

Printing Longest Common Subsequence

Given two sequences, print the longest subsequence present in both of them.

Examples:

LCS for input Sequences "ABCDGH" and "AEDFHR" is "ADH" of length 3.

LCS for input Sequences "AGGTAB" and "GXTXAYB" is "GTAB" of length 4.

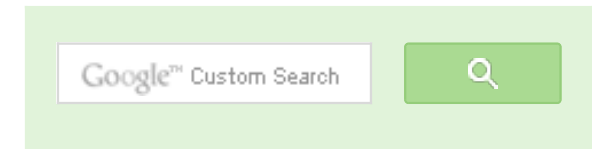
We have discussed [Longest Common Subsequence \(LCS\)](#) problem in a [previous post](#). The function discussed there was mainly to find the length of LCS. To find length of LCS, a 2D table $L[][]$ was constructed. In this post, the function to construct and print LCS is discussed.

Following is detailed algorithm to print the LCS. It uses the same 2D table $L[][]$.

- 1) Construct $L[m+1][n+1]$ using the steps discussed in [previous post](#).
- 2) The value $L[m][n]$ contains length of LCS. Create a character array `lcs[]` of length equal to the length of lcs plus 1 (one extra to store `\0`).
- 2) Traverse the 2D array starting from $L[m][n]$. Do following for every cell $L[i][j]$
 -a) If characters (in X and Y) corresponding to $L[i][j]$ are same (Or $X[i-1] == Y[j-1]$), then include this character as part of LCS.
 -b) Else compare values of $L[i-1][j]$ and $L[i][j-1]$ and go in direction of greater value.

The following table (taken from [Wiki](#)) shows steps (highlighted) followed by the above algorithm.

0	1	2	3	4	5	6	7
Ø	M	Z	J	A	W	X	U
0	Ø	0	0	0	0	0	0



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```
1 X 0 0 0 0 0 1 1
2 M 0 1 1 1 1 1 1
3 J 0 1 1 2 2 2 2
4 Y 0 1 1 2 2 2 2
5 A 0 1 1 2 3 3 3
6 U 0 1 1 2 3 3 3
7 Z 0 1 2 2 3 3 3
```

Following is C++ implementation of above approach.

```
/* Dynamic Programming implementation of LCS problem */
#include<iostream>
#include<cstring>
#include<cstdlib>
using namespace std;

/* Returns length of LCS for X[0..m-1], Y[0..n-1] */
void lcs( char *X, char *Y, int m, int n )
{
    int L[m+1][n+1];

    /* Following steps build L[m+1][n+1] in bottom up fashion. Note
       that L[i][j] contains length of LCS of X[0..i-1] and Y[0..j-1] */
    for (int i=0; i<=m; i++)
    {
        for (int j=0; j<=n; j++)
        {
            if (i == 0 || j == 0)
                L[i][j] = 0;
            else if (X[i-1] == Y[j-1])
                L[i][j] = L[i-1][j-1] + 1;
            else
                L[i][j] = max(L[i-1][j], L[i][j-1]);
        }
    }

    // Following code is used to print LCS
    int index = L[m][n];

    // Create a character array to store the lcs string
```

```

char lcs[index+1];
lcs[index] = '\0'; // Set the terminating character

// Start from the right-most-bottom-most corner and
// one by one store characters in lcs[]
int i = m, j = n;
while (i > 0 && j > 0)
{
    // If current character in X[] and Y are same, then
    // current character is part of LCS
    if (X[i-1] == Y[j-1])
    {
        lcs[index-1] = X[i-1]; // Put current character in result
        i--; j--; index--;      // reduce values of i, j and index
    }

    // If not same, then find the larger of two and
    // go in the direction of larger value
    else if (L[i-1][j] > L[i][j-1])
        i--;
    else
        j--;
}

// Print the lcs
cout << "LCS of " << X << " and " << Y << " is " << lcs;
}

/* Driver program to test above function */
int main()
{
    char X[] = "AGGTAB";
    char Y[] = "GXTXAYB";
    int m = strlen(X);
    int n = strlen(Y);
    lcs(X, Y, m, n);
    return 0;
}

```

Output:

LCS of AGGTAB and GXTXAYB is GTAB

References:

http://en.wikipedia.org/wiki/Longest_common_subsequence_problem

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Vijay Nair • 11 hours ago

i have a feeling you dont need to do the diagnol thing at all,

instead i tried this and it works for all cases that i tried

```
char *pString = new char[SizeofString+1];
int maxSeen = 0;
int writeCtr =0;
for (int j = 1; j <= n; j++)
{
    if (L[m][j] > maxSeen)
    {
        pString[writeCtr++] = second[j-1];
        maxSeen = L[m][j];
    }
}
```

pString[writeCtr]='\0';

this works just fine and its order n which is less than the mXn it would take to r

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anyone...give me the applications where we use LCS...and i request geeksfog articles describing few applications where we can use the concept...

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differentiating files ??

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kaushik Lele • 7 days ago

I have modified above code a little. So that in first loop of i-j itself the character: soon as loop is over, LCS is ready

```
public class LCSLongestCommonSubsequence {

    public static void main(String[] args) {
        String str1 = "AGGTAB";
        String str2 = "GXTXAYB";
        int m = str1.length();
        int n = str2.length();
        System.out.println("Length of LCS is n" + lcs( str1, str2, m, n ) );
    }

    public static Result lcs( String x, String y, int m, int n )
    {
        Result L[][] = new Result[m+1][n+1];
        int i, j;
        /* Following steps build L[m+1][n+1] in bottom up fashion. Note
        that L[i][i] contains length of LCS of X[0..i-1] and Y[0..i-1] */
```

[see more](#)

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kaushik Lele → kaushik Lele • 7 days ago

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