Date : 22th - Oct- 2020
Morning Session : 9am – 11.00 PM
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Topics: Dynamic Programing - 3

The longest common subsequence (LCS) is defined as the longest subsequence that is common to all the given sequences, provided that the elements of the subsequence are not required to occupy consecutive positions within the original sequences.

If S1 and S2 are the two given sequences then, Z is the common subsequence of S1 and S2 if Z is a subsequence of both S1 and S2. Furthermore, Z must be a strictly increasing sequence of the indices of both S1 and S2.

In a strictly increasing sequence, the indices of the elements chosen from the original sequences must be in ascending order in Z.

If

S1 = {B, C, D, A, A, C, D}

Then, {A, D, B} cannot be a subsequence of S1 as the order of the elements is not the same (ie. not strictly increasing sequence).

Let us understand LCS with an example.

If

S1 = {B, C, D, A, A, C, D}

S2 = {A, C, D, B, A, C}

Then, common subsequences are {B, C}, {C, D, A, C}, {D, A, C}, {A, A, C}, {A, C}, {C, D}, ...

Among these subsequences, {C, D, A, C} is the longest common subsequence. We are going to find this longest common subsequence using dynamic programming.

For Problems Explanation please go through Recorded Lecture

Recorded Lecture

How is a dynamic programming algorithm more efficient than the recursive algorithm while solving an LCS problem?

The method of dynamic programming reduces the number of function calls. It stores the result of each function call so that it can be used in future calls without the need for redundant calls.

In the above dynamic algorithm, the results obtained from each comparison between elements of X and the elements of Y are stored in a table so that they can be used in future computations.

So, the time taken by a dynamic approach is the time taken to fill the table (ie. O(mn)). Whereas, the recursion algorithm has the complexity of 2max(m, n).

Longest Common Subsequence Applications

1. in compressing genome resequencing data
2. to authenticate users within their mobile phone through in-air signatures

MCQ's

1. LCS for input Sequences "ABCDGH" and "AEDFHR" is of length
    a. 1
    b. 2
    c. 3
    d. 4

Answer: C

2. LCS for input Sequences "AGGTAB" and "GXTXAYB" of length
   a. 1
   b. 2
   c. 3
   d. 4

Answer: D

3. What is the time complexity of the brute force algorithm used to solve the Knapsack problem?
a) O(n)
b) O(n!)
c) O(2^n)
d) O(n^3)

Answer: C

4. What is the time complexity of the dynamic programming implementation of the Knapsack problem with n items and a maximum weight of W?
a) O(n)
b) O(n + w)
c) O(nW)
d) O(n^2)

Answer: C

guys go through these links before coming to tomorrow's class

https://www.geeksforgeeks.org/graph-data-structure-and-algorithms/

https://www.geeksforgeeks.org/graph-data-structure-and-algorithms/

https://www.programiz.com/dsa/graph