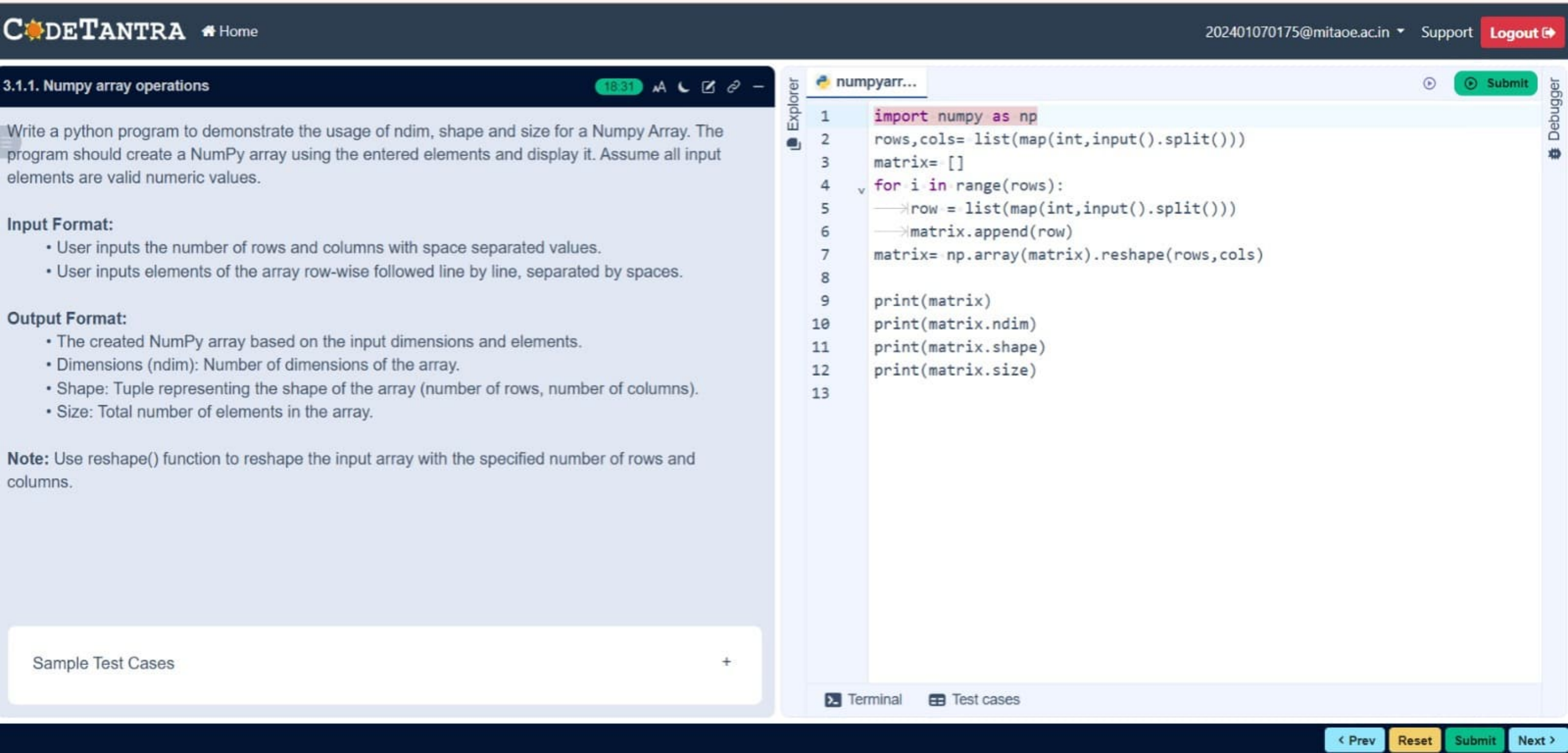


3.1.1. Numpy array operations

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.

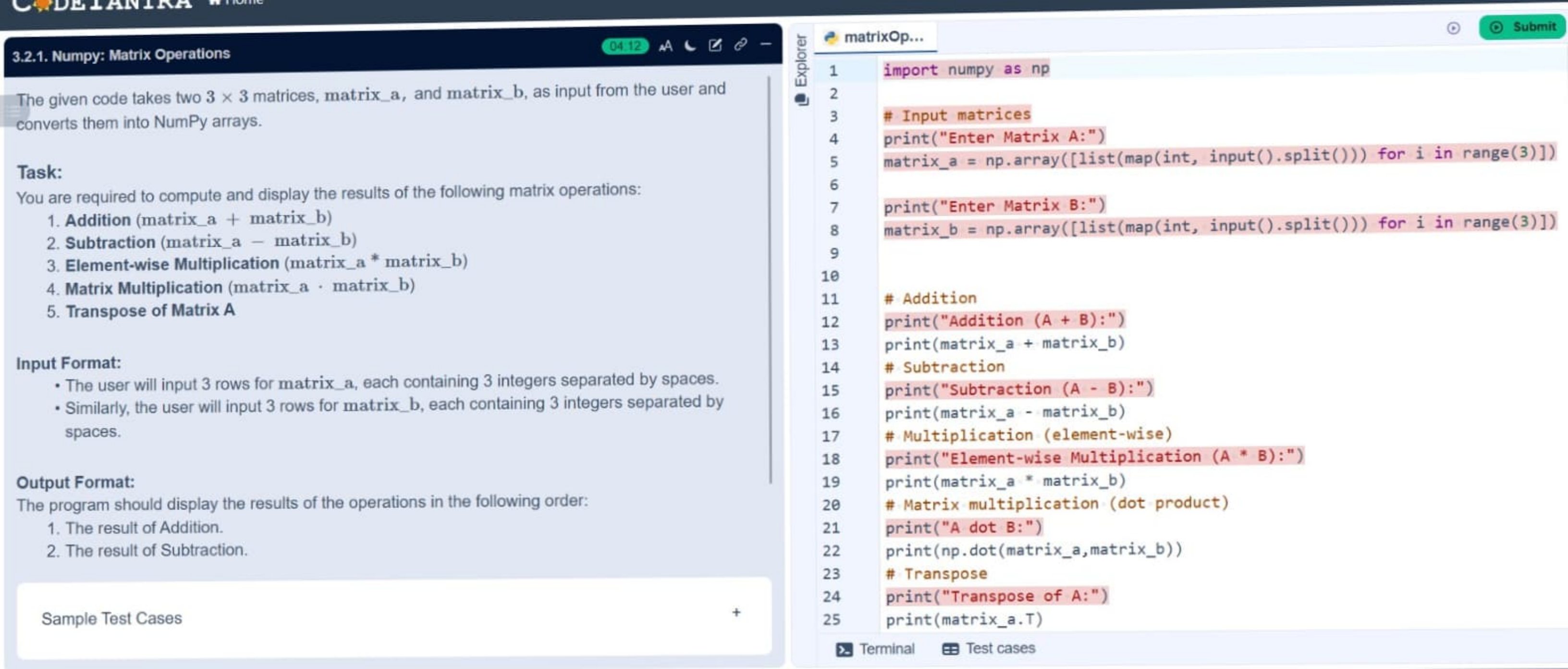
Output Format:

- 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 +

```python
import numpy as np
rows,cols= list(map(int,input().split()))
matrix= []
for i in range(rows):
    row = list(map(int,input().split()))
    matrix.append(row)
matrix= np.array(matrix).reshape(rows,cols)

print(matrix)
print(matrix.ndim)
print(matrix.shape)
print(matrix.size)

```



3.2.1. Numpy: Matrix Operations

The given code takes two 3×3 matrices, $\mathrm{matrix\_a}$, and $\mathrm{matrix\_b}$, 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** $(\mathrm{matrix\_a} + \mathrm{matrix\_b})$
2. **Subtraction** $(\mathrm{matrix\_a} - \mathrm{matrix\_b})$
3. **Element-wise Multiplication** $(\mathrm{matrix\_a} * \mathrm{matrix\_b})$
4. **Matrix Multiplication** $(\mathrm{matrix\_a} \cdot \mathrm{matrix\_b})$
5. **Transpose of Matrix A**

Input Format:

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

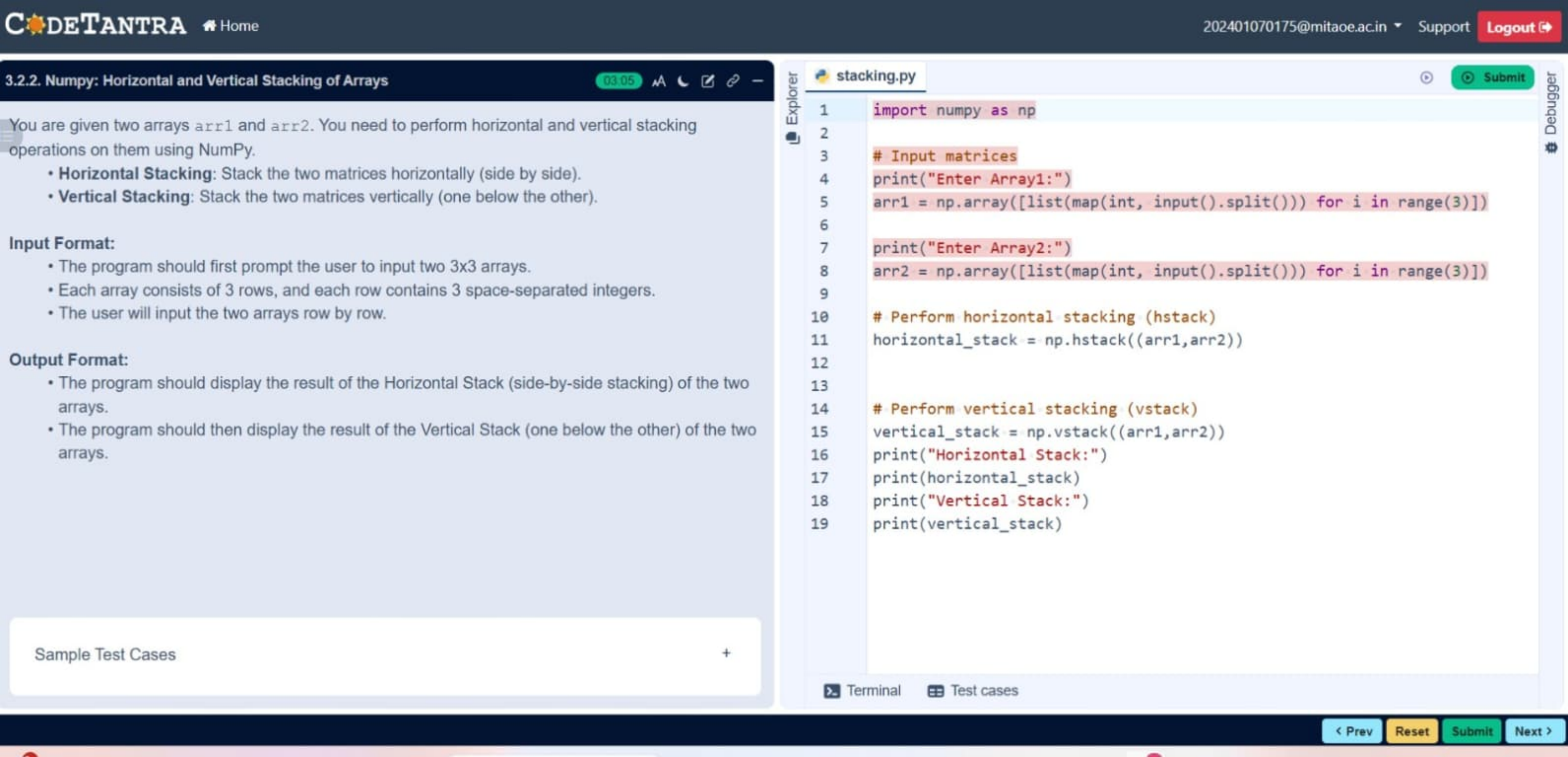
Output Format:

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

1. The result of Addition.
2. The result of Subtraction.

Sample Test Cases +

```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)
```



3.2.2. Numpy: Horizontal and Vertical Stacking of Arrays

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:

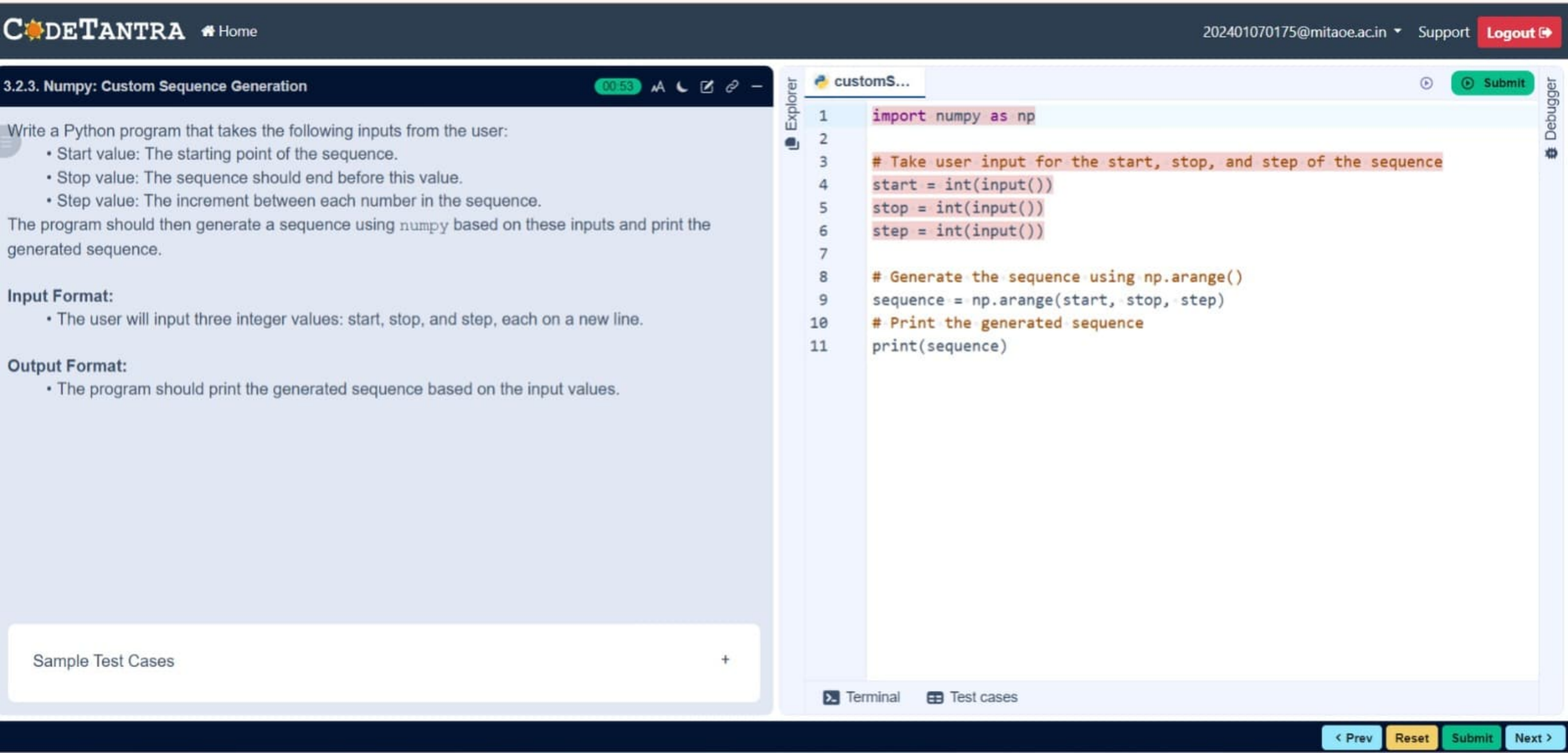
- The program should first prompt the user to input two 3x3 arrays.
- Each array consists of 3 rows, and each row contains 3 space-separated integers.
- The user will input the two arrays row by row.

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 +

```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)
```



3.2.3. Numpy: Custom Sequence Generation

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.

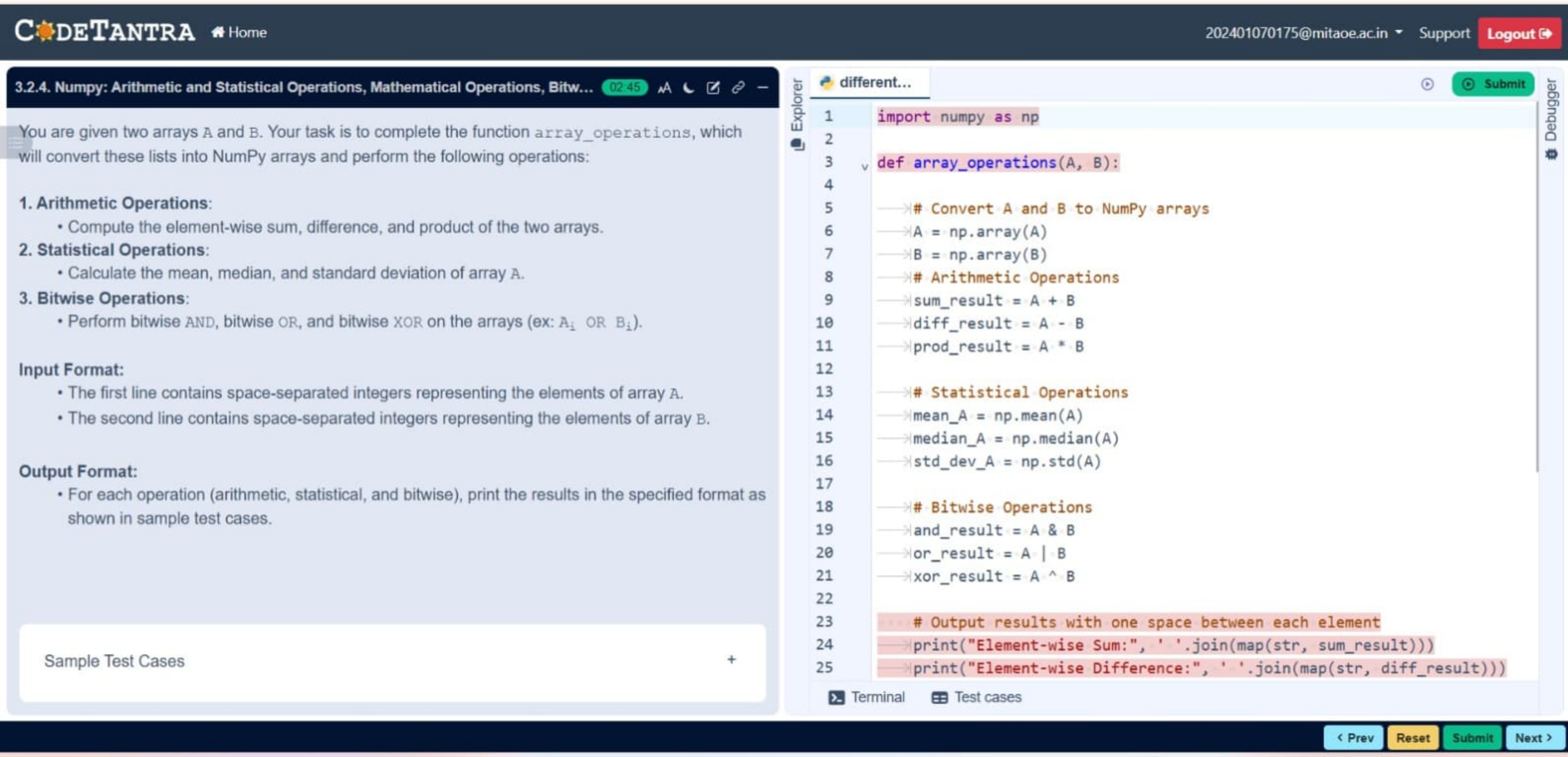
Input Format:

- 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.

```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)
```



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).

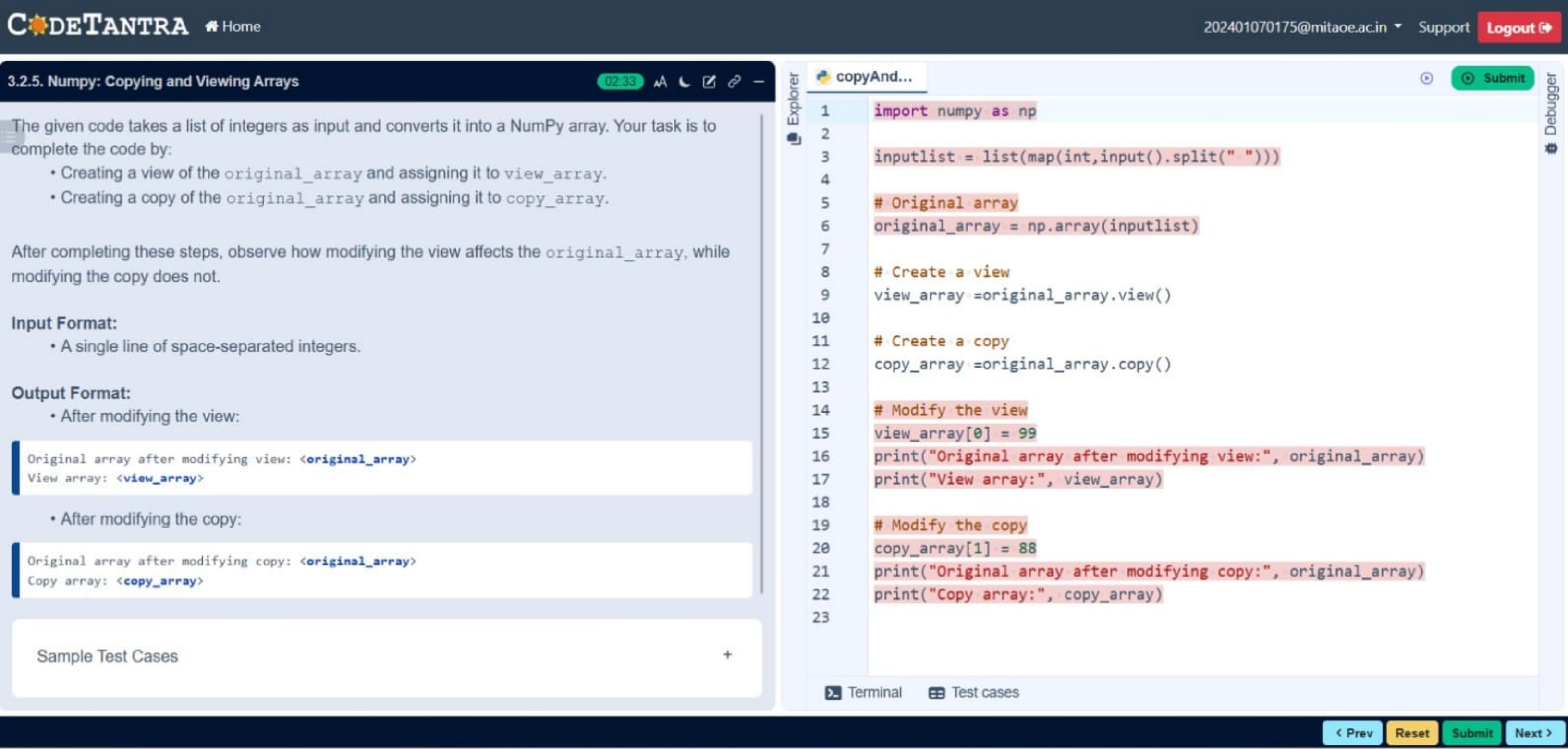
Input Format:

- 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.

```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)))
```



3.2.5. Numpy: Copying and Viewing Arrays

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:

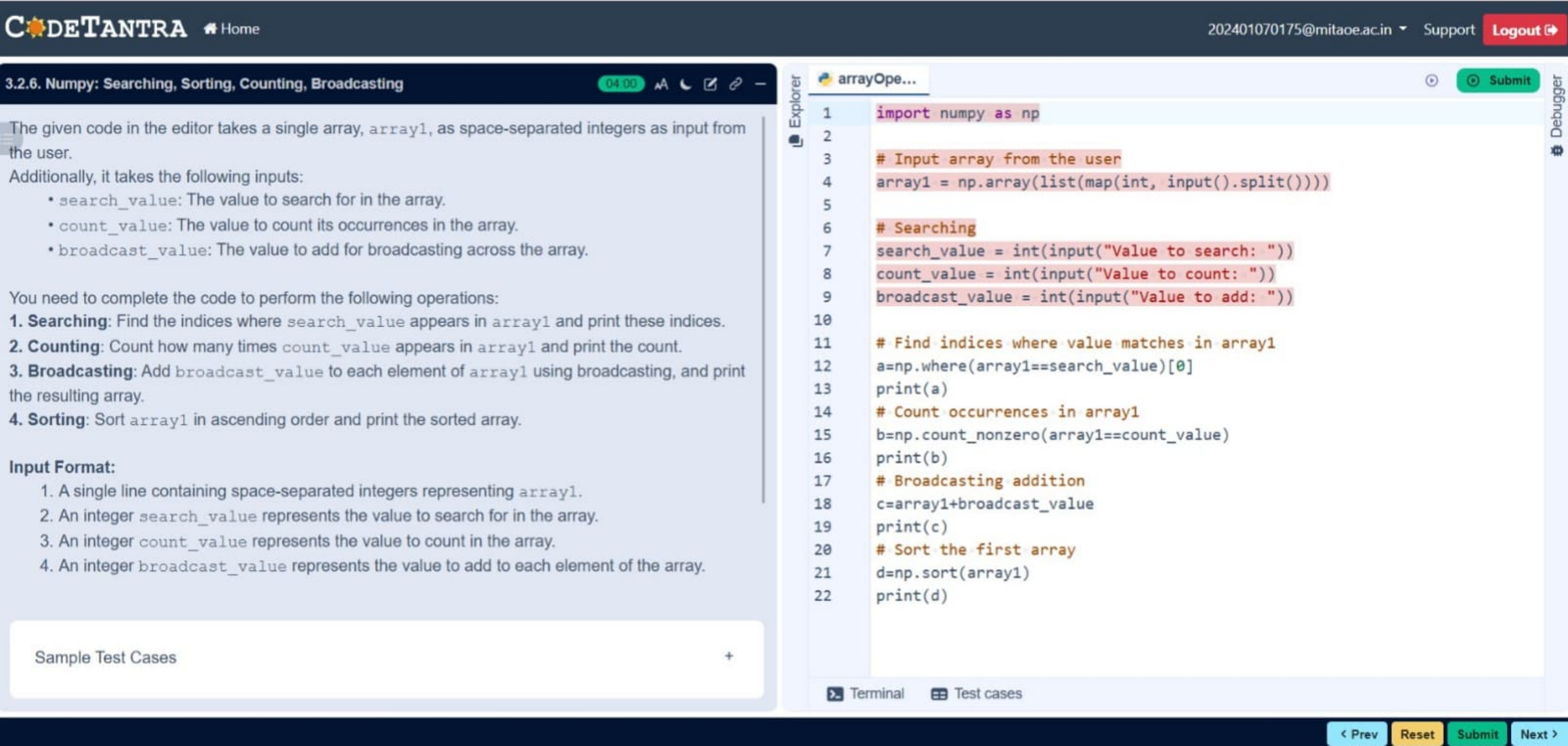
```
Original array after modifying view: <original_array>
View array: <view_array>
```

- After modifying the copy:

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

Sample Test Cases +

```python
import numpy as np

inputlist = list(map(int,input().split(" ")))

# Original array
original_array = np.array(inputlist)

# Create a view
view_array =original_array.view()

# Create a copy
copy_array =original_array.copy()

# Modify the view
view_array[0] = 99
print("Original array after modifying view:", original_array)
print("View array:", view_array)

# Modify the copy
copy_array[1] = 88
print("Original array after modifying copy:", original_array)
print("Copy array:", copy_array)
```



3.2.6. Numpy: Searching, Sorting, Counting, Broadcasting

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:

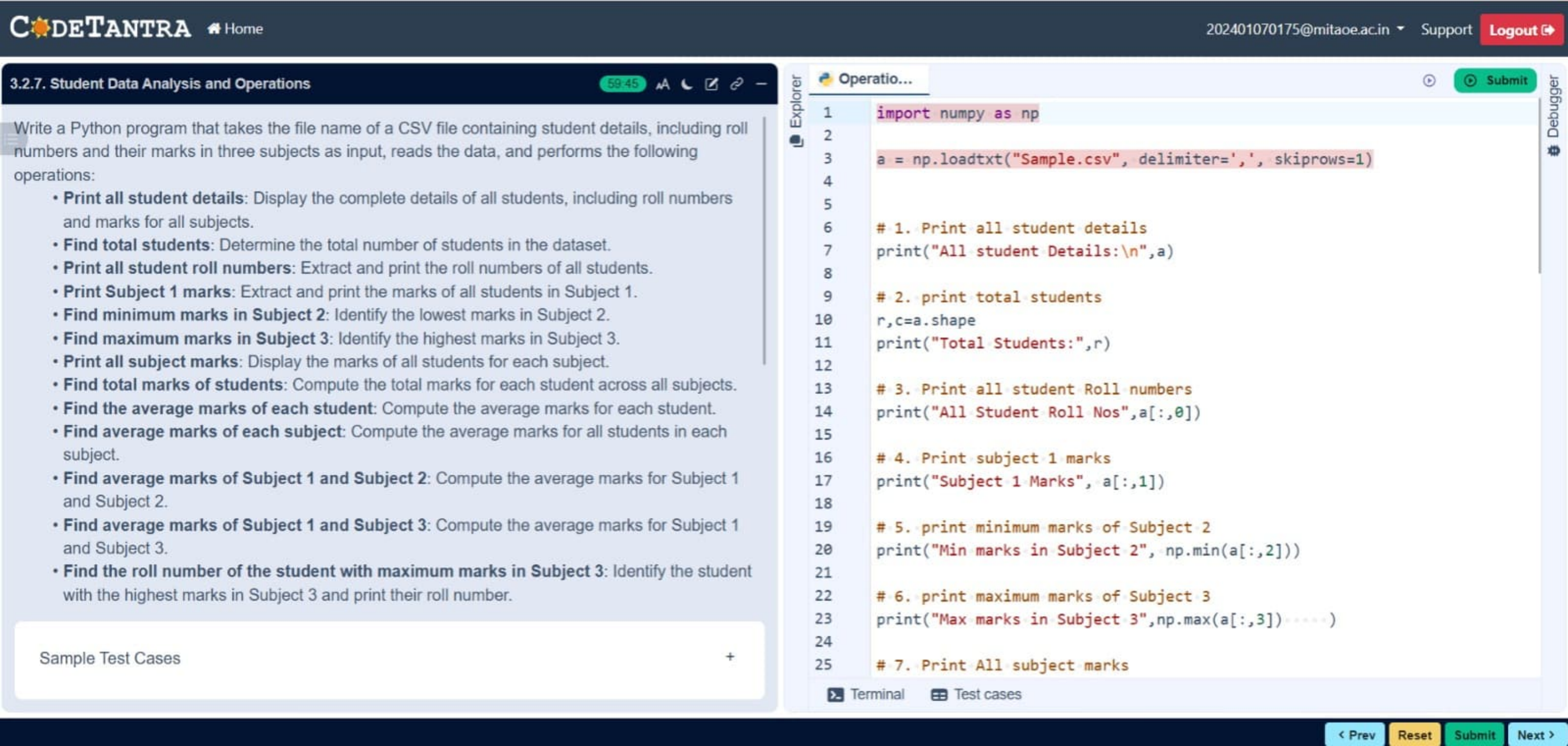
1. **Searching**: Find the indices where `search_value` appears in `array1` and print these indices.
2. **Counting**: Count how many times `count_value` appears in `array1` and print the count.
3. **Broadcasting**: Add `broadcast_value` to each element of `array1` using broadcasting, and print the resulting 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.

Sample Test Cases +

```python
import numpy as np

# Input array from the user
array1 = np.array(list(map(int, input().split())))

# Searching
search_value = int(input("Value to search: "))
count_value = int(input("Value to count: "))
broadcast_value = int(input("Value to add: "))

# Find indices where value matches in array1
a=np.where(array1==search_value)[0]
print(a)
# Count occurrences in array1
b=np.count_nonzero(array1==count_value)
print(b)
# Broadcasting addition
c=array1+broadcast_value
print(c)
# Sort the first array
d=np.sort(array1)
print(d)
```



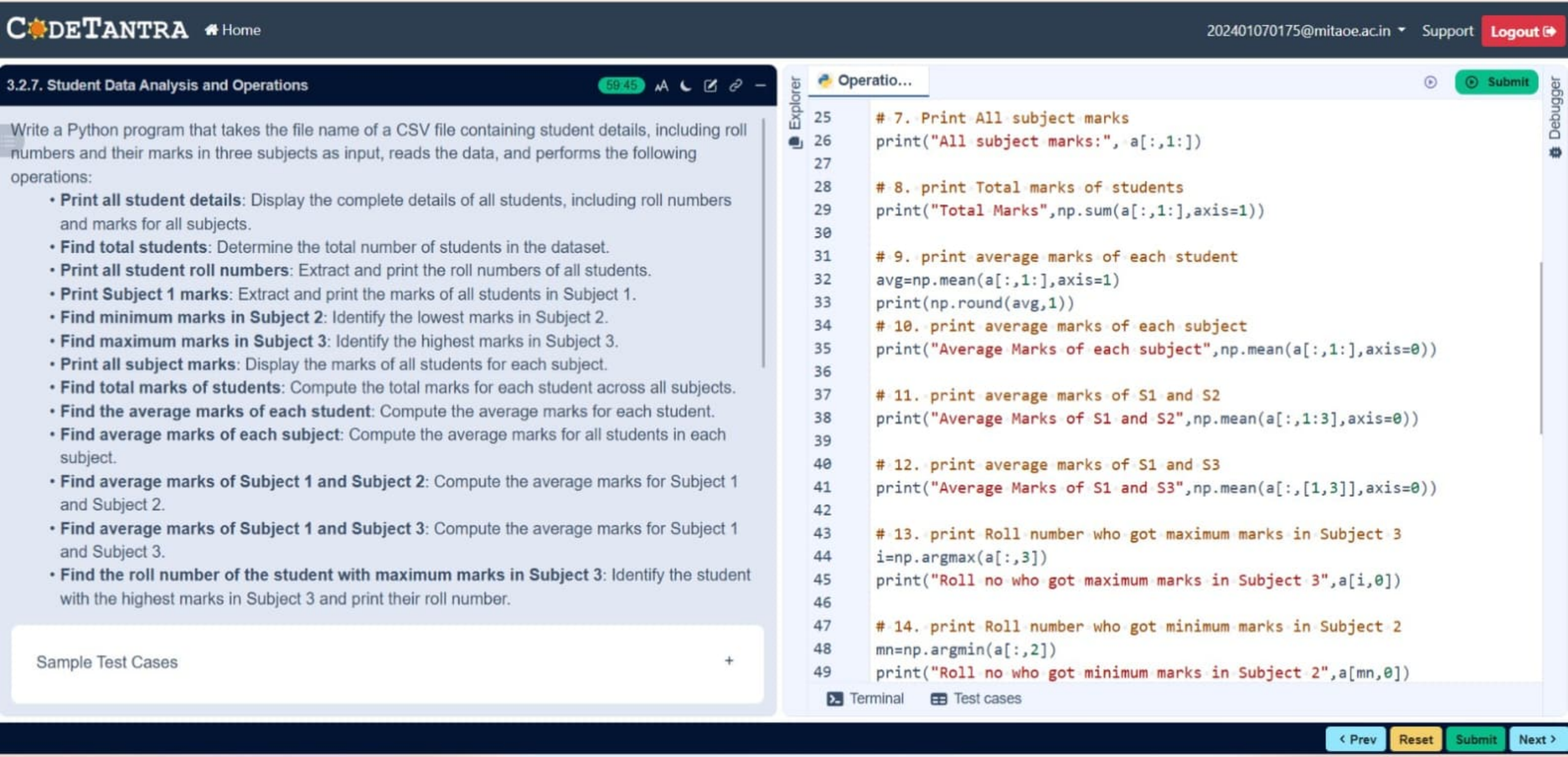
3.2.7. Student Data Analysis and Operations

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.

Sample Test Cases +

```python
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
```



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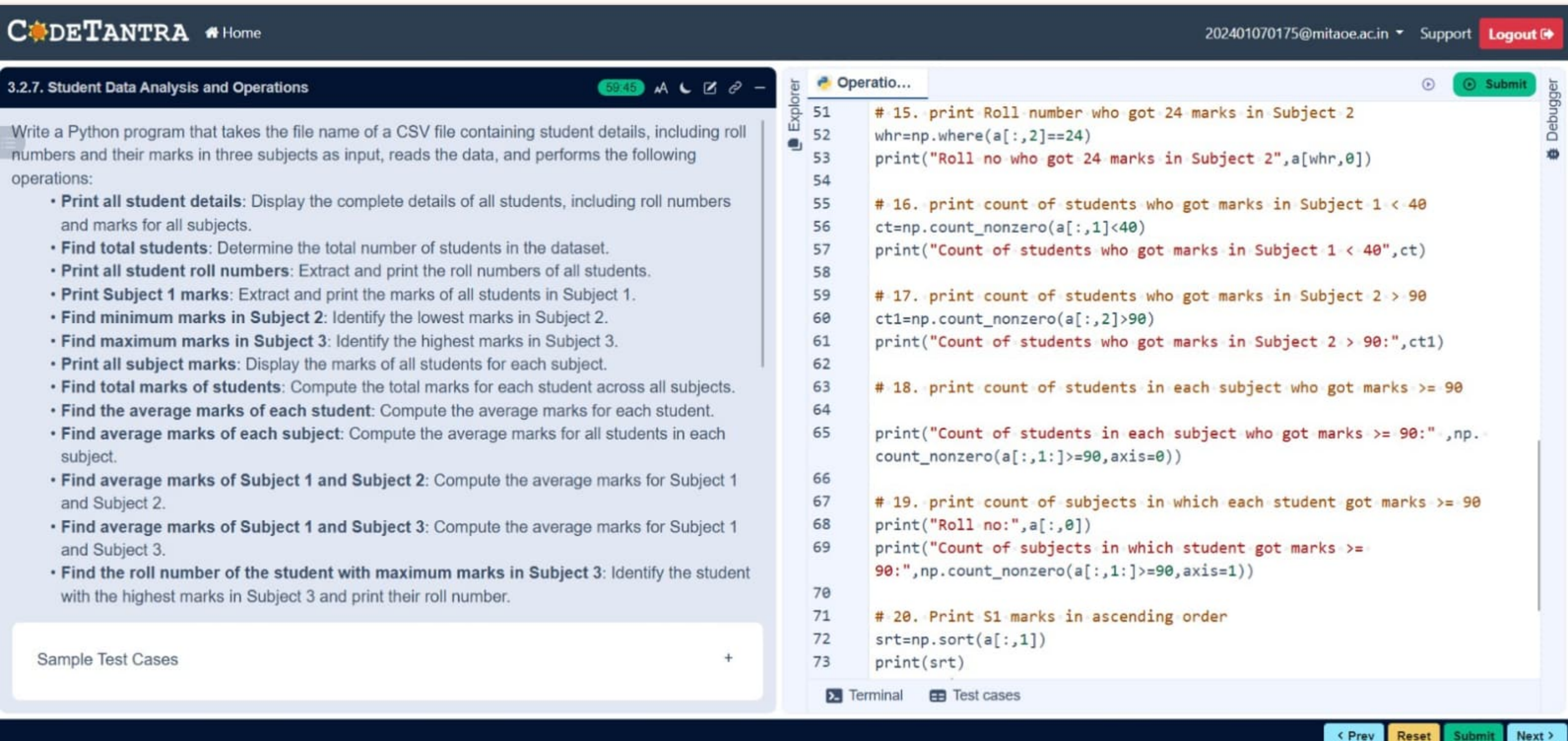
- **Find maximum marks in Subject 3**: Identify the highest marks in Subject 3.
- **Print all subject marks**: Display the marks of all students for each subject.
- **Find total marks of students**: Compute the total marks for each student across all subjects.
- **Find the average marks of each student**: 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.

Sample Test Cases +

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

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

# 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])
```



3.2.7. Student Data Analysis and Operations

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- **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.

Sample Test Cases +

```python
# 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)

# 17. print count of students who got marks in Subject 2 > 90
ct1=np.count_nonzero(a[:,2]>90)
print("Count of students who got marks in Subject 2 > 90:",ct1)

# 18. print count of students in each subject who got marks >= 90

print("Count of students in each subject who got marks >= 90:" ,np.count_nonzero(a[:,1:]>=90,axis=0))

# 19. print count of subjects in which each student got marks >= 90
print("Roll no:",a[:,0])
print("Count of subjects in which student got marks >= 90:",np.count_nonzero(a[:,1:]>=90,axis=1))

# 20. Print S1 marks in ascending order
srt=np.sort(a[:,1])
print(srt)
```