

Longest Increasing Subsequence

ZPRAC-16-17-Lab11

Longest Increasing Subsequence [40 points]

ANNOUNCEMENT:

Up to 20% marks will be allotted for good programming practice. These include

- Comments for non trivial code
 - Indentation: align your code properly
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Given a sequence of N integers, you must find the length of the longest increasing subsequence.

A subsequence is a sequence obtained by deleting zero or more elements from a sequence. An increasing subsequence is one in which the elements are in strictly increasing order.

For example, consider the sequence {1,12,2,20,3,0,10,-1,14}. The LIS (longest increasing subsequence) is {1,2,3,10,14} of length 5.

One can compute the LIS of a sequence using the following observation:

Let $LIS[n]$, $1 \leq n \leq N$, denote the length of the longest increasing subsequence with $A[n]$ as the last element of the subsequence. Using $LIS[i]$, for an $i < n$, the subsequence obtained by adding $A[n]$ (provided $A[n]$ is greater than $A[i]$) will have +1 length. Hence, $LIS[i]$ can be computed as follows:

$$LIS[n] = 1 + \max_{i=1,2,\dots,n-1 \text{ and } A[n] > A[i]} (LIS[i])$$

The length of the longest increasing subsequence can then be computed by finding the maximum of $LIS[n]$ for all possible values of n .

Input Format:

First line contains an integer N denoting the length of the sequence.

The next line contains N space separated integers denoting the contents of the sequence.

Constraints:

$$1 \leq N \leq 1000$$

Output Format:

A single integer, which is the length of the longest increasing subsequence.

Examples:

Given Input:

9

1 12 2 20 3 0 10 -1 14

Expected Output:

5

Explanation: The subsequence {1,2,3,10,14} is the longest increasing subsequence with length 5.