## Topic 1- Introduction

### Q1. First Palindromic String

**Aim:** To find the first palindromic string in a list.

**Algorithm:**

1. Take input list of words.
2. Traverse each word.
3. Check if word == reverse of word.
4. Print first palindrome found, else print "

**Code (Python):**

words = input("Enter words: ").split() ans

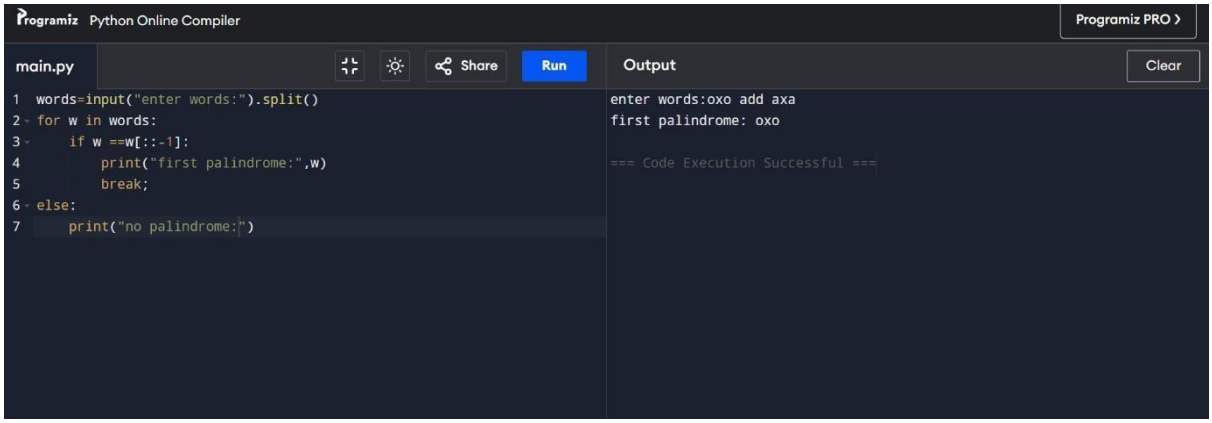
= "" for w in words:  if w == w[::-1]:

ans = w  break print("First

Palindrome:", ans)  **Input:**

abc car ada racecar cool **Output:**

First Palindrome: ada




### Q2. Count Common Indices in Two Arrays

**Aim:** To count how many elements of one list exist in another.

**Algorithm:**

1. Take input arrays nums1 and nums2.

2. For each element in nums1, check if in nums2 → count1.
3. For each element in nums2, check if in nums1 → count2.
4. Print [count1, count2].

**Code (Python):**

nums1 = list(map(int, input("Enter nums1: ").split()))

nums2 = list(map(int, input("Enter nums2: ").split()))

set1, set2 = set(nums1), set(nums2) answer1 = sum(1

for x in nums1 if x in set2) answer2 = sum(1 for x in

nums2 if x in set1) print("Output:", [answer1, answer2])

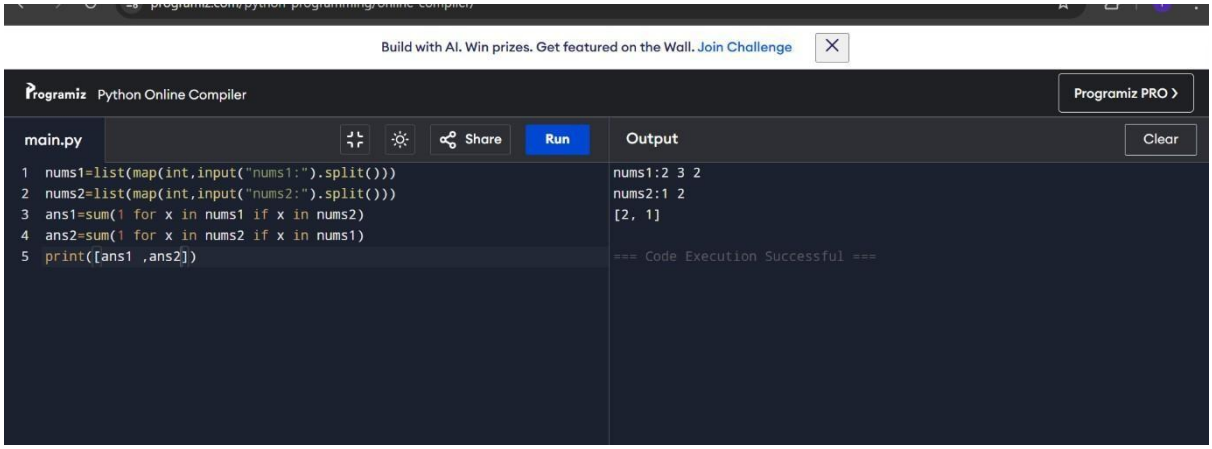
**Input:**

Enter nums1: 4 3 2 3 1 Enter nums2:

2 2 5 2 3 6

**Output:**

[3, 4]




**Q3. Sum of Squares of Distinct Counts of Subarrays Aim:**

To calculate sum of (distinct_count²) for all subarrays.

**Algorithm:**

1. Take input array nums.
2. For each starting index i → create empty set.
3. For each ending index j → add element, count distincts.
4. Add square of count to total.

5. Print total.

**Code (Python):**

nums = list(map(int, input("Enter numbers: ").split()))

n = len(nums) total = 0 for i in range(n): seen = set()

for j in range(i, n): seen.add(nums[j]) total

+= len(seen) ** 2 print("Sum of squares:", total)

**Input:**

Enter array: 1 2 1

**Output:**

Result: 15


**Q4. Count Pairs with Condition**

**Aim:** To count pairs (i, j) where nums[i] == nums[j] and (i*j) divisible by k.

**Algorithm:**

1. Take nums and k.
2. Loop through all pairs (i < j).
3. If nums[i] == nums[j] and i*j % k == 0 → count++.
4. Print count.

**Code (Python):**

nums = list(map(int, input("Enter numbers: ").split())) k

= int(input("Enter k: ")) count = 0 n = len(nums) for i

in range(n): for j in range(i+1, n): if nums[i]

== nums[j] and (i*j) % k == 0:

count += 1 print("Pairs

count:", count) **Input:** Enter

nums: 3 1 2 2 2 1 3

Enter k: 2 **Output:**

Pairs: 4


**Q5. Max of Array (with given test cases)**

**Aim:** To find maximum element in array with least time complexity.

**Algorithm:**

1. Take input array.
2. Use built-in max() for efficiency.
3. Print max element.

**Code (Python):**

arr = list(map(int, input("Enter numbers: ").split())) if

not arr: print("Array is empty") else: max_val

= arr[0] for num in arr: if num > max_val:

max_val = num print("Maximum:",

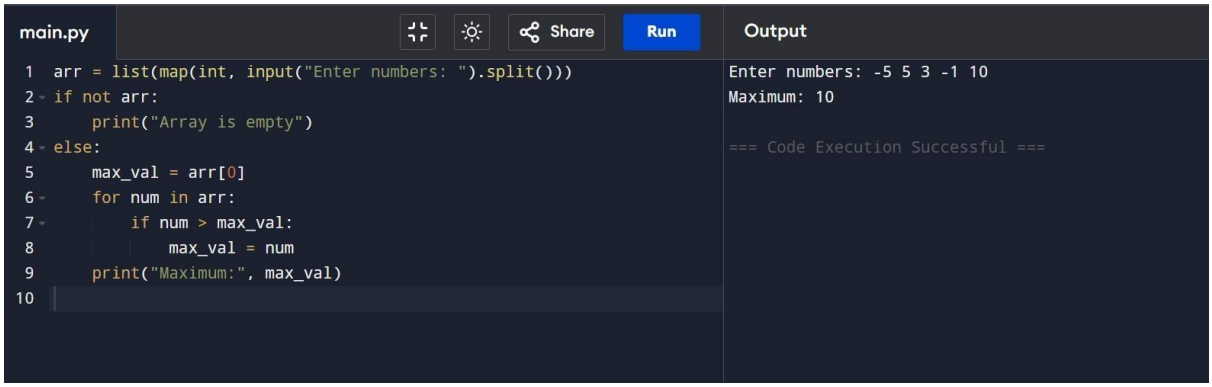
max_val)

**Input:**

Enter array: -10 2 3 -4 5

**Output:**

Max: 5




**Q6. Sort and Find Maximum**

**Aim:** Sort array and return maximum element. **Algorithm:**

1. Input array.
2. Sort array using efficient algorithm (Python uses Timsort).
3. Print sorted list and last element as max.

**Python Code:**

arr = list(map(int, input("Enter numbers: ").split())) if

not arr: print("Array is empty") else:

arr.sort() print("Maximum after sorting:",

arr[-1])

**Input:** 3 3 3 3 3 **Output:**

Sorted: [3, 3, 3, 3, 3]

Max: 3


**Q7. Unique Elements of List**

**Aim:** Remove duplicates and return only unique elements. **Algorithm:**

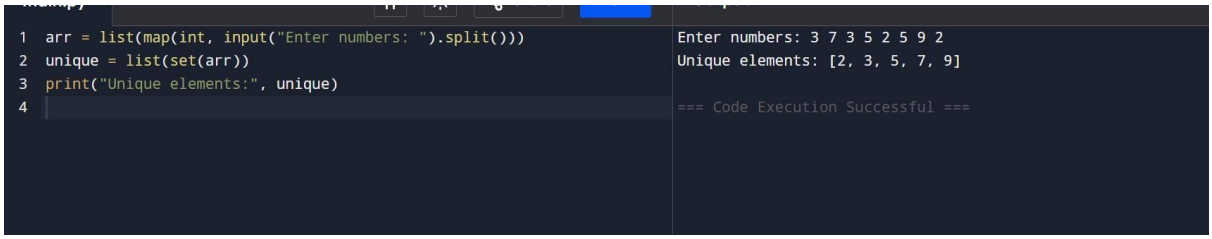
1. Input list.
2. Convert to set (removes duplicates).
3. Convert back to list.
4. Print. **Python Code:**

arr = list(map(int, input("Enter numbers: ").split()))

unique = list(set(arr)) print("Unique elements:", unique)

**Input:** 3 7 3 5 2 5 9 2
**Output:** Unique: [2, 3, 5, 7, 9] (order may vary)

**Space Complexity:** O(n) because a set stores unique elements.




**Q8. Bubble Sort**

**AIM:**
Sort an array of integers using the **Bubble Sort** technique.

**Algorithm/Method:**

1. Start from the first element, compare it with the next element.
2. If the first element is greater, swap them.
3. Move to the next element and repeat the process for the whole array.
4. Repeat the above steps for all elements until no swaps are needed (array is sorted).

**Input:**

[64, 34, 25, 12, 22, 11, 90] **Output:**

[11, 12, 22, 25, 34, 64, 90]

**Code:**

def bubble_sort(arr): n = len(arr) for

i in range(n): swapped = False

for j in range(0, n-i-1): if arr[j] >

arr[j+1]: arr[j], arr[j+1] =

arr[j+1], arr[j] swapped = True

if not swapped:

break return

arr

arr = [64, 34, 25, 12, 22, 11, 90] print("Sorted array:",

bubble_sort(arr))


**Q9. Binary Search**

**AIM:**

Check if a given number exists in a sorted array using **Binary Search**.

**Algorithm/Method:**

1. Sort the array (if not already sorted).
2. Set low = 0 and high = n-1.
3. Find mid = (low + high)//2.
4. If arr[mid] == key, element is found.
5. If arr[mid] < key, search in the right half.
6. If arr[mid] > key, search in the left half.

7. Repeat until element is found or low > high.

**INPUT:**

Array = [3, 4, 6, -9, 10, 8, 9, 30]

Key = 10

**OUTPUT:**

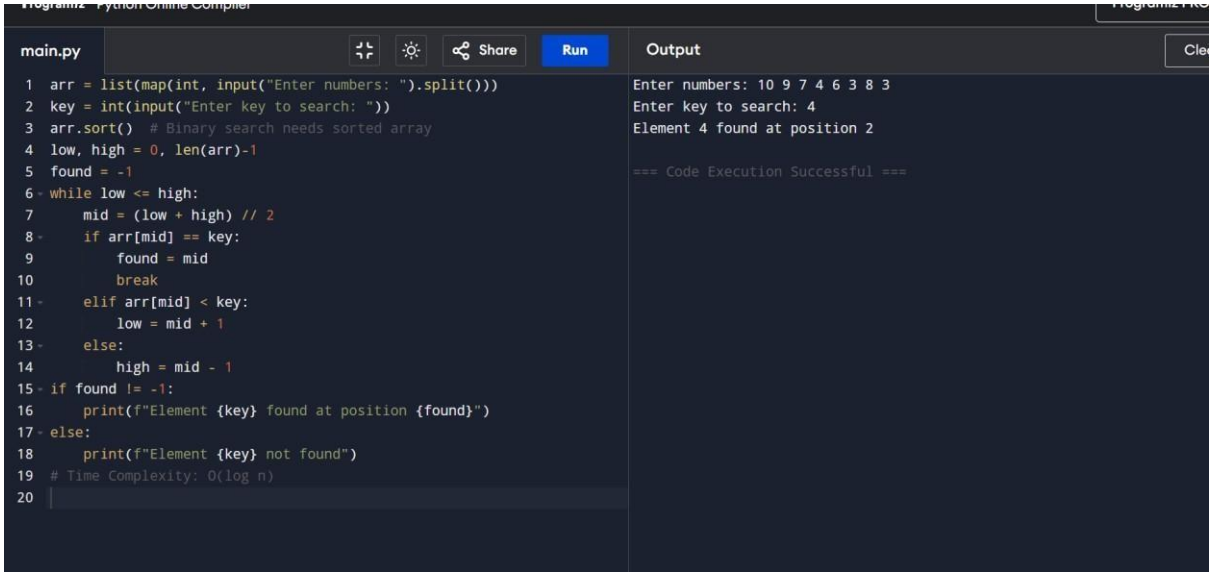
Element 10 is found at position 6

**CODE:**

```
def binary_search(arr, key):
arr.sort()     low, high =
0, len(arr)-1      while low
<= high:
       mid = (low + high) // 2         if
arr[mid] == key:
           return mid + 1  # 1-based position         elif
arr[mid] < key:

           low = mid + 1
else:              high = mid
- 1     return -1


arr = [3, 4, 6, -9, 10, 8, 9, 30] key
= 10 pos = binary_search(arr,
key) if pos
!= -1:
   print(f"Element {key} is found at position {pos}") else:
print(f"Element {key} is not found")
```




**Q10. Merge Sort (O(n log n) Sorting)**

**AIM:**
Sort an array of integers in ascending order using **Merge Sort** without built-in functions.

**Algorithm/Method:**

1. Divide the array into two halves recursively until each sub-array has one element.
2. Merge two sorted arrays by comparing elements one by one.
3. Repeat merging until the entire array is sorted.

**Input:**

[5, 2, 9, 1, 5, 6] **Output:**

[1, 2, 5, 5, 6, 9]

**Code:**

```
def merge_sort(arr):     if len(arr)
<= 1:         return arr     mid =
len(arr) // 2     left =
merge_sort(arr[:mid])     right =
merge_sort(arr[mid:])     return
merge(left, right)

def merge(left, right):
    result = []     i = j = 0     while i <
len(left) and j < len(right):         if left[i]
< right[j]:
            result.append(left[i])             i
+= 1         else:
            result.append(right[j])
j += 1     result.extend(left[i:])
result.extend(right[j:])     return
result

nums = [5, 2, 9, 1, 5, 6] print("Sorted array:",
merge_sort(nums))
```