PRACTICAL NO. : 05

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Roll No. : 06

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Leet Code ID : Bhortekar_Coder - LeetCode Profile

AIM : Implement a dynamic algorithm for Longest Common Subsequence (LCS) to find the length and LCS for DNA sequences.

Problem Statement :

DNA sequences can be viewed as strings of A, C, G, and T characters, which represent nucleotides. Finding the similarities between two DNA sequences are an important computation performed in bioinformatics.

[Note that a subsequence might not include consecutive elements of the original sequence.]

TASK 1: Find the similarity between the given X and Y sequence.

X=AGCCCTAAGGGCTACCTAGCTT

Y= GACAGCCTACAAGCGTTAGCTTG

CODE IN TEXT FORMAT :

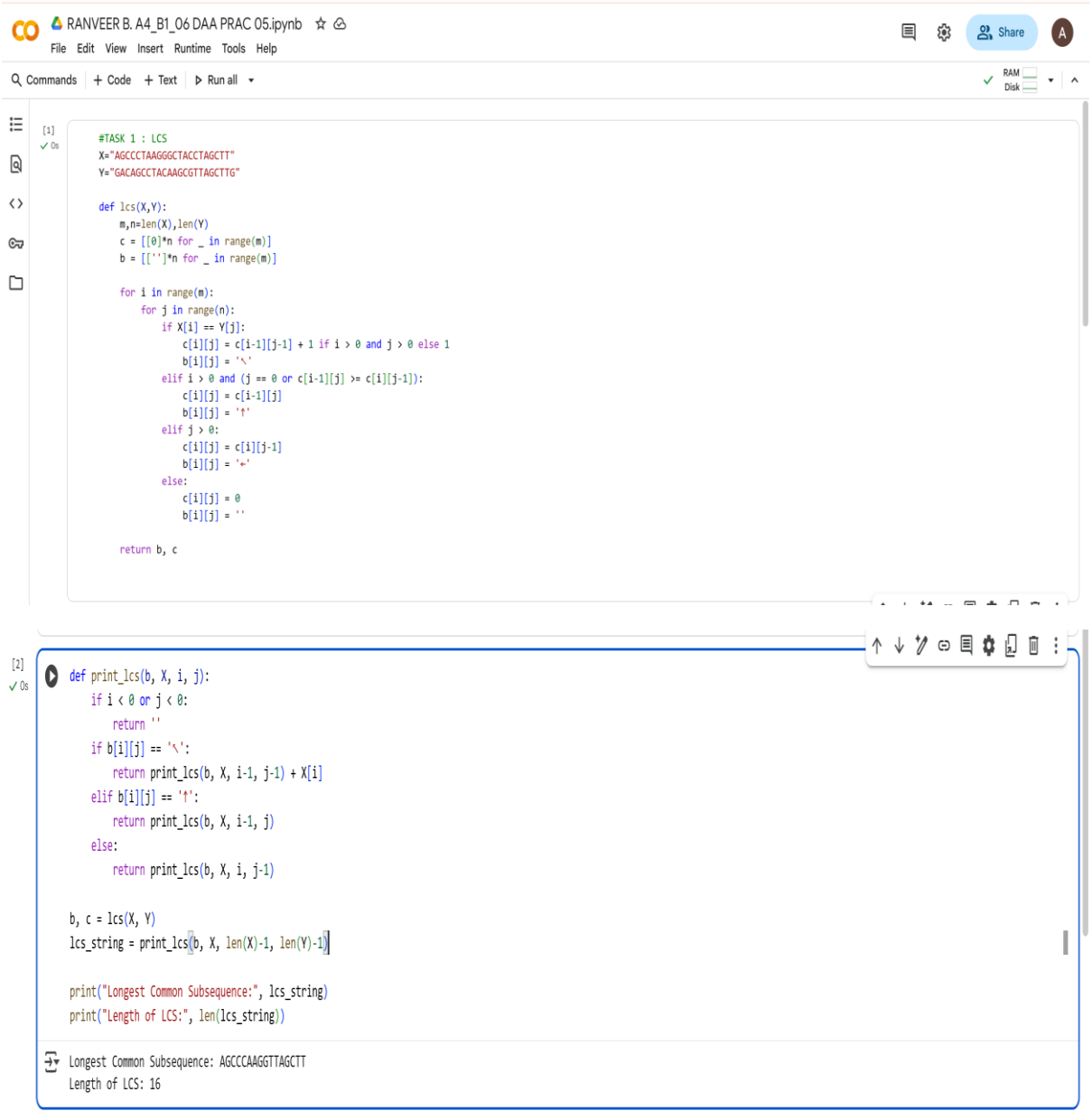
#TASK 1 : LCS

```
X="AGCCCTAAGGGCTACCTAGCTT"

Y="GACAGCCTACAAGCGTTAGCTTG"


def lcs(X,Y):
    m,n=len(X),len(Y)
```

```
    c = [[0]*n for _ in range(m)]
    b = [['']*n for _ in range(m)]

    for i in range(m):
        for j in range(n):
            if X[i] == Y[j]:
                c[i][j] = c[i-1][j-1] + 1 if i > 0 and j > 0 else 1
                b[i][j] = '↖'
            elif i > 0 and (j == 0 or c[i-1][j] >= c[i][j-1]):
                c[i][j] = c[i-1][j]
                b[i][j] = '↑'
            elif j > 0:
                c[i][j] = c[i][j-1]
                b[i][j] = '←'
            else:
                c[i][j] = 0
                b[i][j] = ''

    return b, c
# Print LCS()
def print_lcs(b, X, i, j):
    if i < 0 or j < 0:
        return ''
    if b[i][j] == '↖':
        return print_lcs(b, X, i-1, j-1) + X[i]
    elif b[i][j] == '↑':
        return print_lcs(b, X, i-1, j)
    else:
```

```
    return print_lcs(b, X, i, j-1)

b, c = lcs(X, Y)
lcs_string = print_lcs(b, X, len(X)-1, len(Y)-1)

print("Longest Common Subsequence:", lcs_string)
print("Length of LCS:", len(lcs_string))
```

CODE/OUTPUT SCREENSHOT :



TASK-2 : Find the longest repeating subsequence (LRS). Consider it as a variation of the longest common subsequence (LCS) problem.

Let the given string be S. You need to find the LRS within S. To use the LCS framework, you effectively compare S with itself. So, consider string1 = S and string2 = S.

Example:

AABCBDC

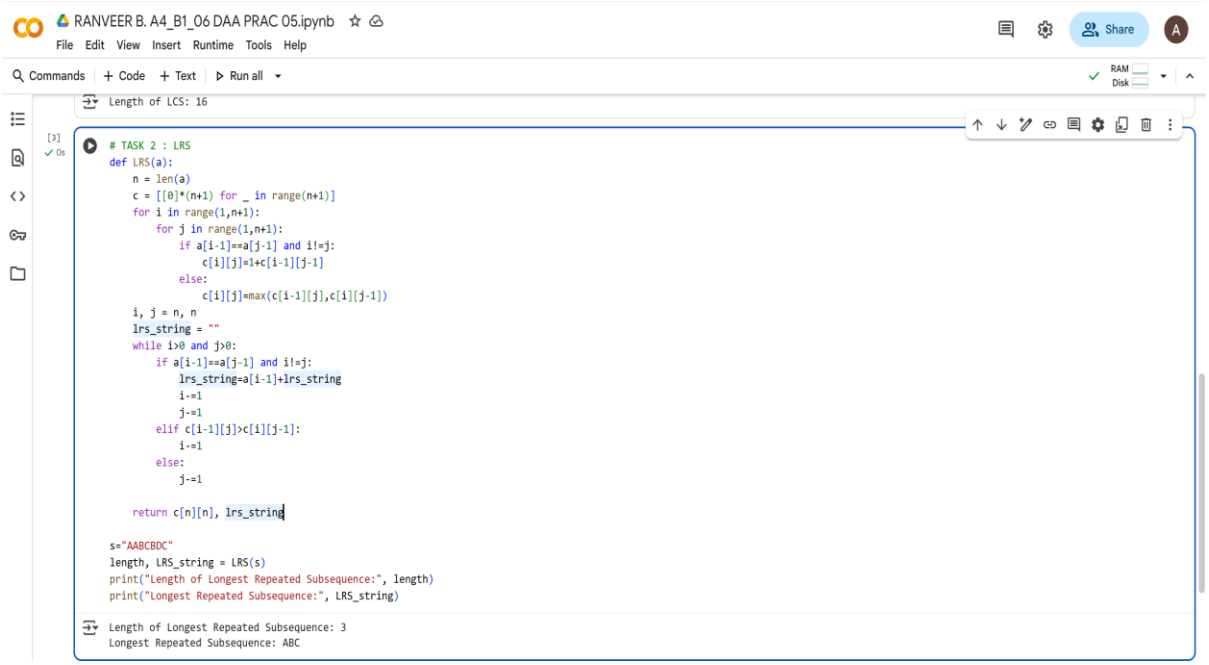
LRS= ABC or ABD

CODE IN TEXT FORMAT :

```
# TASK 2 : LRS
def LRS(a):
    n = len(a)
    c = [[0]*(n+1) for _ in range(n+1)]
    for i in range(1,n+1):
        for j in range(1,n+1):
            if a[i-1]==a[j-1] and i!=j:
                c[i][j]=1+c[i-1][j-1]
            else:
                c[i][j]=max(c[i-1][j],c[i][j-1])
    i, j = n, n
    lrs_string = ""
    while i>0 and j>0:
        if a[i-1]==a[j-1] and i!=j:
            lrs_string=a[i-1]+lrs_string
            i-=1
            j-=1
        elif c[i-1][j]>c[i][j-1]:
            i-=1
```

```
        else:
            j-=1

    return c[n][n], lrs_string

s="AABCBDC"
length, LRS_string = LRS(s)
print("Length of Longest Repeated Subsequence:", length)
print("Longest Repeated Subsequence:", LRS_string)
```

CODE/OUTPUT SCREENSHOT :



LEETCODE SUBMISSION : Longest Common Subsequence - LeetCode

Problem Statement : ID – 1143.Longest Common Subsequence

PROBLEM STATEMENT SCREENSHOT :

1143. Longest Common Subsequence

Medium | Topics | Companies | Hint

Given two strings `text1` and `text2`, return *the length of their longest* ***common subsequence***. If there is no **common subsequence**, return `0`.

A **subsequence** of a string is a new string generated from the original string with some characters (can be none) deleted without changing the relative order of the remaining characters.

- For example, `"ace"` is a subsequence of `"abcde"`.

A **common subsequence** of two strings is a subsequence that is common to both strings.

Example 1:

```
Input: text1 = "abcde", text2 = "ace"
Output: 3
Explanation: The longest common subsequence is "ace" and its length is 3.
```

Example 2:

```
Input: text1 = "abc", text2 = "abc"
Output: 3
Explanation: The longest common subsequence is "abc" and its length is 3.
```

Example 3:

```
Input: text1 = "abc", text2 = "def"
Output: 0
Explanation: There is no such common subsequence, so the result is 0.
```

Constraints:

- `1 <= text1.length, text2.length <= 1000`
- `text1` and `text2` consist of only lowercase English characters.

CODE IN TEXT FORMAT :

```
int longestCommonSubsequence(char *text1, char *text2) {
  int n = strlen(text1), m = strlen(text2);
  int dp[n+1][m+1];

  for(int i=0;i<=n;i++) {
    for(int j=0;j<=m;j++) {
      if(i==0 || j==0)
        dp[i][j] = 0;
      else if(text1[i-1] == text2[j-1])
```

```
            dp[i][j] = 1 + dp[i-1][j-1];
        else
            dp[i][j] = dp[i-1][j] > dp[i][j-1] ? dp[i-1][j] : dp[i][j-1];
      }
   }
   return dp[n][m];
}
```

CODE/SUBMISSION SCREENSHOT :