Ahsania Mission University of Science & Technology

Lab Report

Lab No: 03

Course Code: CSE 2202

Course Title: Computer Algorithm Sessional.

Submitted By:

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Task No.: 01

Problem Statement: Maximum Subarray Sum

- ✓ Given an integer array numsnums, find the subarray with the largest sum, and print its sum.
- ✓ Note: A subarray is a contiguous non-empty sequence of elements within an array.

Input Format

- The first line contains T, the number of test cases.
- The first line in each test case contains N, the number of elements in an array.
- The second line in each test case contains N integers, denoting the elements in the array.

Output Format
For each test case, output the maximum subarray sum of each array.
Constraints
• 1≤ T≤100
• 1≤ N≤100
• −109≤ Ai≤109

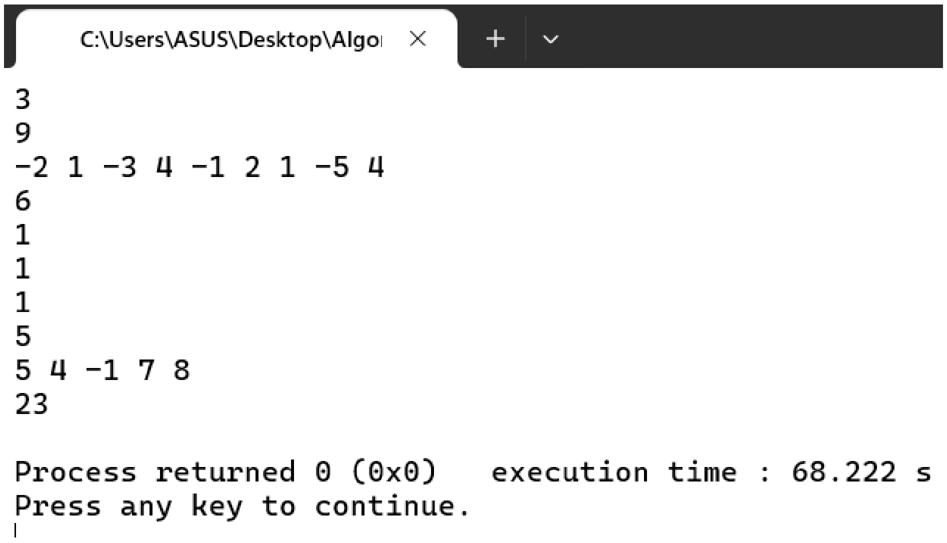
Input
```
3
9
-2 1 -3 4 -1 2 1 -5 4
1
1
5
5 4 -1 7 8
```
Output
```
6
1
23
```

Source Code:

```
#include <bits/stdc++.h>
using namespace std;

int main()
{
   int t;
   cin >> t;

   while(t--)
   {
      int n;
      cin >> n;

      int arr[n];
      for(int i = 0; i < n; i++)
      {
         cin >> arr[i];
      }

      int maxsum = INT_MIN;

      // Iterate over all possible subarrays
      for(int i = 0; i < n; i++)
      {
         int currentSum = 0;

         for(int j = i; j < n; j++)
         {
            currentSum += arr[j]; // Add current element to the sum
            if(currentSum>maxsum)
            {
               maxsum = currentSum; // Update maxsum if the currentSum is larger
            }

         }
      }

      cout << maxsum << endl;
   }
```

```
    return 0;
}
```

Output:



```
3
9
-2 1 -3 4 -1 2 1 -5 4
6
1
1
1
5
5 4 -1 7 8
23

Process returned 0 (0x0)   execution time : 68.222 s
Press any key to continue.
```

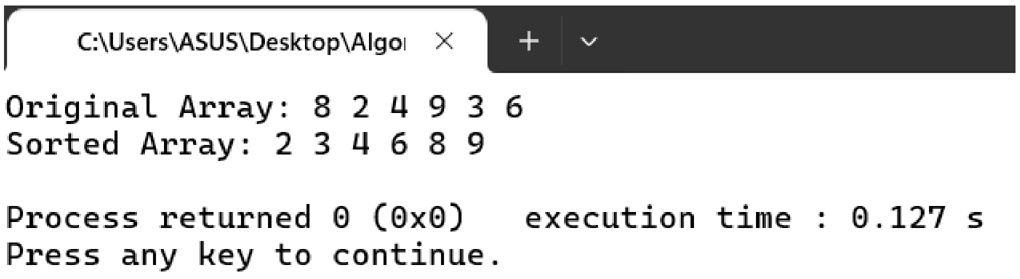
Task No.: 02

Problem Statement : Implement Insertion Sort Algorithm.

Source Code:

```
#include <iostream>
using namespace std;
void insertionSort(int arr[], int n)
{
    for (int i = 1; i < n; i++)
    {
        int key = arr[i];
        int j = i - 1;
        while (j >= 0 && arr[j] > key)
        {
            arr[j + 1] = arr[j];
            j = j - 1;
        }
        arr[j + 1] = key;
    }
}
void printArray(int arr[], int n)
{
    for (int i = 0; i < n; i++)
    {
        cout << arr[i] << " ";
    }
    cout << endl;
}

int main()
{
    int arr[] = {8, 2, 4, 9, 3, 6};
    int n = sizeof(arr) / sizeof(arr[0]);
    cout << "Original Array: ";
    printArray(arr, n);
    insertionSort(arr, n);
    cout << "Sorted Array: ";
    printArray(arr, n);

    return 0;
}
```

Output:



```
Original Array: 8 2 4 9 3 6
Sorted Array: 2 3 4 6 8 9

Process returned 0 (0x0)   execution time : 0.127 s
Press any key to continue.
```

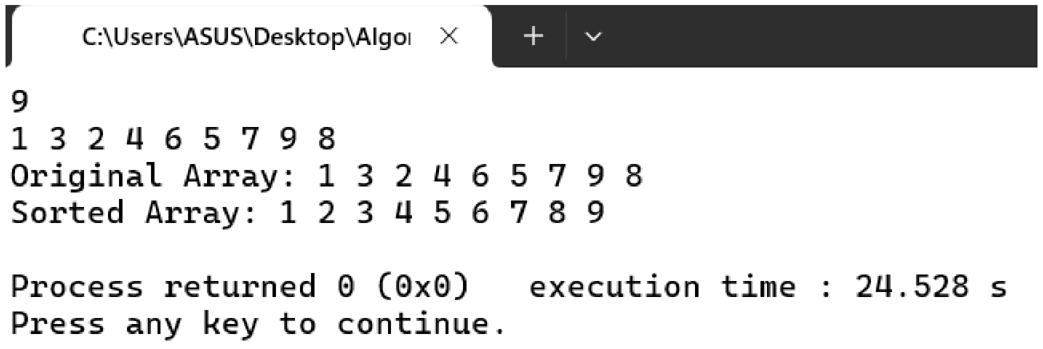
Task No.: 03

Problem Statement: Implement Merge Sort algorithm.

Source Code:

```
#include <iostream>
using namespace std;
void merge(int arr[], int left, int mid, int right)
{
    int n1 = mid - left + 1;
    int n2 = right - mid;
    int L[n1], R[n2];
    for (int i = 0; i < n1; i++)
        L[i] = arr[left + i];
    for (int j = 0; j < n2; j++)
        R[j] = arr[mid + 1 + j];
    int i = 0, j = 0, k = left;
    while (i < n1 && j < n2)
    {
        if (L[i] <= R[j])
        {
            arr[k] = L[i];
            i++;
        }
        else
        {
            arr[k] = R[j];
            j++;
        }
        k++;
    }
    while (i < n1)
    {
        arr[k] = L[i];
        i++;
        k++;
    }
    while (j < n2)
    {
        arr[k] = R[j];
        j++;
        k++;
    }
}
void mergeSort(int arr[], int left, int right)
{
    if (left < right)
    {
        int mid = left + (right - left) / 2;
        mergeSort(arr, left, mid);
        mergeSort(arr, mid + 1, right);
        merge(arr, left, mid, right);
    }
}
void printArray(int arr[], int n)
{
    for (int i = 0; i < n; i++)
    {
        cout << arr[i] << " ";
    }
    cout << endl;
}

int main()
{
    int n;
    cin>>n;
    int arr[n];
    for(int i = 0; i < n; i++)
    {
        cin>> arr[i];
    }
    cout << "Original Array: ";
    printArray(arr, n);
    mergeSort(arr, 0, n - 1);
    cout << "Sorted Array: ";
    printArray(arr, n);
    return 0;
}
```

Output:



```
9
1 3 2 4 6 5 7 9 8
Original Array: 1 3 2 4 6 5 7 9 8
Sorted Array: 1 2 3 4 5 6 7 8 9

Process returned 0 (0x0)   execution time : 24.528 s
Press any key to continue.
```

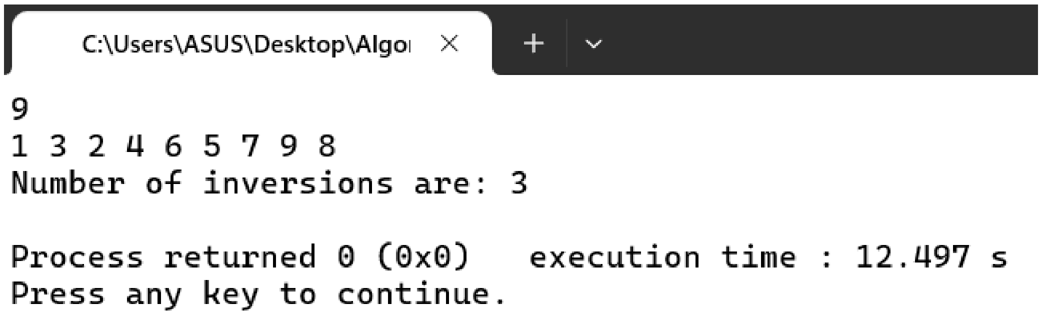
Task No.: 04

Problem Statemen: Countiversion using merge sort algorithm.

Source Code:

```
#include <iostream>
using namespace std;

int countAndMerge(int arr[], int l, int m, int r) {
    int n1 = m - l + 1;
    int n2 = r - m;
    int left[n1], right[n2];
    for (int i = 0; i < n1; i++) {
        left[i] = arr[l + i];
    }
    for (int i = 0; i < n2; i++) {
        right[i] = arr[m + 1 + i];
    }

    int res = 0, i = 0, j = 0, k = l;
    while (i < n1 && j < n2) {
        if (left[i] <= right[j]) {
            arr[k] = left[i];
            i++;
        } else {
            arr[k] = right[j];
            j++;
            res += (n1 - i);
        }
        k++;
    }

    while (i < n1) {
        arr[k] = left[i];
        i++;
        k++;
    }
    while (j < n2) {
        arr[k] = right[j];
        j++;
        k++;
    }

    return res;
}
int countInv(int arr[], int l, int r) {
    int res = 0;
    if (l < r) {
        int m = l + (r - l) / 2;
        res = res + countInv(arr, l, m);
        res = res + countInv(arr, m + 1, r);
        res = res + countAndMerge(arr, l, m, r);
    }
    return res;
}

int main() {
    int n;
    cin>>n;
    int arr[n];
    for(int i = 0; i < n; i++)
    {
        cin>> arr[i];
    }
    cout << "Number of inversions are: " << countInv(arr, 0, n - 1) << endl;

    return 0;
}
```

Output:



C:\Users\ASUS\Desktop\Algo

```
9
1 3 2 4 6 5 7 9 8
Number of inversions are: 3

Process returned 0 (0x0)   execution time : 12.497 s
Press any key to continue.
```

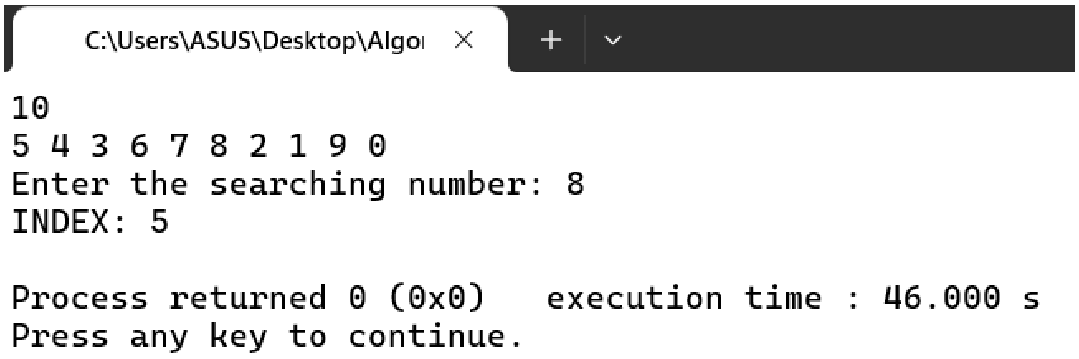
Task No.: 05

Problem Statement: Implement linier search algorithm.

Source Code:

```
#include <iostream>
using namespace std;
int main()
{
    int n;
    cin>>n;
    int arr[n];
    for(int i=0; i<n; i++)
    {
        cin>>arr[i];
    }
    int s;
    cout<<"Enter the searching number: ";
    cin>>s;
    for(int i=0; i<n; i++)
    {
        if(s == arr[i])
        {
            cout<<"INDEX: ";
            cout<<i<<endl;
            break;
        }
    }
    return 0;
}
```

Output:



```
C:\Users\ASUS\Desktop\Algo

10
5 4 3 6 7 8 2 1 9 0
Enter the searching number: 8
INDEX: 5

Process returned 0 (0x0)   execution time : 46.000 s
Press any key to continue.
```

Task No.: 06

Problem Statement: Problem: Leader of an Array
Write a program to print all the leaders in the array. An element is a leader if it is strictly greater than all the elements to its right side. And the rightmost element is always a leader.

Input Format

- The first line contains N, the number of elements in an array.
- The second line contains N integers, denoting the elements in the array.

Output Format
In a single line output all the leaders in the given array.

Sample 1:
Input
6
16 17 4 3 5 2

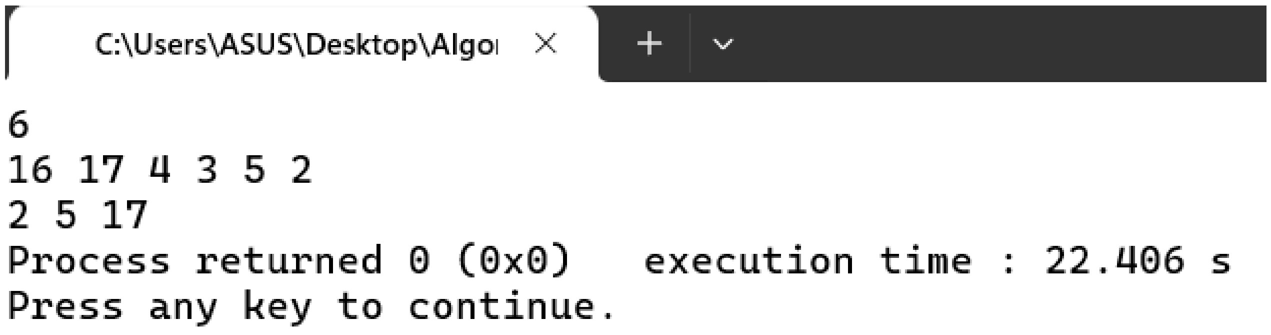
Output

```
17 5 2
```

Source Code:

```
#include <iostream>
using namespace std;

int main()
{
   int n;
   cin >> n;
   int arr[1000];

   for (int i = 0; i < n; i++)
   {
      cin >> arr[i];
   }

   int max_from_right = arr[n - 1];
   cout << max_from_right << " ";
   for (int i = n - 2; i >= 0; i--)
   {
      if (arr[i] > max_from_right)
      {
         max_from_right = arr[i];
         cout << max_from_right << " ";
      }
   }

   return 0;
}
```

Output:



```
6
16 17 4 3 5 2
2 5 17
Process returned 0 (0x0)   execution time : 22.406 s
Press any key to continue.
```