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Experiment No.	4

AIM:	Experiment using dynamic programming approach: finding longest common subsequence of two strings

Program 1

Algorithm:

LCS-LENGTH(X, Y):

```
1. m = X.length
2. n = Y.length
3. let c[0 ..m, 0 .. n] and b[1...m, 1...n] be new tables
4. for i = 1 to m
5. c[i, 0] = 0
6. for j = 0 to n
7. c[0, j] = 0
8. for i = 1 to m
9. for j = 1 to n
10. if x[i] == y[j]
11. c[i, j] = c[i — 1, j — 1] + 1
12. b[i, j] = 0
13. elseif c [i — 1, j] > c[i, j — 1]
14. c[i, j] = c[i — 1, j]
15. b[i, j] = 1
16. else c[i, j] = c[i, j — 1]
17. b[i, j] = 2
18. return c and b
```

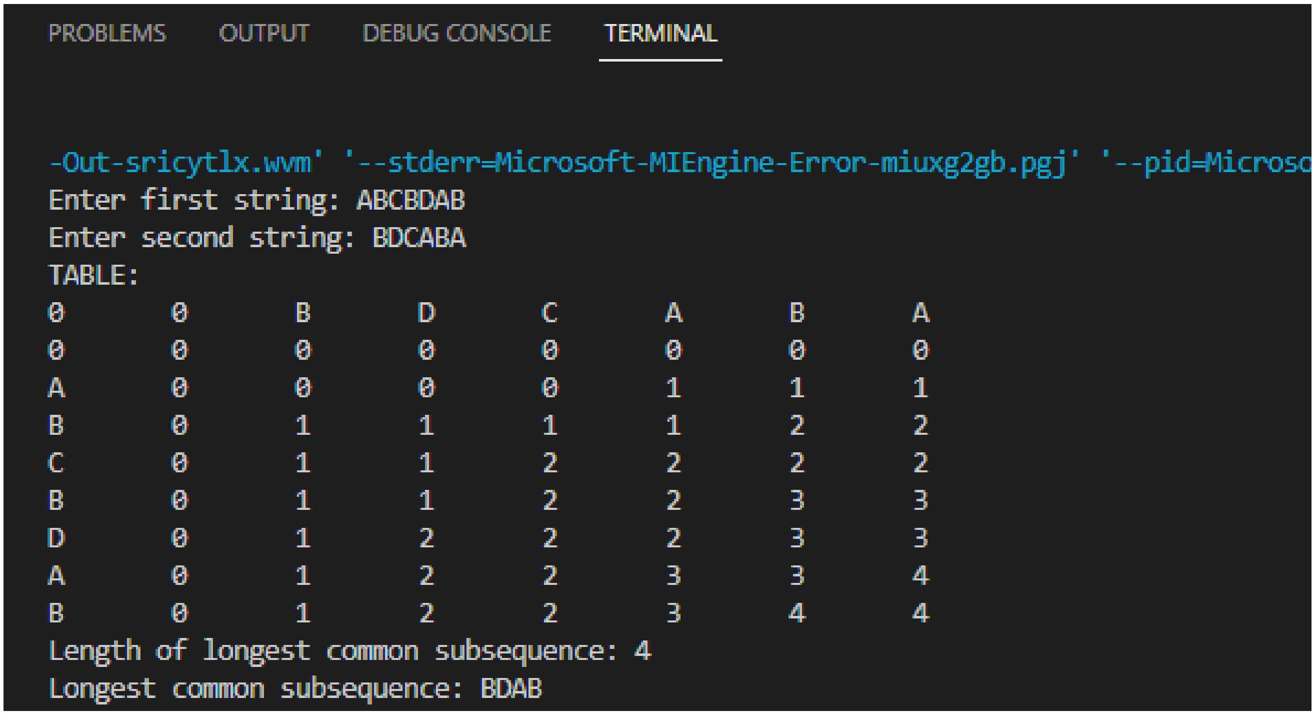
PRINT-LCS(b, X, i, j):

```
1. if i == 0 or j== 0
2. return
3. if b[i, j]== 0
4. PRINT-LCS(b, X, i —1, j — 1)
5. print x[i]
6. elseif b[i, j] == 1
7. PRINT-LCS(b, X, i -1, j)
8. else PRINT-LCS(b, X, i, j - 1)
```

PROGRAM:

```c
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
void longestCommonSubsequence(char *str1, char *str2, char *lcs, int *lcs_len){
    *lcs_len = 0;
    int m = strlen(str1);
    int n = strlen(str2);
    int c[m + 1][n + 1];
    // initialising first row to 0
    for (int i = 0; i < n + 1; i++)
        c[0][i] = 0;
    // initialising first column to 0
    for (int i = 0; i < m + 1; i++)
        c[i][0] = 0;
    for (int i = 1; i < m + 1; i++) {
        for (int j = 1; j < n + 1; j++) {
            if (str1[i - 1] == str2[j - 1])
                c[i][j] = c[i - 1][j - 1] + 1;
            else {
                if (c[i - 1][j] > c[i][j - 1])
                    c[i][j] = c[i - 1][j];
                else
                    c[i][j] = c[i][j - 1];
            }
        }
    }
    printf("TABLE:\n");
    printf("0\t0\t");
    for (int i = 0; i < n; i++)
        printf("%c\t", str2[i]);
    printf("\n");
    for (int i = 0; i < m + 1; i++) {
        if (i != 0)
            printf("%c\t", str1[i - 1]);
        else
            printf("0\t");
        for (int j = 0; j < n + 1; j++)
            printf("%d\t", c[i][j]);
        printf("\n");
    }
    *lcs_len = c[m][n];
    lcs[(*lcs_len)] = '\0';
    int u = m, v = n;
    int idx = (*lcs_len) - 1;
    while (idx >= 0){
        if (str1[u - 1] == str2[v - 1]){
            lcs[idx--] = str1[u - 1];
            u--;
            v--;
        } else if (c[u][v] == c[u][v - 1])
            v--;
        else
            u--;
    }
}
int main(){
    char a[100], b[100];
    printf("Enter first string: ");
    fgets(a, sizeof(a), stdin);
    int a_size = strlen(a);
    a[--a_size] = '\0';
    printf("Enter second string: ");
    fgets(b, sizeof(b), stdin);
    int b_size = strlen(b);
    b[--b_size] = '\0';
    char lcs[100];
    int lcs_len = 0;
    longestCommonSubsequence(a, b, lcs, &lcs_len);
    printf("Length of longest common subsequence: %d\n", lcs_len);
    printf("Longest common subsequence: %s\n", lcs);
}
```

RESULT:



```
-Out-sricytlx.wvm' '--stderr=Microsoft-MIEngine-Error-miuxg2gb.pgj' '--pid=Microso
Enter first string: ABCBDAB
Enter second string: BDCABA
TABLE:
0       0       B       D       C       A       B       A
0       0       0       0       0       0       0       0
A       0       0       0       0       1       1       1
B       0       1       1       1       1       2       2
C       0       1       1       2       2       2       2
B       0       1       1       2       2       3       3
D       0       1       2       2       2       3       3
A       0       1       2       2       3       3       4
B       0       1       2       2       3       4       4
Length of longest common subsequence: 4
Longest common subsequence: BDAB
```

CONCLUSION: Thus, we have implemented a program to find Longest Common Subsequence through a dynamic programming approach.