CHAROTAR UNIVERSITY OF SCIENCE & TECHNOLOGY

DEVANG PATEL INSTITUTE OF ADVANCE TECHNOLOGY & RESEARCH

Computer Science & Engineering

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SUBJECT: DESIGN AND ANALYSIS OF ALGORITHM

CODE: CS 351

DYNAMIC PROGRAMMING

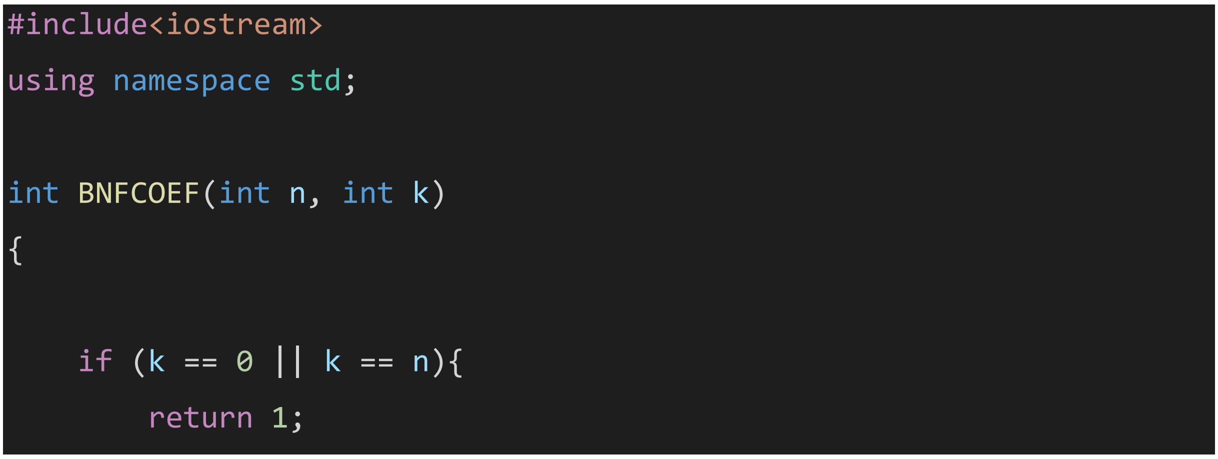
PRACTICAL-5.1

AIM:

Implement a program which has BNMCOEF() function that takes two parameters n and k and returns the value of Binomial Coefficient C(n, k). Compare the dynamic programming implementation with recursive implementation of BNMCOEF(). (In output, entire table should be displayed.)

Test Case	n	k
1	5	2
2	11	6
3	12	5

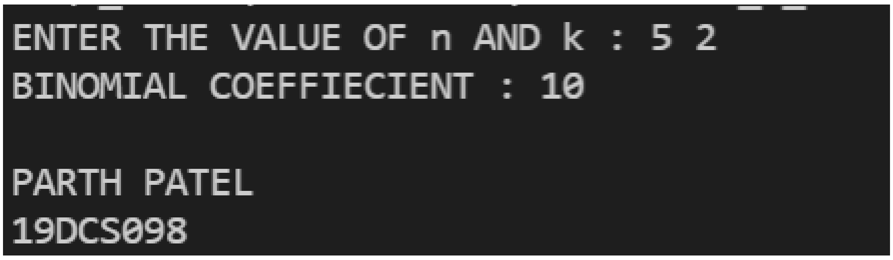
PROGRAM CODE:



```
#include<iostream>
using namespace std;

int BNFCOEF(int n, int k)
{

    if (k == 0 || k == n){
        return 1;
    }


    return BNFCOEF(n - 1, k - 1) +
                BNFCOEF(n - 1, k);
}
int main()
{
    int n,k;

    cout<<"ENTER THE VALUE OF n AND k : ";
    cin>>n>>k;
    cout<<"BINOMIAL COEFFIECIENT : " <<BNFCOEF(n,k)<<endl;
    cout<<endl;
    cout<<"PARTH PATEL\n19DCS098"<<endl;
    return 0;
}
```

OUTPUT:

TEST CASE-1:



```
ENTER THE VALUE OF n AND k : 5 2
BINOMIAL COEFFIECIENT : 10

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```
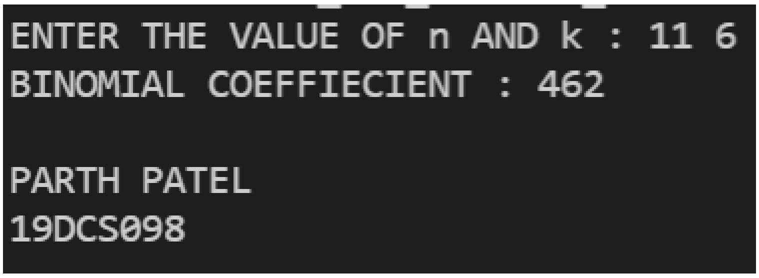

TEST CASE-2:



```
ENTER THE VALUE OF n AND k : 11 6
BINOMIAL COEFFIECIENT : 462

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```
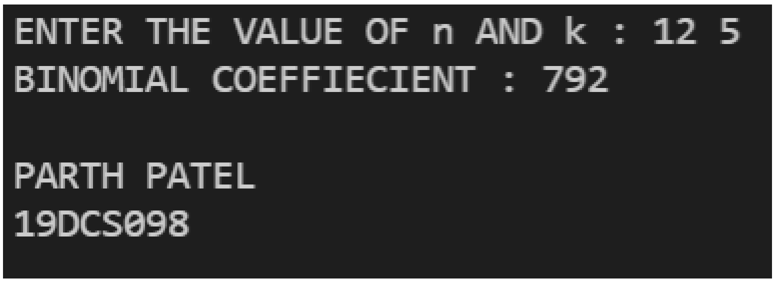

TEST CASE-3:



```
ENTER THE VALUE OF n AND k : 12 5
BINOMIAL COEFFIECIENT : 792

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```

PRACTICAL-5.2

AIM:

Implement the program 4.2 using Dynamic Programing. Compare Greedy and Dynamic approach

PROGRAM CODE:

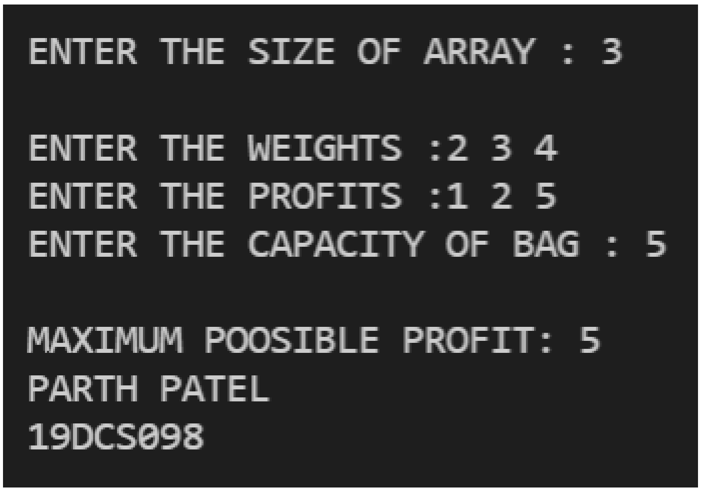
```
#include <iostream>
using namespace std;
int max(int x, int y)
{
    if (x > y)
        return x;
    else
        return y;
}
int knapsackSolution(int bagCapacity, int weight[], int profit[],
int number)
{
    int matrix[number + 1][bagCapacity + 1];
    for (int i = 0; i < number + 1; i++)
        for (int j = 0; j < bagCapacity + 1; j++)
        {
            if (i == 0 || j == 0)
                matrix[i][j] = 0;
            else if (j >= weight[i - 1])
```

```
                matrix[i][j] = max(matrix[i - 1][j], profit[i - 1] +
matrix[i - 1][j - weight[i - 1]]);
            else
                matrix[i][j] = matrix[i - 1][j];
        }
    return matrix[number][bagCapacity];
}
int main()
{
    int number, bagCapacity;
    cout << "\nENTER THE SIZE OF ARRAY : ";
    cin >> number;

    int weight[number], profit[number];
    cout << "\nENTER THE WEIGHTS :";
    for (int i = 0; i < number; i++)
        cin >> weight[i];
    cout << "ENTER THE PROFITS :";
    for (int i = 0; i < number; i++)
        cin >> profit[i];
    cout << "ENTER THE CAPACITY OF BAG : ";
    cin >> bagCapacity;
    cout << "\nMAXIMUM POOSIBLE PROFIT: " <<
knapsackSolution(bagCapacity, weight, profit, number) << endl;
    cout << "PARTH PATEL\n19DCS098" << endl;
    return 0;
}
```

OUTPUT:

Test Case-1:



```
ENTER THE SIZE OF ARRAY : 3

ENTER THE WEIGHTS :2 3 4
ENTER THE PROFITS :1 2 5
ENTER THE CAPACITY OF BAG : 5

MAXIMUM POOSIBLE PROFIT: 5
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```
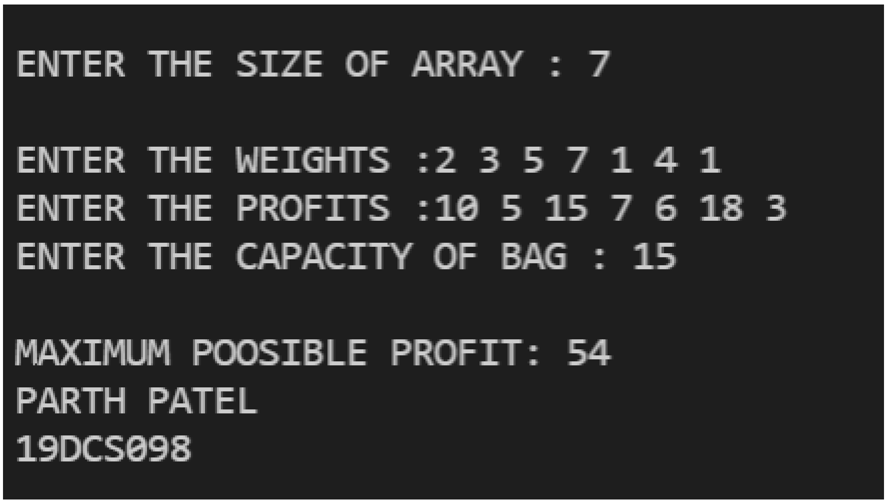

Test Case-2:



```
ENTER THE SIZE OF ARRAY : 7

ENTER THE WEIGHTS :2 3 5 7 1 4 1
ENTER THE PROFITS :10 5 15 7 6 18 3
ENTER THE CAPACITY OF BAG : 15

MAXIMUM POOSIBLE PROFIT: 54
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```
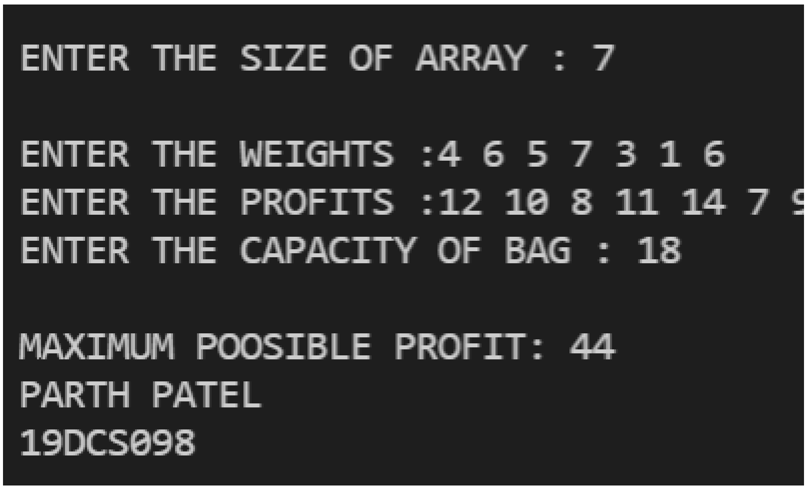

Test Case-3:



```
ENTER THE SIZE OF ARRAY : 7

ENTER THE WEIGHTS :4 6 5 7 3 1 6
ENTER THE PROFITS :12 10 8 11 14 7 9
ENTER THE CAPACITY OF BAG : 18

MAXIMUM POOSIBLE PROFIT: 44
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```
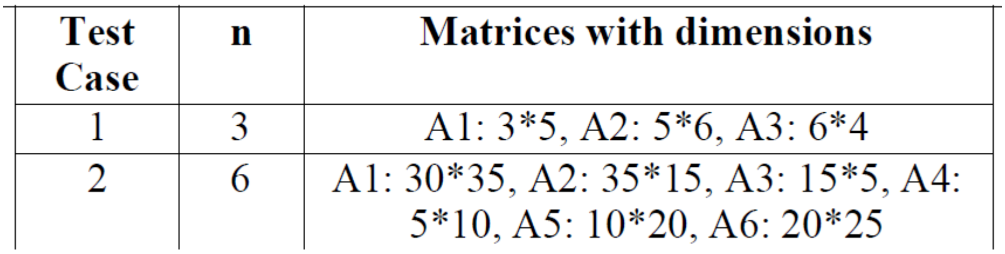

PRACTICAL-5.3

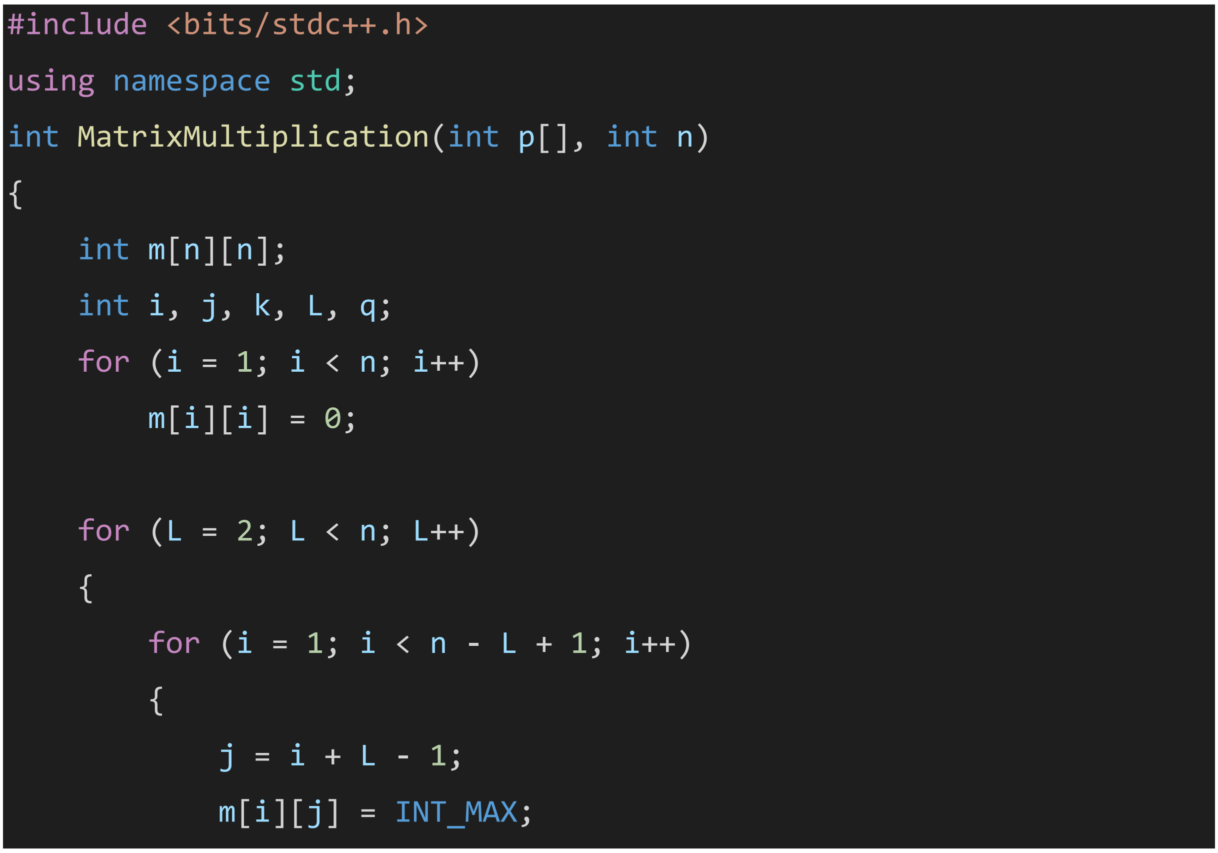
AIM:

Given a chain < A1, A2,…,An> of n matrices, where for i=1,2,…,n matrix Ai with dimensions. Implement the program to fully parenthesize the product A1,A2,…,An in a way that minimizes the number of scalar multiplications. Also calculate the number of scalar multiplications for all possible combinations of matrices



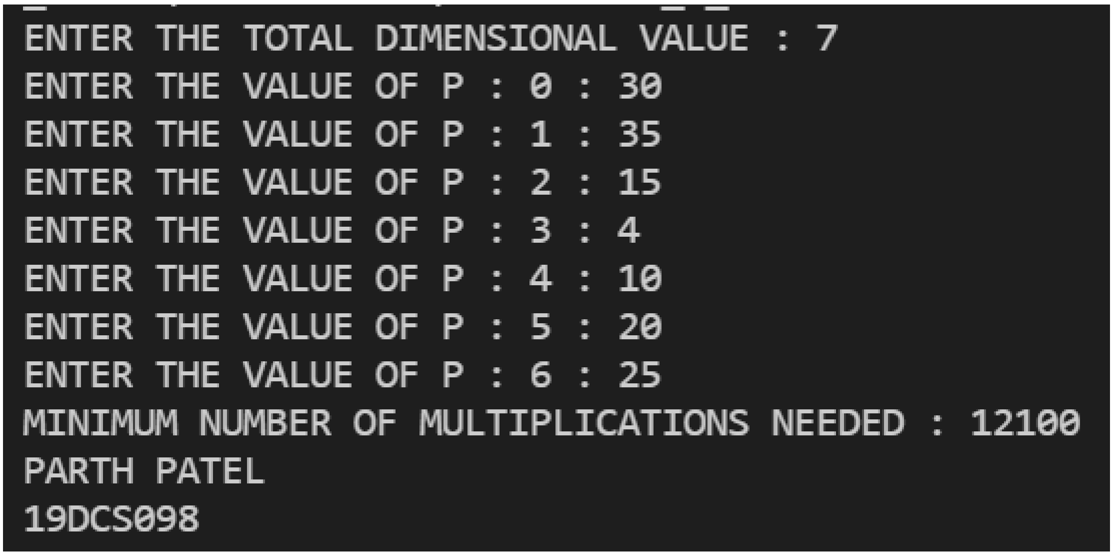
Test Case	n	Matrices with dimensions
1	3	A1: 3*5, A2: 5*6, A3: 6*4
2	6	A1: 30*35, A2: 35*15, A3: 15*5, A4: 5*10, A5: 10*20, A6: 20*25

PROGRAM CODE:



```
#include <bits/stdc++.h>
using namespace std;
int MatrixMultiplication(int p[], int n)
{
    int m[n][n];
    int i, j, k, L, q;
    for (i = 1; i < n; i++)
        m[i][i] = 0;

    for (L = 2; L < n; L++)
    {
        for (i = 1; i < n - L + 1; i++)
        {
            j = i + L - 1;
            m[i][j] = INT_MAX;
            for (k = i; k <= j - 1; k++)
            {

                q = m[i][k] + m[k + 1][j] +
                    p[i - 1] * p[k] * p[j];
                if (q < m[i][j])
                    m[i][j] = q;
            }
        }
    }
    return m[1][n - 1];
}
int main()
{
    int n;

    cout << "ENTER THE TOTAL DIMENSIONAL VALUE : ";
    cin >> n;
    int arr[n];
    for (int i = 0; i < n; i++)
    {
        cout << "ENTER THE VALUE OF P : " << i << " : ";
        cin >> arr[i];
    }
    int length = sizeof(arr) / sizeof(arr[0]);
    cout << "MINIMUM NUMBER OF MULTIPLICATIONS NEEDED : " <<
MatrixMultiplication(arr, length) << endl;
    cout << "PARTH PATEL\n19DCS098" << endl;
    return 0;
}
```

OUTPUT:



```
ENTER THE TOTAL DIMENSIONAL VALUE : 7
ENTER THE VALUE OF P : 0 : 30
ENTER THE VALUE OF P : 1 : 35
ENTER THE VALUE OF P : 2 : 15
ENTER THE VALUE OF P : 3 : 4
ENTER THE VALUE OF P : 4 : 10
ENTER THE VALUE OF P : 5 : 20
ENTER THE VALUE OF P : 6 : 25
MINIMUM NUMBER OF MULTIPLICATIONS NEEDED : 12100
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```

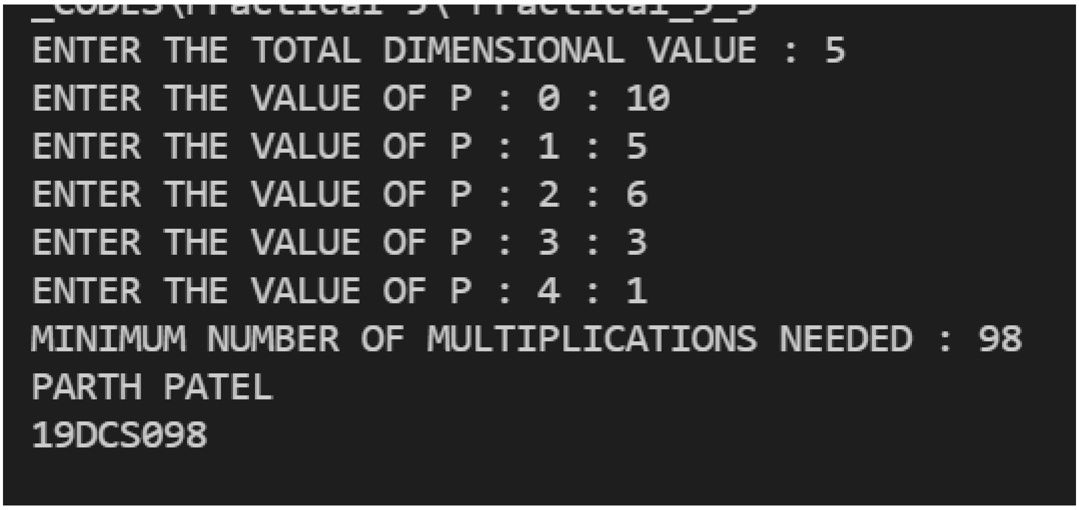

```
_CODES\Practical 5\ Practical_5_5
ENTER THE TOTAL DIMENSIONAL VALUE : 5
ENTER THE VALUE OF P : 0 : 10
ENTER THE VALUE OF P : 1 : 5
ENTER THE VALUE OF P : 2 : 6
ENTER THE VALUE OF P : 3 : 3
ENTER THE VALUE OF P : 4 : 1
MINIMUM NUMBER OF MULTIPLICATIONS NEEDED : 98
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```
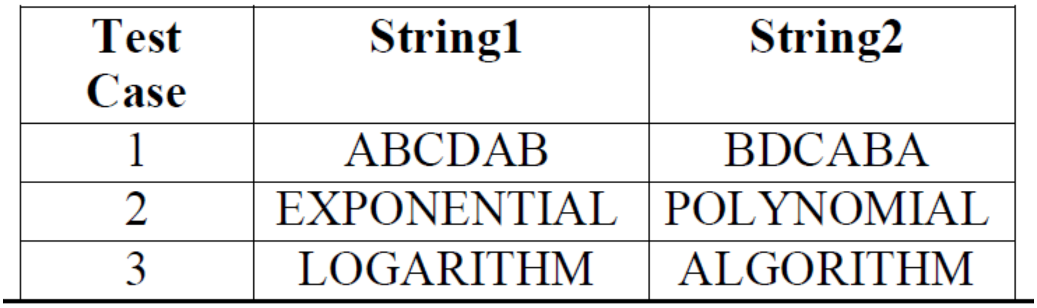

PRACTICAL-5.4

AIM:

Implement a program to print the longest common subsequence for the following strings:



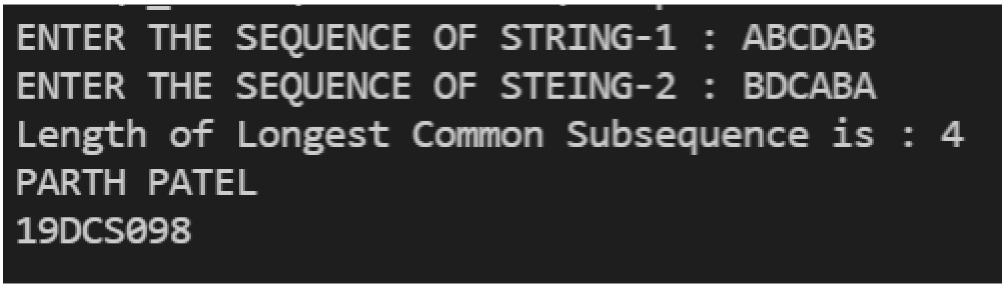
Test Case	String1	String2
1	ABCDAB	BDCABA
2	EXPONENTIAL	POLYNOMIAL
3	LOGARITHM	ALGORITHM

PROGRAM CODE:

```
#include <iostream>
#include <string.h>
using namespace std;
int maximum(int a, int b);
int longestCommonSubsequence(char *X, char *Y, int m, int n)
{
    if (m == 0 || n == 0)
        return 0;
    if (X[m - 1] == Y[n - 1])
        return 1 + longestCommonSubsequence(X, Y, m - 1, n - 1);
    else
        return maximum(longestCommonSubsequence(X, Y, m, n - 1),
longestCommonSubsequence(X, Y, m - 1, n));
}
int maximum(int a, int b)
{
    return (a > b) ? a : b;
}
int main()
{
    char X[100], Y[100];
    cout << "ENTER THE SEQUENCE OF STRING-1 : ";
    cin >> X;
    cout << "ENTER THE SEQUENCE OF STEING-2 : ";
    cin >> Y;
    int m = strlen(X);
    int n = strlen(Y);
    cout << "Length of Longest Common Subsequence is : " <<
longestCommonSubsequence(X, Y, m, n);

    cout<<"\nPARTH PATEL\n19DCS098"<<endl;
    return 0;
}
```

OUTPUT:

Test Case-1:



```
ENTER THE SEQUENCE OF STRING-1 : ABCDAB
ENTER THE SEQUENCE OF STEING-2 : BDCABA
Length of Longest Common Subsequence is : 4
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```
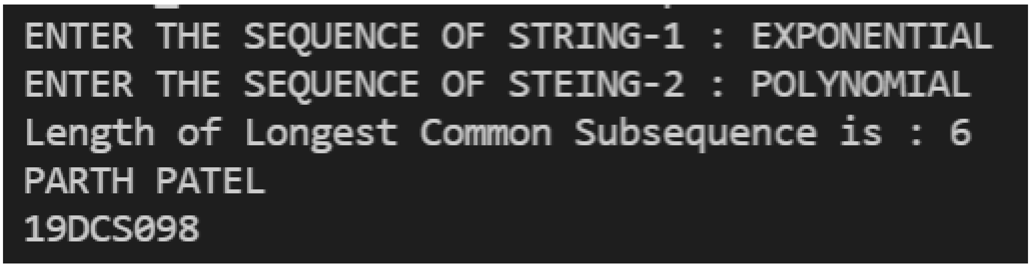

Test Case-2:



```
ENTER THE SEQUENCE OF STRING-1 : EXPONENTIAL
ENTER THE SEQUENCE OF STEING-2 : POLYNOMIAL
Length of Longest Common Subsequence is : 6
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```
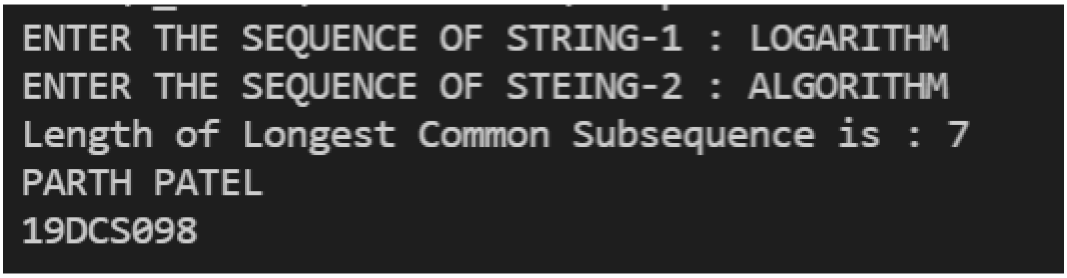

Test Case-3:



```
ENTER THE SEQUENCE OF STRING-1 : LOGARITHM
ENTER THE SEQUENCE OF STEING-2 : ALGORITHM
Length of Longest Common Subsequence is : 7
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```