}, and  cumulative sum of array is {comp}') |

**Question 15:** Create a NumPy array and find the absolute difference between each element and the mean of the array.

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| arr = np.array([2,3,5,7,8,9])  mn = np.mean(arr)  diff = np.abs(arr - mn )  print(f'Mean of array is {mn},Absolute differnce is{diff}') |

**Question 16:** Generate a NumPy array of random numbers and find the mode of the values.

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| arr = np.array([2, 3, 2, 1, 5, 2, 6, 2, 7, 2])  unique\_values, counts = np.unique(arr, return\_counts=True)  mode\_index = np.argmax(counts)  mode = unique\_values[mode\_index]  print(mode) |

**NumPy Advanced Operations**

**Question 17:** Create a NumPy array and reshape it into a 3x4 matrix.

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| az = np.array([1,2,3,2,4,6,8,0,9,4,2,4])  ac =az.reshape(3,4)  print(ac) |

**Question 18:** Create a NumPy array and find the indices of the maximum and minimum values in the array.

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| arr = np.array([2,3,5,7,9,4,2,1,3,6,8,6,5])  min\_index = np.argmin(arr)  max\_index = np.argmax(arr)  print(f'Minimum value index is {min\_index}, Maximum value index is {max\_index}') |

**Advanced NumPy Functions**

**Question 19:** Create a NumPy array and sort it in ascending order.

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| af = np.array([1,2,3,2,4,6,8,0,9,4,2,4])  a =np.sort(af)  print(a) |

**Question 20:** Create a NumPy array and find the unique values in the array.

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| aa = np.array([1,2,4,5,3,5,3,1,3,5,7,8,4,2,4,2])  c = np.unique(aa)  print(c) |

**Question 21:** Create a NumPy array and find the unique values and their counts.

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| sa = np.array([1,2,4,5,3,5,3,1,3,5,7,8,4,2,4,2])  kk , count1 = np.unique(sa, return\_counts=True)  print(kk)  print(count1) |