

## 10 - Searching & Sorting

Ex. No. : 10.1

Date: 5.6.24

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### Merge Sort

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

**For example:**

Input	Result
5 6 5 4 3 8	3 4 5 6 8

### Program:

```
a=int(input())
l=[]
l.extend(input().split())
for i in range(a-1):
    for j in range(a-1):
        if(int(l[j])>int(l[j+1])):
            t=int(l[j])
            l[j]=int(l[j+1])
            l[j+1]=t
for i in range(a):
    print(int(l[i]),end=" ")
```

## Output:

	Input	Expected	Got
✓	5 6 5 4 3 8	3 4 5 6 8	3 4 5 6 8
✓	9 14 46 43 27 57 41 45 21 70	14 21 27 41 43 45 46 57 70	14 21 27 41 43 45 46 5
✓	4 86 43 23 49	23 43 49 86	23 43 49 86

Passed all tests! ✓

**Correct**

Marks for this submission: 1.00/1.00.

Ex. No. : 10.2

Date: 5.6.24

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## **Bubble Sort**

Given an list of 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**

- $2 \leq n \leq 600$
- $1 \leq a[i] \leq 2 \times 10^6$ .

### **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

**For example:**

Input	Result
3 3 2 1	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

## Program:

```
def bubble_sort(arr):  
    n = len(arr)  
    swaps = 0  
  
    for i in range(n):  
        for j in range(0, n-i-1):  
            if arr[j] > arr[j + 1]:  
                # Swap elements  
                arr[j], arr[j + 1] = arr[j + 1], arr[j]  
                swaps += 1  
  
    return swaps  
  
# Input the size of the list  
n = int(input())  
  
# Input the list of integers  
arr = list(map(int, input().split()))  
  
# Perform bubble sort and count the number of swaps  
num_swaps = bubble_sort(arr)
```

```
# Print the number of swaps
print("List is sorted in", num_swaps, "swaps.")
```

```
# Print the first element
print("First Element:", arr[0])
```

```
# Print the last element
print("Last Element:", arr[-1])
```

## Output:

	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! ✓

**Correct**

Marks for this submission: 1.00/1.00.

**Ex. No. : 10.3**

**Date: 5.6.24**

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### **Peak Element**

Given an list, find peak element in it. A peak element is an element that is greater than its neighbors.

An element  $a[i]$  is a peak element if

$A[i-1] \leq A[i] \geq A[i+1]$  for middle elements.  $[0 < i < n-1]$

$A[i-1] \leq A[i]$  for last element  $[i=n-1]$

$A[i] \geq A[i+1]$  for first element  $[i=0]$

#### **Input Format**

The first line contains a single integer  $n$ , the length of  $A$ .

The second line contains  $n$  space-separated integers,  $A[i]$ .

#### **Output Format**

**Print** peak numbers separated by space.

#### **Sample Input**

5

8 9 10 2 6

#### **Sample Output**

10 6

#### **For example:**

Input	Result
4 12 3 6 8	12 8

### **Program:**

```
def find_peak(arr):  
    peak_elements = []
```

```
# Check for the first element
if arr[0] >= arr[1]:
    peak_elements.append(arr[0])

# Check for middle elements
for i in range(1, len(arr) - 1):
    if arr[i - 1] <= arr[i] >= arr[i + 1]:
        peak_elements.append(arr[i])

# Check for the last element
if arr[-1] >= arr[-2]:
    peak_elements.append(arr[-1])
```

```
return peak_elements
```

```
# Input the length of the list
n = int(input())
```

```
# Input the list of integers
arr = list(map(int, input().split()))
```

```
# Find peak elements and print the result
peak_elements = find_peak(arr)
print(*peak_elements)
```

## Output:

	Input	Expected	Got	
✓	7 15 7 10 8 9 4 6	15 10 9 6	15 10 9 6	✓
✓	4 12 3 6 8	12 8	12 8	✓

Passed all tests! ✓

**Correct**

Marks for this submission: 1.00/1.00.



Ex. No. : 10.4

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## Binary Search

Write a Python program for binary search.

**For example:**

Input	Result
1 2 3 5 8 6	False
3 5 9 45 42 42	True

## Program:

```
a = input().split(",")  
b = input()  
print(b in a)
```

## Output:

	Input	Expected	Got	
✓	1,2,3,5,8 6	False	False	✓
✓	3,5,9,45,42 42	True	True	✓
✓	52,45,89,43,11 11	True	True	✓

Passed all tests! ✓

**Correct**

Marks for this submission: 1.00/1.00.

**Ex. No. : 10.5**

**Date: 5.6.24**

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### **Frequency of Elements**

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

**Constraints:**

$1 \leq n$ ,  $\text{arr}[i] \leq 100$

**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

## **Program:**

```
def count_frequency(arr):
```

```
    frequency = {}
```

```
    # Count the frequency of each number in the list
```

```
    for num in arr:
```

```
frequency[num] = frequency.get(num, 0) + 1
```

```
# Sort the dictionary based on keys
```

```
sorted_frequency = sorted(frequency.items())
```

```
# Print the frequency of each number
```

```
for num, freq in sorted_frequency:
```

```
    print(num, freq)
```

```
# Input the list of numbers
```

```
arr = list(map(int, input().split()))
```

```
# Count the frequency and print the result
```

```
count_frequency(arr)
```

## Output:

	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! ✓

**Correct**

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