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AIM:	Experiment based on divide and conquer approach. Finding the running time of an algorithm. The understanding of running time of algorithms is explored by implementing two basic sorting algorithms namely merge sort and quick sort.
PROGRAM	
THEORY:	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
INPUT:	Input two strings either of numbers of alphabets
ALGORITHM:	In dynamic programming approach we store the values of longest common subsequence in a two dimentional array which reduces the time complexity to **O(n * m)** where n and m are the lengths of the strings. Let the input sequences be X and Y of lengths m and n respectively. And let dp[n][m] be the length of LCS of the two sequences X and Y. We iterate through a two dimentional loops of lengths n and m and use the following algorithm to update the table dp[][]:- • If any of the loop variable i or j is 0 , then dp[i][j] = 0. • if X[i-1] = Y[j-1] ,i.e., when the characters at ith and jth index matches, dp[i][j] = 1 + dp[i-1][j-1].

	• Otherwise, store the maximum value we get after considering either the charater X[i] or the character Y[j],i.e.,dp[i][j] = max(dp[i][j-1],dp[i-1][j]). To retrieve the subsequence, follow a bottom-up approach.When the length of subsequence considering the Y[j] is greater than that considering X[i],decrement j, increment i when the length of subsequence considering the Y[j] is less than that considering X[i].Whenever the the length of subsequence considering the Y[j] is equal to that considering X[i],include the character in the answer.

PROGRAM:

```
#include<stdio.h>
 #include<string.h>
 int i, j, m, n, c[20][20];

 char x[20], y[20], b[20][20];

 int max (int a, int b);

 void
 print (int i, int j)
 {

 if (i == 0 || j == 0)

 return;

 if (b[i][j] == 'c')

     {

 print (i - 1, j - 1);

 printf ("%c", x[i - 1]);

 }

   else if (b[i][j] == 'u')

 print (i - 1, j);

   else

 print (i, j - 1);
```

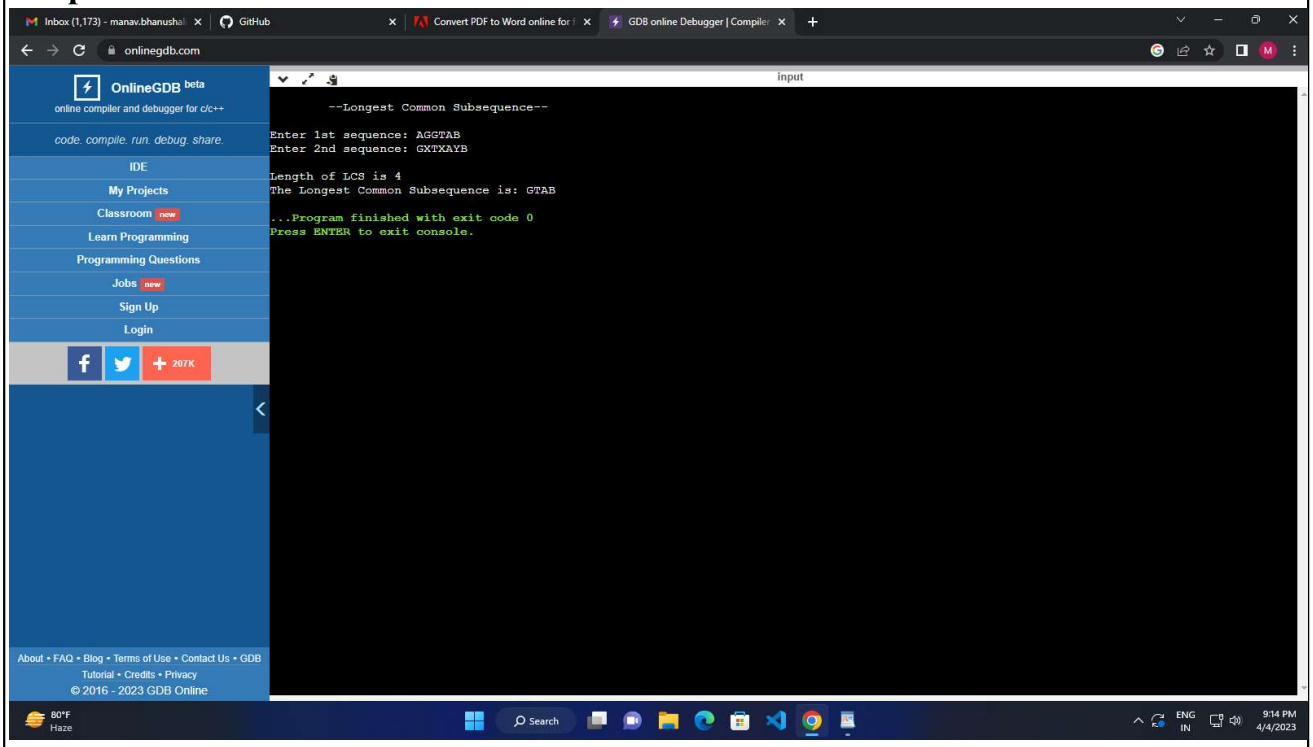
```
}


void
lcs ()
{

m = strlen (x);

n = strlen (y);

for (i = 0; i <= m; i++)
   {

c[i][0] = 0;


for (i = 0; i <= n; i++)
          {
           c[0][i] = 0;



for (i = 1; i <= m; i++)
             {
              for (j = 1; j <= n; j++)

                    {

if (x[i - 1] == y[j - 1])

                       {

c[i][j] = c[i - 1][j - 1] + 1;
```

```
b[i][j] = 'c';

}

                else if (c[i - 1][j] >= c[i][j - 1])

                  {

c[i][j] = c[i - 1][j];
                    b[i][j] = 'u';

}

                else

                  {

c[i][j] = c[i][j - 1];
                    b[i][j] = 'l';

}

}

}

}

}

}
```

```
int
max (int a, int b)
{

if (a > b)
    {

return a;

}

  else

return b;

}



// Returns length of LCS for X[0..m-1], Y[0..n-1]
  int
lcs_length (char *x, char *y, int m, int n)
{

if (m == 0 || n == 0)

return 0;

if (x[m - 1] == y[n - 1])

return 1 + lcs_length (x, y, m - 1, n - 1);

  else
```

```
return max (lcs_length (x, y, m, n - 1), lcs_length (x, y, m - 1, n));

}



int
main ()
{

printf ("\n\t--Longest Common Subsequence--\n");

printf ("\nEnter 1st sequence: ");

scanf ("%s", x);

printf ("Enter 2nd sequence: ");

scanf ("%s", y);

printf ("\nLength of LCS is %d",lcs_length(x,y,m,n));

printf ("\nThe Longest Common Subsequence is: ");
  lcs ();

print (m, n);


return 0;

}
```


Output:



RESULT ANALYSIS:	We have presented two approaches to find the longest common subsequences- • Naive Recursive approach in **$O(2^n)$** time-complexity. • Dynamic Programming approach in **O(n * m)** time-complexity.