

ASSIGNMENT

NumPy

Question 1 :

- a) If `arr = np.array([1, 2, 3, 4, 5])`, what happens if you execute `arr[1:4] = 10`?
- b) For the array `arr = np.array([0, 1, 2, 3, 4, 5])`, what does `arr[:2]` return?

Question 2:

```
import numpy as np
```

```
a = np.array([[1, 2, 3],  
              [4, 5, 6]])
```

```
b = np.array([10, 20, 30])
```

What will be the output of the operation `a + b`? Explain how broadcasting is applied in this scenario.

Question 3:

Create a 1D array of random numbers and find the indices of local peaks (values that are strictly greater than their neighbors).

(A local peak is an element in an array that is greater than both its left and right neighbors.)

(Hint : create a random 1D array, and use `np.where()` function to put a condition, relate it to slicing and use comparisons to formulate the function.)

Question 4:

Create a square matrix (of dimension `p`) and calculate its determinant using an inbuilt function. Now, use scalar multiplication to multiply each element of matrix by any number, say `k`. Prove that that the determinant of the new matrix is k^p times the determinant of original matrix.

Question 5:

Create a structured array where each element has fields for a name, age, and weight. Then sort the array by age.

Pandas:

Name	Age	Gender	Grade	City	
Alice	20	Female	85	New York	
Bob		Male	78	San Francisco	
Charlie	22	Male	90	Los Angeles	
David	21	Male	74	New York	
Eve	20	Female		San Francisco	
Frank	23		88	Los Angeles	
Grace	22	Female	82		
Hank	20	Male	79	Chicago	
Isla		Female	92		
John	21			New York	

Answer the following:

- How can you identify any outliers in the Age and Grade columns using pandas?
- How can you group the students based on City and calculate the average Grade for each city?
- How can you filter out the students who have a Grade greater than 80 and are from the city of "New York"?
- How can you sort the dataset based on Grade in descending order and then by Age in ascending order, if two students have the same grade?
- How can you create a new column Pass/Fail, which categorizes students as 'Pass' if their Grade is 80 or above and 'Fail' otherwise?