# Practical 3

## About this unit

Practical 3

**Practice Lab Assignment**

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**Lab Assignment**

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## 3.1.1. Numpy array operations

06:41

Write a python program to demonstrate the usage of ndim, shape and size for a Numpy Array. The program should create a NumPy array using the entered elements and display it. Assume all input elements are valid numeric values.

**Input Format:**

- User inputs the number of rows and columns with space separated values.
- User inputs elements of the array row-wise followed line by line, separated by spaces.

**Output Format:**

- The created NumPy array based on the input dimensions and elements.
- Dimensions (ndim): Number of dimensions of the array.
- Shape: Tuple representing the shape of the array (number of rows, number of columns).
- Size: Total number of elements in the array.

**Note:** Use reshape() function to reshape the input array with the specified number of rows and columns.

Sample Test Cases +

Explorer

numpyarr.py

Submit

Debugger

```python
import numpy as np
rows, cols = map(int, input().split())

elements = []
for _ in range(rows):
    row_elements = list(map(int, input().split()))
    elements.extend(row_elements)

arr = np.array(elements).reshape(rows, cols)

print(arr)

print(arr.ndim)

print( arr.shape)
print( arr.size)
```

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## 3.2.1. Numpy: Matrix Operations

02:25

The given code takes two $3 \times 3$ matrices, $\text{matrix\_a}$, and $\text{matrix\_b}$, as input from the user and converts them into NumPy arrays.

**Task:**

You are required to compute and display the results of the following matrix operations:

1. **Addition** ($\text{matrix\_a} + \text{matrix\_b}$)
2. **Subtraction** ($\text{matrix\_a} - \text{matrix\_b}$)
3. **Element-wise Multiplication** ($\text{matrix\_a} * \text{matrix\_b}$)
4. **Matrix Multiplication** ($\text{matrix\_a} \cdot \text{matrix\_b}$)
5. **Transpose of Matrix A**

**Input Format:**

- The user will input 3 rows for $\text{matrix\_a}$, each containing 3 integers separated by spaces.
- Similarly, the user will input 3 rows for $\text{matrix\_b}$, each containing 3 integers separated by spaces.

**Output Format:**

The program should display the results of the operations in the following order:

1. The result of Addition.
2. The result of Subtraction.
3. The result of Element-wise Multiplication.
4. The result of Matrix Multiplication.
5. The Transpose of Matrix A.

Sample Test Cases +

Explorer

matrixOpe...

Submit

Debugger

```python
import numpy as np

# Input matrices
print("Enter Matrix A:")
matrix_a = np.array([list(map(int, input().split())) for i in range(3)])

print("Enter Matrix B:")
matrix_b = np.array([list(map(int, input().split())) for i in range(3)])


# Addition
print("Addition (A + B):")
print(matrix_a + matrix_b)
# Subtraction
print("Subtraction (A - B):")
print(matrix_a - matrix_b)
# Multiplication (element-wise)
print("Element-wise Multiplication (A * B):")
print(matrix_a * matrix_b)
# Matrix multiplication (dot product)
print("A dot B:")
print(np.dot(matrix_a,matrix_b))
# Transpose
print("Transpose of A:")
print(matrix_a.T)
```

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## 3.2.2. Numpy: Horizontal and Vertical Stacki... 08:04

You are given two arrays `arr1` and `arr2`. You need to perform horizontal and vertical stacking operations on them using NumPy.

- **Horizontal Stacking**: Stack the two matrices horizontally (side by side).
- **Vertical Stacking**: Stack the two matrices vertically (one below the other).

**Input Format:**

- The program should first prompt the user to input two 3x3 arrays.
- Each array consists of 3 rows, and each row contains 3 space-separated integers.
- The user will input the two arrays row by row.

**Output Format:**

- The program should display the result of the Horizontal Stack (side-by-side stacking) of the two arrays.
- The program should then display the result of the Vertical Stack (one below the other) of the two arrays.

Sample Test Cases +

Explorer

stacking.py

Submit

Debugger

```python
import numpy as np

# Input matrices
print("Enter Array1:")
arr1 = np.array([list(map(int, input().split())) for i in range(3)])

print("Enter Array2:")
arr2 = np.array([list(map(int, input().split())) for i in range(3)])

# Perform horizontal stacking (hstack)
horizontal_stack = np.hstack((arr1,arr2))


# Perform vertical stacking (vstack)
vertical_stack = np.vstack((arr1,arr2))
print("Horizontal Stack:")
print(horizontal_stack)
print("Vertical Stack:")
print(vertical_stack)
```

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## 3.2.3. Numpy: Custom Sequence Generation

01:11

Write a Python program that takes the following inputs from the user:

- Start value: The starting point of the sequence.
- Stop value: The sequence should end before this value.
- Step value: The increment between each number in the sequence.

The program should then generate a sequence using numpy based on these inputs and print the generated sequence.

**Input Format:**

- The user will input three integer values: start, stop, and step, each on a new line.

**Output Format:**

- The program should print the generated sequence based on the input values.

Sample Test Cases +

Explorer

customSe...

Submit

```python
import numpy as np

# Take user input for the start, stop, and step of the sequence
start = int(input())
stop = int(input())
step = int(input())

# Generate the sequence using np.arange()
sequence = np.arange(start, stop, step)
# Print the generated sequence
print(sequence)
```

Debugger

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CODETANTRA

3.2.4. Numpy: Arithmetic and Statistical Ope... 04:03

You are given two arrays A and B. Your task is to complete the function `array_operations`, which will convert these lists into NumPy arrays and perform the following operations:

**1. Arithmetic Operations**:
- Compute the element-wise sum, difference, and product of the two arrays.

**2. Statistical Operations**:
- Calculate the mean, median, and standard deviation of array A.

**3. Bitwise Operations**:
- Perform bitwise AND, bitwise OR, and bitwise XOR on the arrays (ex: $A_i$ OR $B_i$).

**Input Format:**
- The first line contains space-separated integers representing the elements of array A.
- The second line contains space-separated integers representing the elements of array B.

**Output Format:**
- For each operation (arithmetic, statistical, and bitwise), print the results in the specified format as shown in sample test cases.

Sample Test Cases +

Explorer

differentO...

Submit

Debugger

```python
import numpy as np

def array_operations(A, B):

    # Convert A and B to NumPy arrays
    A = np.array(A)
    B = np.array(B)

    # Arithmetic Operations
    sum_result = A + B
    diff_result = A - B
    prod_result = A * B

    # Statistical Operations
    mean_A = np.mean(A)
    median_A = np.median(A)
    std_dev_A = np.std(A)

    # Bitwise Operations
    and_result = A & B
    or_result = A | B
    xor_result = A ^ B

    # Output results with one space between each element
    print("Element-wise Sum:", ' '.join(map(str, sum_result)))
    print("Element-wise Difference:", ' '.join(map(str, diff_result)))
    print("Element-wise Product:", ' '.join(map(str, prod_result)))

    print(f"Mean of A: {mean_A}")
    print(f"Median of A: {median_A}")
    print(f"Standard Deviation of A: {std_dev_A}")

    print("Bitwise AND:", ' '.join(map(str, and_result)))
    print("Bitwise OR:", ' '.join(map(str, or_result)))
    print("Bitwise XOR:", ' '.join(map(str, xor_result)))

A = list(map(int, input().split())) # Elements of array A
B = list(map(int, input().split())) # Elements of array B
array_operations(A, B)
```

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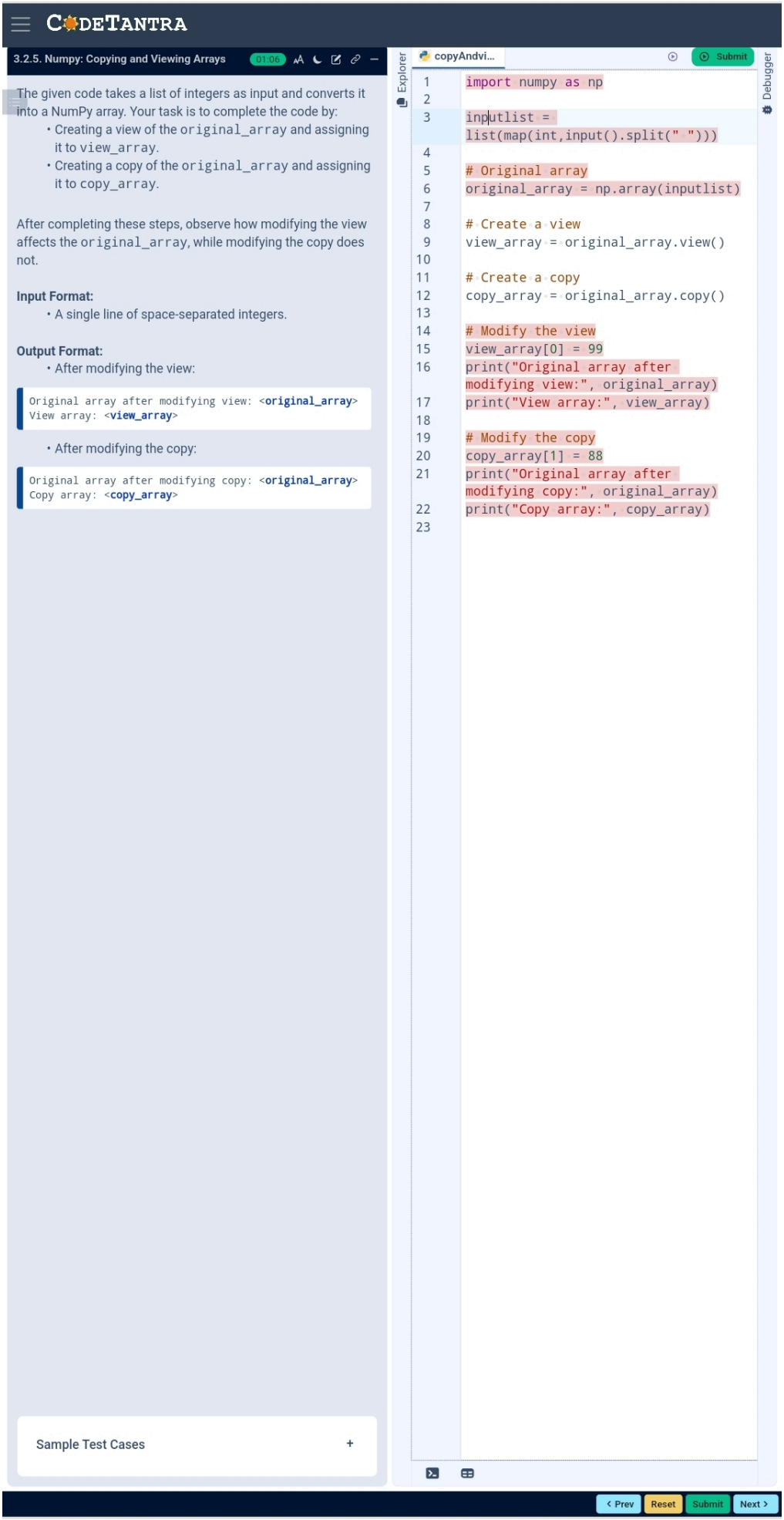

CODETANTRA

3.2.5. Numpy: Copying and Viewing Arrays 01:06

The given code takes a list of integers as input and converts it into a NumPy array. Your task is to complete the code by:

- Creating a view of the `original_array` and assigning it to `view_array`.
- Creating a copy of the `original_array` and assigning it to `copy_array`.

After completing these steps, observe how modifying the view affects the `original_array`, while modifying the copy does not.

**Input Format:**

- A single line of space-separated integers.

**Output Format:**

- After modifying the view:

```
Original array after modifying view: <original_array>
View array: <view_array>
```

- After modifying the copy:

```
Original array after modifying copy: <original_array>
Copy array: <copy_array>
```

Sample Test Cases +

Explorer

copyAndvi... Submit

```
1  import numpy as np
2
3  inputlist =
   list(map(int,input().split(" ")))
4
5  # Original array
6  original_array = np.array(inputlist)
7
8  # Create a view
9  view_array = original_array.view()
10
11 # Create a copy
12 copy_array = original_array.copy()
13
14 # Modify the view
15 view_array[0] = 99
16 print("Original array after
   modifying view:", original_array)
17 print("View array:", view_array)
18
19 # Modify the copy
20 copy_array[1] = 88
21 print("Original array after
   modifying copy:", original_array)
22 print("Copy array:", copy_array)
23
```

Debugger

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CODETANTRA

3.2.6. Numpy: Searching, Sorting, Counting, ... 05:04

The given code in the editor takes a single array, `array1`, as space-separated integers as input from the user.
Additionally, it takes the following inputs:

- `search_value`: The value to search for in the array.
- `count_value`: The value to count its occurrences in the array.
- `broadcast_value`: The value to add for broadcasting across the array.

You need to complete the code to perform the following operations:
**1. Searching**: Find the indices where `search_value` appears in `array1` and print these indices.
**2. Counting**: Count how many times `count_value` appears in `array1` and print the count.
**3. Broadcasting**: Add `broadcast_value` to each element of `array1` using broadcasting, and print the resulting array.
**4. Sorting**: Sort `array1` in ascending order and print the sorted array.

**Input Format:**

1. A single line containing space-separated integers representing `array1`.
2. An integer `search_value` represents the value to search for in the array.
3. An integer `count_value` represents the value to count in the array.
4. An integer `broadcast_value` represents the value to add to each element of the array.

**Output Format:**

1. The indices where `search_value` occurs in `array1`.
2. The count of occurrences of `count_value` in `array1`.
3. The array after adding the `broadcast_value` to each element.
4. The sorted array.

Sample Test Cases +

Explorer

arrayOpera...

Submit

Debugger

```
1  import numpy as np
2
3  # Input array from the user
4  array1 = np.array(list(map(int,
   input().split())))
5
6  # Searching
7  search_value = int(input("Value to
   search: "))
8  count_value = int(input("Value to
   count: "))
9  broadcast_value = int(input("Value
   to add: "))
10
11 # Find indices where value matches
   in array1
12 search_indices = np.where(array1 ==
   search_value)[0]
13 print( search_indices)
14
15 # Count occurrences in array1
16 count_occurance =
   np.count_nonzero(array1 ==
   count_value)
17 print( count_occurance)
18
19 # Broadcasting addition
20 broadcast_result = array1 +
   broadcast_value
21 print( broadcast_result)
22
23 # Sort the first array
24 sorted_array = np.sort(array1)
25 print( sorted_array)
```

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## 3.2.7. Student Data Analysis and Operations

40:50

Write a Python program that takes the file name of a CSV file containing student details, including roll numbers and their marks in three subjects as input, reads the data, and performs the following operations:

- **Print all student details**: Display the complete details of all students, including roll numbers and marks for all subjects.
- **Find total students**: Determine the total number of students in the dataset.
- **Print all student roll numbers**: Extract and print the roll numbers of all students.
- **Print Subject 1 marks**: Extract and print the marks of all students in Subject 1.
- **Find minimum marks in Subject 2**: Identify the lowest marks in Subject 2.
- **Find maximum marks in Subject 3**: Identify the highest marks in Subject 3.
- **Print all subject marks**: Display the marks of all students for each subject.
- **Find total marks of students**: Compute the total marks for each student across all subjects.
- **Find the average marks of each student**: Compute the average marks for each student.
- **Find average marks of each subject**: Compute the average marks for all students in each subject.
- **Find average marks of Subject 1 and Subject 2**: Compute the average marks for Subject 1 and Subject 2.
- **Find average marks of Subject 1 and Subject 3**: Compute the average marks for Subject 1 and Subject 3.
- **Find the roll number of the student with maximum marks in Subject 3**: Identify the student with the highest marks in Subject 3 and print their roll number.
- **Find the roll number of the student with minimum marks in Subject 2**: Identify the student with the lowest marks in Subject 2 and print their roll number.
- **Find the roll number of students who scored 24 marks in Subject 2**: Identify students who obtained exactly 24 marks in Subject 2 and print their roll numbers.
- **Find the count of students who got less than 40 marks in Subject 1**: Count the number of students who scored less than 40 marks in Subject 1.
- **Find the count of students who got more than 90 marks in Subject 2**: Count the number of students who scored more than 90 marks in Subject 2.
- **Find the count of students who scored >=90 in each subject**: Count the number of students who scored 90 or more marks in each subject.
- **Find the count of subjects in which each student scored >=90**: Determine how many subjects each student scored 90 or more marks in.
- **Print Subject 1 marks in ascending order**: Sort and print the marks of students in Subject 1 in ascending order.
- **Print students who scored between 50 and 90 in Subject 1**: Display students who scored marks between 50 and 90 in Subject 1.
- **Find index positions of students who scored 79 in Subject 1**: Identify the index positions of students who scored exactly 79 marks in Subject 1.

**Note:** Fill in the missing code to perform the above-mentioned operations.

Sample Test Cases +

Explorer

Operations...

Submit

Debugger

```
import numpy as np

a = np.loadtxt("Sample.csv", delimiter=',', skiprows=1)

# 1. Print all student details
print("All student Details:\n",a)

# 2. print total students
r,c=a.shape
print("Total Students:",r)

# 3. Print all student Roll numbers
print("All Student Roll Nos",a[:,0])

# 4. Print subject 1 marks
print("Subject 1 Marks",a[:,1])

# 5. print minimum marks of Subject 2
print("Min marks in Subject 2", np.min(a[:,2]))

# 6. print maximum marks of Subject 3
print("Max marks in Subject 3", np.max(a[:,3]))

# 7. Print All subject marks
print("All subject marks:",a[:,1:])

# 8. print Total marks of students
total_marks =np.sum(a[:, 1:], axis=1)
print("Total Marks", total_marks)

# 9. print average marks of each student
avg=np.mean(a[:,1:],axis=1)
print(np.round(avg,1))

# 10. print average marks of each subject
print("Average Marks of each subject",np.mean(a[:, 1:],axis=0))

# 11. print average marks of S1 and S2
print("Average Marks of S1 and S2",np.mean(a[:, 1:3],axis=0))

# 12. print average marks of S1 and S3
print("Average Marks of S1 and S3",np.mean(a[:, [1, 3]],axis=0))

# 13. print Roll number who got maximum marks in Subject 3
i=np.argmax(a[:,3])
print("Roll no who got maximum marks in Subject 3",a[i,0])

# 14. print Roll number who got minimum marks in Subject 2
mn=np.argmin(a[:,2])
print("Roll no who got minimum marks in Subject 2",a[mn,0])

# 15. print Roll number who got 24 marks in Subject 2
whr=np.where(a[:, 2] == 24)
print("Roll no who got 24 marks in Subject 2",a[whr,0])


# 16. print count of students who got marks in Subject 1 < 40
ct=np.count_nonzero(a[:,1]<40)
print("Count of students who got marks in Subject 1 < 40", ct)
```

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