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):

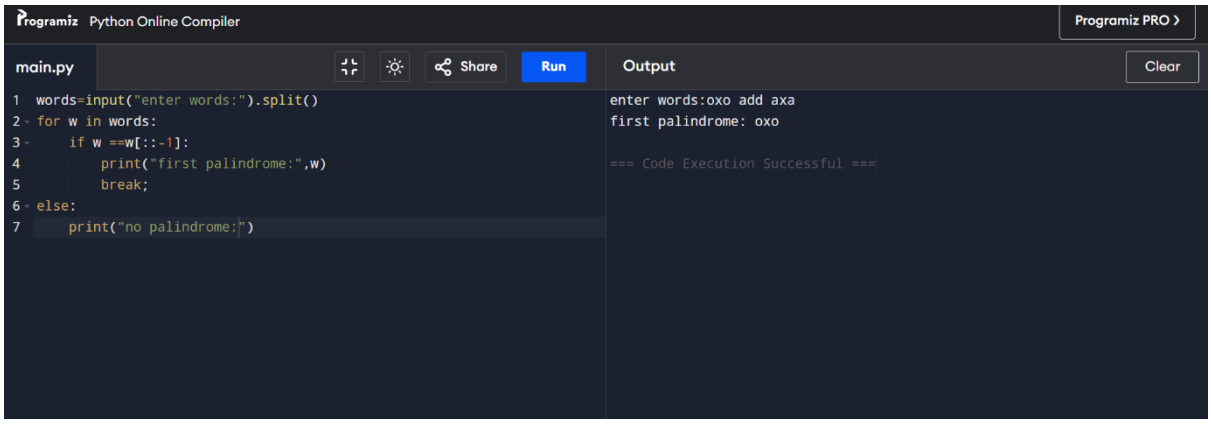
```
words = input("Enter words: ").split()
ans = ""
for w in words:
    if w == w[::-1]:
        ans = w
        break
print("First Palindrome:", ans)
```

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])
```

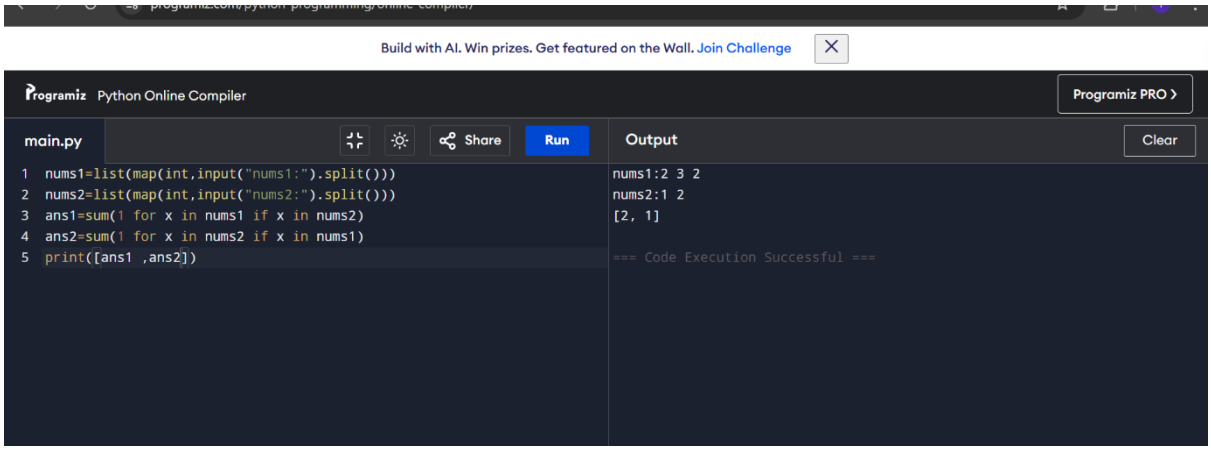
Input:

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:

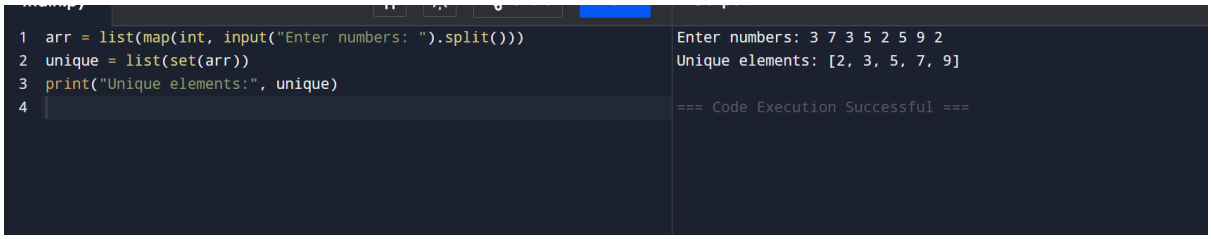
```
arr = list(map(int, input("Enter numbers: ").split()))

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:

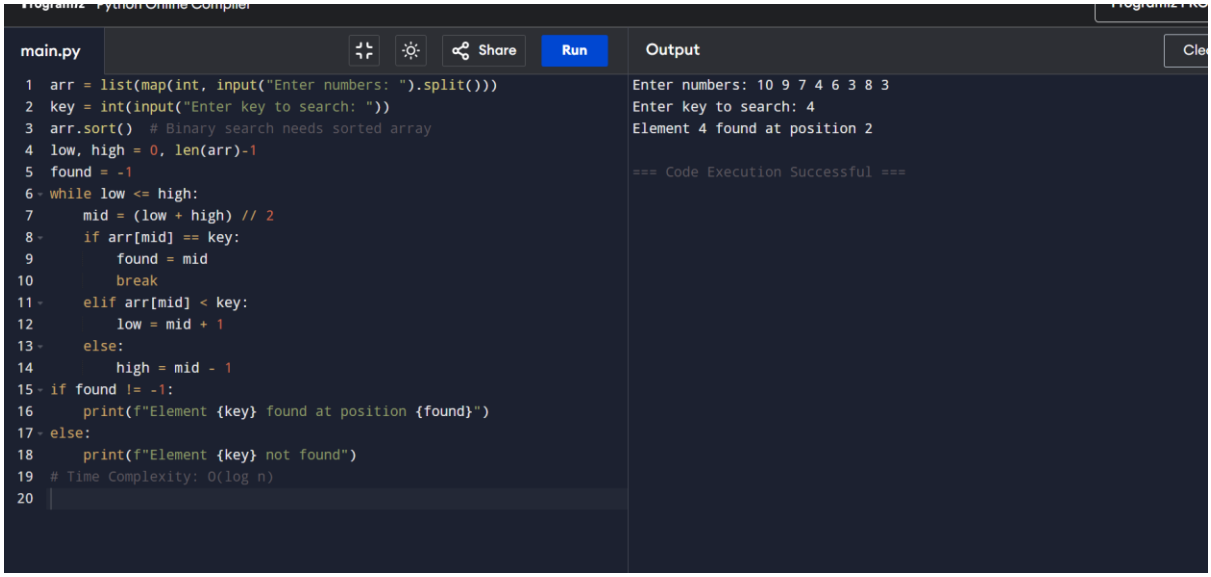
Element 10 is found at position 6

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))
```