Design and Analysis of Algorithms Assignment - 6

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Longest Increasing Sub-sequence

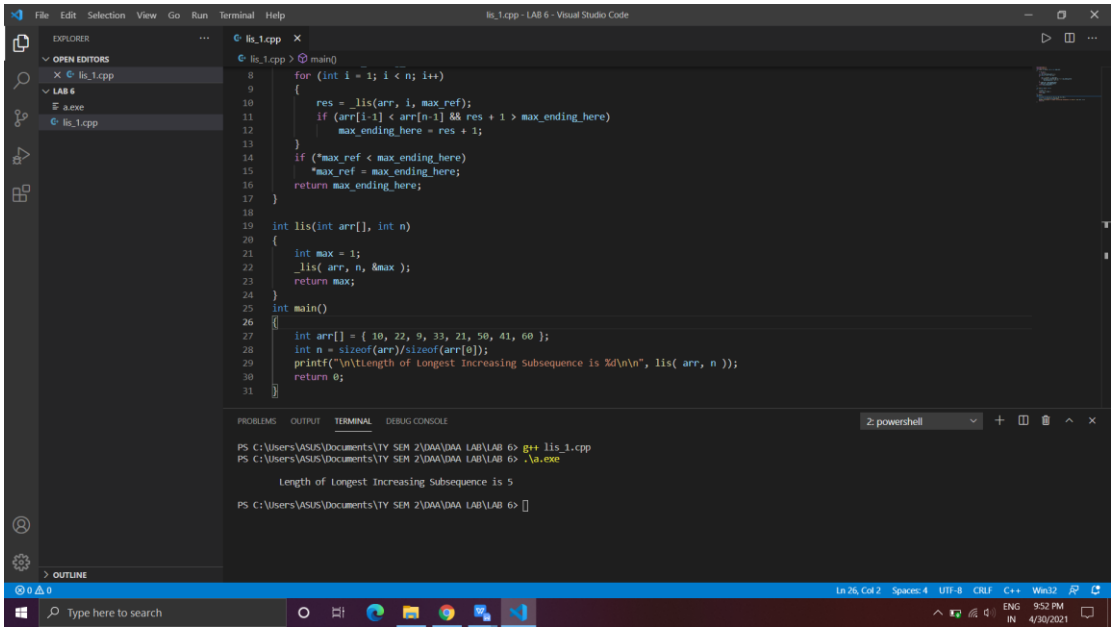
Approach 1: *Using Recursion*

CODE :

```
#include<stdio.h>
#include<stdlib.h>
int _lis( int arr[], int n, int *max_ref)
{
    if (n == 1)
        return 1;
    int res, max_ending_here = 1;
    for (int i = 1; i < n; i++)
    {
        res = _lis(arr, i, max_ref);
        if (arr[i-1] < arr[n-1] && res + 1 > max_ending_here)
            max_ending_here = res + 1;
    }
    if (*max_ref < max_ending_here)
       *max_ref = max_ending_here;
    return max_ending_here;
}
```

```
int lis(int arr[], int n)

{

    int max = 1;

    _lis( arr, n, &max );

    return max;

}

int main()

{

    int arr[] = { 10, 22, 9, 33, 21, 50, 41, 60 };

    int n = sizeof(arr)/sizeof(arr[0]);

    printf("\n\tLength of Longest Increasing Subsequence is %d\n\n", lis( arr, n ));

    return 0;

}
```

O/P :



Time Complexity: Exponential

Space Complexity: O(1)

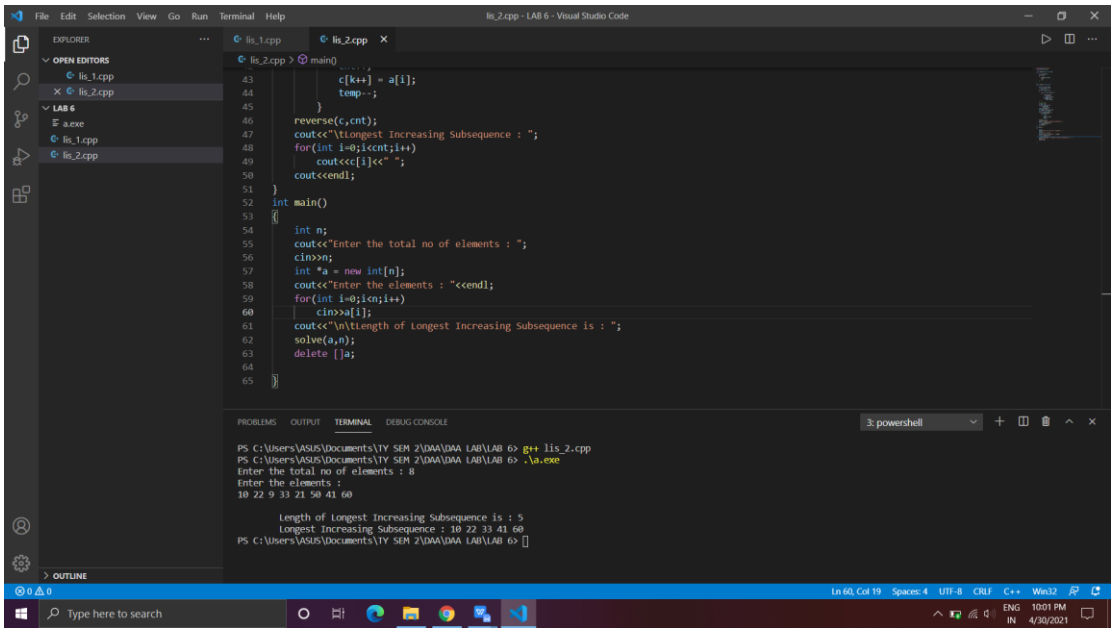
Approach 2: *Using Dynamic Programming*

CODE :

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


void reverse(int* c,int cnt)
{
    int i=0,j=cnt-1;
    while(i<j)
    {
        swap(c[i],c[j]);
        i++;
        j--;
    }
}
void solve(int *a,int n)
{
    int *b = new int[n];
    for(int i=0;i<n;i++)
        b[i] = 1;
    for(int i=1;i<n;i++)
    {
        for(int j=i-1;j>=0;j--)
        {
            if(a[j]>=a[i])
                continue;
            int temp = b[j]+1;
            if(temp>b[i])
                b[i] = temp;
        }
    }
```

```
    //cout<<endl;
    int max = 0;
    for(int i=0;i<n;i++)
        if(b[i]>max)
            max = b[i];
    cout<<max<<endl;
    int temp = max,cnt=0,k=0;
    int *c = new int[n];
    for(int i=n-1;i>=0;i--)
        if(temp==b[i])
        {
            cnt++;
            c[k++] = a[i];
            temp--;
        }
    reverse(c,cnt);
    cout<<"\tLongest Increasing Subsequence : ";
    for(int i=0;i<cnt;i++)
        cout<<c[i]<<" ";
    cout<<endl;
}
int main()
{
    int n;
    cout<<"Enter the total no of elements : ";
    cin>>n;
    int *a = new int[n];
    cout<<"Enter the elements : "<<endl;
    for(int i=0;i<n;i++)
        cin>>a[i];
    cout<<"\n\tLength of Longest Increasing Subsequence is : ";
    solve(a,n);
    delete []a;
}
```

O/P :



Time Complexity: O(n^2)

Space Complexity: O(n)