

LIS DP

Problem Statement

The Longest Increasing Subsequence (LIS) problem is to find the length of the longest subsequence of a given sequence such that all elements of the subsequence are sorted in increasing order

Input: $\text{arr}[] = \{3, 10, 2, 1, 20\}$

Output: Length of LIS = 3

The longest increasing subsequence is 3, 10, 20

- Given Array {10, 22, 9, 33, 21, 50, 41, 60, 80}
- Then LIS length is 6
- Since LIS Sequence {10, 22, 33, 50, 60, 80}
- Approach : For calculating LIS till ith index we will check all the number from 1 to (i-1)th where is smaller than arr[i] and then add 1 to LIS till that index.
- What is meaning of dp[i] in our approach??.
- Time Complexity ??

arr[]	10	22	9	33	21	50	41	60	80
LIS	1	2		3		4		5	6

Code of LIS

```
void solve()
{
    ll n,maxi=0;
    cin>>n;
    ll arr[n+1],dp[n+1];
    for(int i=0;i<n;i++)
    {
        cin>>arr[i];
        dp[i]=1;
    }
    for(int i=0;i<n;i++)
    {
        for(int j=0;j<i;j++)
        {
            if(arr[i]>arr[j])
                dp[i]=max(dp[i],dp[j]+1);
        }
    }
    for(int i=0;i<n;i++)
        maxi=max(maxi,dp[i]);
    cout<<maxi<<"\n";
}
```

Better Approach

- Approach discuss is $O(n^2)$. We can optimize it to $O(n\log(n))$
- Go through these link
 - [CPAlgo LIS](#)
 - Video tutorial [Tushar Roy LIS](#)