1.Given an listof integers, sort the array in ascending order using the *Bubble Sort* algorithm above. Once sorted, print the following three lines:

1. List is sorted in numSwaps swaps., where numSwaps is the number of swaps that took place.
2. First Element: firstElement, the *first* element in the sorted list.
3. Last Element: lastElement, the *last* element in the sorted list.

For example, given a worst-case but small array to sort: a=[6,4,1]. It took 3 swaps to sort the array. Output would be

```
Array is sorted in 3 swaps.
First Element: 1
Last Element: 6
```

Input Format

The first line contains an integer,n , the size of the list a .
The second line contains n, space-separated integers a[i].

Constraints

· 2<=n<=600

· 1<=a[i]<=$2x10^6$.

Output Format

You must print the following three lines of output:

1. List is sorted in numSwaps swaps., where numSwaps is the number of swaps that took place.
2. First Element: firstElement, the *first* element in the sorted list.
3. Last Element: lastElement, the *last* element in the sorted list.

Sample Input 0

3

1 2 3

Sample Output 0

List is sorted in 0 swaps.

First Element: 1

Last Element: 3

Program:

```
a=int(input())
count=0
```

```
b=list(map(int,input().split()))
for i in range(len(b)):
    for j in range(i+1,len(b)):
        if b[i]>b[j]:
            b[i],b[j]=b[j],b[i]
            count+=1
print("List is sorted in %d swaps."%count)
print("First Element: %d"%b[0])
print("Last Element: %d"%b[-1])
```

	Input	Expected	Got	
✔	3 3 2 1	List is sorted in 3 swaps. First Element: 1 Last Element: 3	List is sorted in 3 swaps. First Element: 1 Last Element: 3	✔
✔	5 1 9 2 8 4	List is sorted in 4 swaps. First Element: 1 Last Element: 9	List is sorted in 4 swaps. First Element: 1 Last Element: 9	✔

Passed all tests! ✔

2. To find the frequency of numbers in a list and display in sorted order.

Constraints:

1<=n, arr[i]<=100

Input:

1 68 79 4 90 68 1 4 5

output:

1 2

4 2

5 1

68 2

79 1

90 1

For example:

Input	Result
4 3 5 3 4 5	3 2 4 2 5 2

Answer:(penalty regime: 0 %)

```
a=list(map(int,input().split()))
for i in range(len(a)):
    for j in range(len(a)):
        if a[i]>a[j]:
            a[i],a[j]=a[j],a[i]
b=set(a)
for i in b:
    print(i,a.count(i))
```

	Input	Expected	Got	
✔	4 3 5 3 4 5	3 2 4 2 5 2	3 2 4 2 5 2	✔
✔	12 4 4 4 2 3 5	2 1 3 1 4 3 5 1 12 1	2 1 3 1 4 3 5 1 12 1	✔
✔	5 4 5 4 6 5 7 3	3 1 4 2 5 3 6 1 7 1	3 1 4 2 5 3 6 1 7 1	✔

Passed all tests! ✔

3. Write a Python program to sort a list of elements using the merge sort algorithm.

For example:

Program:

```
a=int(input())
b=list(map(int,input().split()))
b.sort()
print(*b)
```

4. Given an array of integers `arr`, replace each element with its rank.

The rank represents how large the element is. The rank has the following rules:

- Rank is an integer starting from 1.
- The larger the element, the larger the rank. If two elements are equal, their rank must be the same.
- Rank should be as small as possible.

Example 1:

```
Input: arr = [40,10,20,30]
Output: [4,1,2,3]
Explanation: 40 is the largest element. 10 is the smallest. 20 is the second
smallest. 30 is the third smallest.
```

Example 2:

```
Input: arr = [100,100,100]
Output: [1,1,1]
Explanation: Same elements share the same rank.
```

Example 3:

```
Input: arr = [37,12,28,9,100,56,80,5,12]
Output: [5,3,4,2,8,6,7,1,3]
```

Constraints:

- `0 <= arr.length <= 10^5`
- `-10^9 <= arr[i] <= 10^9`

Program:

```
def arrayRankTransform( arr: list[int]) -> list[int]:
    a=list(set(arr))
    a.sort()
    b={}
    count=0
    for i in a:
        count+=1
```

```
        b.update({i:count})
    p=[]
    for i in arr:
        p.append(b[i])
    return p
```

	Test	Expected	Got	
✔	print(arrayRankTransform([40,10,20,30]))	[4, 1, 2, 3]	[4, 1, 2, 3]	✔
✔	print(arrayRankTransform([100,100,100]))	[1, 1, 1]	[1, 1, 1]	✔
✔	print(arrayRankTransform([37,12,28,9,100,56,80,5,12]))	[5, 3, 4, 2, 8, 6, 7, 1, 3]	[5, 3, 4, 2, 8, 6, 7, 1, 3]	✔

Passed all tests! ✔

5. Bubble Sort is the simplest sorting algorithm that works by repeatedly swapping the adjacent elements if they are in wrong order. You read an list of numbers. You need to arrange the elements in ascending order and print the result. The sorting should be done using bubble sort.

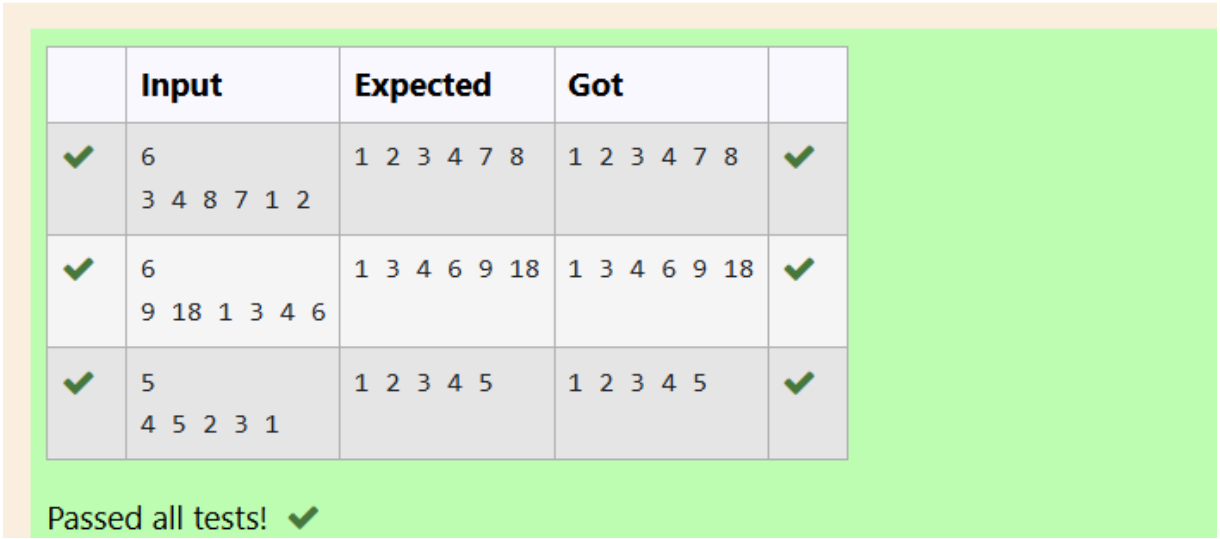
Input Format: The first line reads the number of elements in the array. The second line reads the array elements one by one.

Output Format: The output should be a sorted list.

Program:

```
a=input()
b=list(map(int,input().split()))
for i in range(len(b)):
    for j in range(len(b)):
        if b[i]<b[j]:
            b[i],b[j]=b[j],b[i]
```

```
print(*b)
```



	Input	Expected	Got	
✔	6 3 4 8 7 1 2	1 2 3 4 7 8	1 2 3 4 7 8	✔
✔	6 9 18 1 3 4 6	1 3 4 6 9 18	1 3 4 6 9 18	✔
✔	5 4 5 2 3 1	1 2 3 4 5	1 2 3 4 5	✔

Passed all tests! ✔

6. Given an array of integers `nums`, sort the array in **increasing** order based on the frequency of the values. If multiple values have the same frequency, sort them in **decreasing** order.

Print the *sorted array*.

Example 1:

Input:
6
1 1 2 2 2 3

Output:
3 1 1 2 2 2

Explanation: '3' has a frequency of 1, '1' has a frequency of 2, and '2' has a frequency of 3.

Example 2:

Input:
5
2 3 1 3 2
Output:
1 3 3 2 2
Explanation: '2' and '3' both have a frequency of 2, so they are sorted in decreasing order.

Example 3:

Input:
9
-1 1 -6 4 5 -6 1 4 1
Output:
5 -1 4 4 -6 -6 1 1 1

Constraints:

- `1 <= nums.length <= 100`
- `-100 <= nums[i] <= 100`

Program:

```
a=input()
b=list(map(int,input().split()))
c=set(b)
d={}
for i in c:
    co=b.count(i)
    d.update({i:co})
b.clear()
b=dict(sorted(d.items(),key=lambda item:(item[1],-item[0])))
p=[]
for i in b:
    count=b[i]
    for j in range(b[i]):
        p.append(i)
print(*p)
```

	Input	Expected	Got	
✔	6 1 1 2 2 2 3	3 1 1 2 2 2	3 1 1 2 2 2	✔
✔	5 2 3 1 3 2	1 3 3 2 2	1 3 3 2 2	✔
✔	9 -1 1 -6 4 5 -6 1 4 1	5 -1 4 4 -6 -6 1 1 1	5 -1 4 4 -6 -6 1 1 1	✔

Passed all tests! ✔

7. Given an integer array `nums` sorted in **non-decreasing** order, return *an array of **the squares of each number** sorted in non-decreasing order.*

Example 1:

```
Input: nums = [-4,-1,0,3,10]
Output: [0,1,9,16,100]
Explanation: After squaring, the array becomes [16,1,0,9,100].
After sorting, it becomes [0,1,9,16,100].
```

Example 2:

```
Input: nums = [-7,-3,2,3,11]
Output: [4,9,9,49,121]
```

Program:

```
def sortedSquares(n: list[int]) -> list[int]:
    a=[]
    for i in n:
        a.append(i**2)
    for i in range(0,len(a)):
        for j in range(i+1,len(a)):
            if a[i]>a[j]:
                a[i],a[j]=a[j],a[i]
    return a
```

	Test	Expected	Got	
✔	`print(sortedSquares([-4,-1,0,3,10]))`	`[0, 1, 9, 16, 100]`	`[0, 1, 9, 16, 100]`	✔
✔	`print(sortedSquares([-7,-3,2,3,11]))`	`[4, 9, 9, 49, 121]`	`[4, 9, 9, 49, 121]`	✔

Passed all tests! ✔

8. The problem is that we want to reverse a array in O(N) linear time complexity and we want
the algorithm to be in-place as well!
For example: input is [1,2,3,4,5] then the output is [5,4,3,2,1]
Input
5
1 2 3 4 5

Output
5 4 3 2 1

Program:

```
a=input()
b=list(map(int,input().split()))
print(*b[::-1])
```

	Input	Expected	Got	
✔	5 1 2 3 4 5	5 4 3 2 1	5 4 3 2 1	✔
✔	10 0 2 4 6 8 1 3 5 7 9	9 7 5 3 1 8 6 4 2 0	9 7 5 3 1 8 6 4 2 0	✔

Passed all tests! ✔

9. Given an integer array `nums`, return *an integer array* `counts` *where* `counts[i]` *is the number of smaller elements to the right of* `nums[i]`.

Example 1:

```
Input: nums = [5,2,6,1]
Output: [2,1,1,0]
Explanation:
To the right of 5 there are 2 smaller elements (2 and 1).
To the right of 2 there is only 1 smaller element (1).
To the right of 6 there is 1 smaller element (1).
To the right of 1 there is 0 smaller element.
```

Example 2:

```
Input: nums = [-1]
Output: [0]
```

Example 3:

```
Input: nums = [-1,-1]
Output: [0,0]
```

Program:

```
def countSmaller(num: list[int]) -> list[int]:
    a=[]
    for i in range(0,len(num)):
        count=0
        for j in range(i+1,len(num)):
            if num[i]>num[j]:
```

```
            count+=1
        a.append(count)
    return a
```

	Test	Expected	Got	
✔	`print(countSmaller([5,2,6,1]))`	`[2, 1, 1, 0]`	`[2, 1, 1, 0]`	✔
✔	`print(countSmaller([50,20,60,10]))`	`[2, 1, 1, 0]`	`[2, 1, 1, 0]`	✔
✔	`print(countSmaller([-1]))`	`[0]`	`[0]`	✔
✔	`print(countSmaller([-1, -1]))`	`[0, 0]`	`[0, 0]`	✔

Passed all tests! ✔

10. **Objective:**

Develop a Python program to find the k-th maximum value in a given list of integers. The program should handle various edge cases, including lists with duplicate values, empty lists, and invalid values of k. The k-th maximum value refers to the k-th largest distinct element in the list.

Background:

Finding the k-th maximum value in a list is a common problem in computer science, often encountered in fields like data analysis, competitive programming, and software development. This problem requires an understanding of sorting algorithms, data structures, and efficient problem-solving techniques. By solving this problem, one gains insights into how to handle large datasets and optimize performance in practical applications.

Problem Description:

Given a list of integers, the task is to determine the k-th maximum value in the list. The program should meet the following requirements:

1. **Input:**
    - A list of integers, which can contain both positive and negative values.
    - An integer k, representing the position of the maximum value to find.
2. **Output:**
    - The k-th maximum value in the list.

- If k is greater than the number of distinct elements in the list or if the list is empty, the program should return an appropriate message indicating the error.

Constraints:

- The list may contain duplicate values.
- The value of k should be a positive integer.
- The list may contain up to 10^6 elements, and each element can be as large as 10^9 in magnitude.

Examples:

Consider the following examples for better understanding:

1. **Example 1:**
   - **Input:** list = [3, 1, 5, 4, 2], k = 2
   - **Output:** 4
   - **Explanation:** The distinct elements in the list are [1, 2, 3, 4, 5]. The 2nd maximum value is 4.
2. **Example 2:**
   - **Input:** list = [7, 7, 7, 7, 7], k = 1
   - **Output:** 7
   - **Explanation:** The distinct elements in the list are [7]. The 1st maximum value is 7.
3. **Example 3:**
   - **Input:** list = [2, 1, 2, 1, 2], k = 3
   - **Output:** -1
   - **Explanation:** The distinct elements in the list are [1, 2]. There is no 3rd maximum value.

For example:

Input	Result
5 3 1 5 4 2 2	4
6 7 7 7 7 7 7 1	7
10	-1

Input	Result
2 1 2 1 2 1 2 1 2 1 3	

Program:

```
a=input()
b=list(set(map(int,input().split())))
c=int(input())
if c>len(b):
    print(-1)
else:
    for i in range(len(b)):
        for j in range(len(b)):
            if b[i]>b[j]:
                b[i],b[j]=b[j],b[i]
    for i in range(c):
        count=b[i]
    print(count)
```

	Input	Expected	Got	
✔	5 3 1 5 4 2 2	4	4	✔
✔	6 7 7 7 7 7 7 1	7	7	✔
✔	10 2 1 2 1 2 1 2 1 2 1 3	-1	-1	✔

Passed all tests! ✔