DSA LAB – 4

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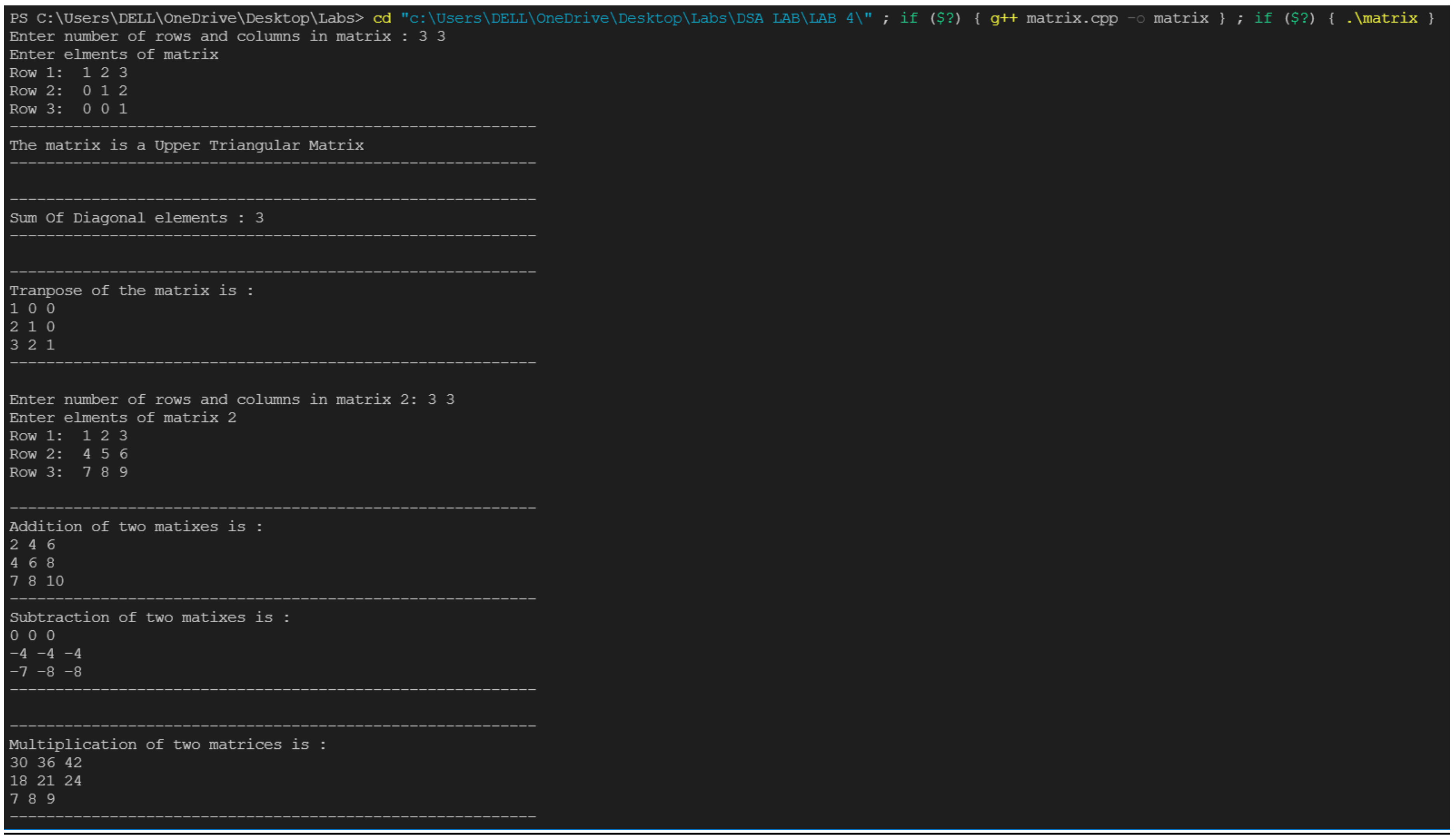
Question1:

Code:

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

void upperTri(int *p, int rows, int columns){
   cout << "----------------------------------------------------------\n";
   // Matrix can have only triangular if it is a square matrix
   if(rows == columns){
      int flag;
      // Checking elements which has to be zero
      for(int i = 0; i < rows; i++){
         for(int j = 0; j < i; j++){
            if(*((p+i*columns)+j) != 0) flag = 0;
            else flag = 1;
         }
      }
      if (flag == 1){
         cout << "The matrix is a Upper Triangular Matrix" << endl;
      }
      else{
         cout << "The matrix is not a Upper Triangular Matrix" << endl;
      }
   }
   // Not a square matrix
   else{
      cout << "The matrix is a rectangular matrix. Triangular matrix does not exist." << endl;
   }
   cout << "----------------------------------------------------------\n\n";
}

void diasum(int *p, int rows, int columns){
   cout << "----------------------------------------------------------\n";
   // Diagonal is defined for only square matrix
   if(rows == columns){
      int sum = 0;
      for(int i = 0; i < rows; i++){
         for(int j = 0; j < columns; j++){
            // Diagonal elemants exist in same row and column
            if(i == j){
               sum = sum + *((p+i*columns)+j);
            }
         }
      }
      cout << "Sum Of Diagonal elements : " << sum << endl;;
   }
   // Not a square matrix
   else{
      cout << "The matrix is a rectangular matrix. Diagonal does not exist." << endl;
   }
   cout << "----------------------------------------------------------\n\n";
}
void transpose(int *p, int rows, int columns){
   cout << "----------------------------------------------------------\n";
   // Define a transpose matrix with opposite order
   int transpose[columns][rows];
   // Reading transpose matrix
   for(int i = 0; i < rows; i++){
      for(int j = 0; j < columns; j++){
         transpose[j][i] = *((p+i*columns)+j);
      }
   }
   // Disaplay transpose matrix
   cout << "Tranpose of the matrix is : " << endl;
   for(int i = 0; i < columns; i++){
      for(int j= 0; j < rows; j++){
         cout << transpose[i][j] << " ";
      }
      cout << "\n";
   }
   cout << "----------------------------------------------------------\n\n";
}
void operations(int *p, int rows, int columns){
   // Define another matrix for addition, subtraction and multiplication operations
   int rowsB, columnsB;
   cout << "Enter number of rows and columns in matrix 2: ";
   cin >> rowsB >> columnsB;
   int matrix_B[rowsB][columnsB];
   // Reading another matrix
   cout << "Enter elments of matrix 2" << endl;
   for(int  i = 0; i < rowsB; i++){
      cout << "Row " << i+1  << ":  ";
      for(int j = 0; j < columnsB; j++){
         cin >> matrix_B[i][j];
      }
   }
   cout << "\n----------------------------------------------------------\n";
   // For Addition and subtraction, both matrices must have same order
   if(rows == rowsB && columns == columnsB){
      cout << "Addition of two matixes is :" << endl;
      for(int i = 0; i < rows; i++){
         for(int  j = 0; j < columns; j++){
            cout << *((p+i*columns)+j) + matrix_B[i][j] << " ";
         }
         cout << "\n";
      }
      cout << "----------------------------------------------------------\n";
      cout << "Subtraction of two matixes is :" << endl;
      for(int i = 0; i < rows; i++){
         for(int  j = 0; j < columns; j++){
            cout << *((p+i*columns)+j) - matrix_B[i][j]<< " ";
         }
         cout << "\n";
      }
   }
   // Don't have same order
   else{
      cout << "Addition and Subtraction is not possible" << endl;
   }
   cout << "----------------------------------------------------------\n\n";
   // For mulitiplication, number of columns of first matrix should be equal to rows of second matrix
   cout << "----------------------------------------------------------\n";
   if(columns == rowsB){
      int sum = 0;
      cout << "Multiplication of two matrices is : " << endl;
      for(int i = 0; i < rows; i++){
         for(int j = 0; j < columnsB; j++){
            for(int k = 0; k < rowsB; k++){
               sum = sum + *((p+i*columns)+k) * matrix_B[k][j];
            }
            cout << sum << " ";
            sum = 0;
         }
         cout << "\n";
      }
   }
   else{
      cout << "Multiplication is not possible" << endl;
   }
   cout << "----------------------------------------------------------\n";
}

int main(){
   int rows, columns;
   cout << "Enter number of rows and columns in matrix : ";
   cin >> rows >> columns;
   int matrix[rows][columns];
   // Taking input a matrix
   cout << "Enter elments of matrix " << endl;
   for(int  i = 0; i < rows; i++){
      cout << "Row " << i+1  << ":  ";
      for(int j = 0; j < columns; j++){
         cin >> matrix[i][j];
      }
   }
   upperTri((int *)matrix, rows, columns);
   diasum((int *)matrix, rows, columns);
   transpose((int *)matrix, rows, columns);
   operations((int *)matrix, rows, columns);
   return 0;
}
```

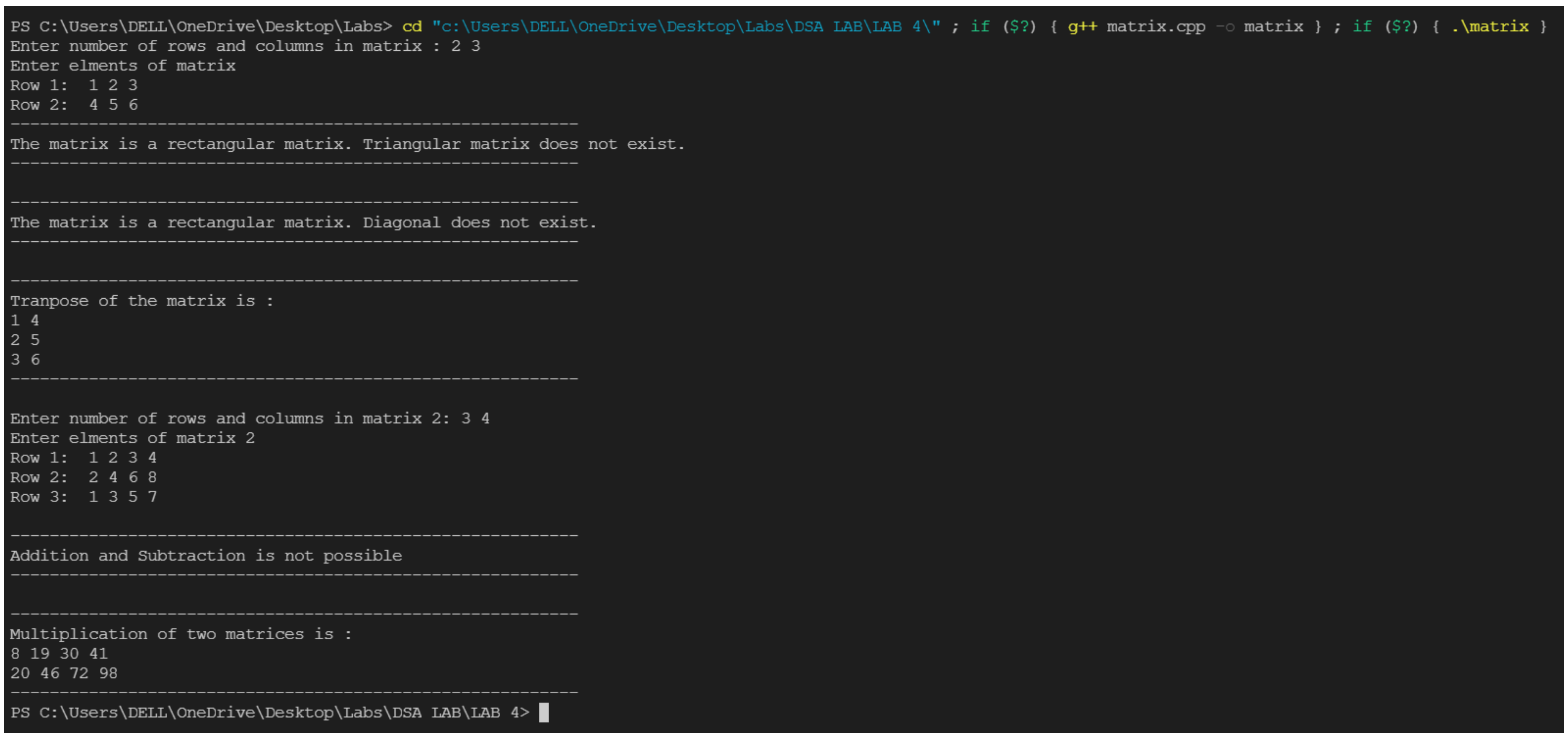
Input & Output:

Square matrix:



```
PS C:\Users\DELL\OneDrive\Desktop\Labs> cd "c:\Users\DELL\OneDrive\Desktop\Labs\DSA LAB\LAB 4\" ; if ($?) { g++ matrix.cpp -o matrix } ; if ($?) { .\matrix }
Enter number of rows and columns in matrix : 3 3
Enter elments of matrix
Row 1:  1 2 3
Row 2:  0 1 2
Row 3:  0 0 1
----------------------------------------------------------
The matrix is a Upper Triangular Matrix
----------------------------------------------------------

----------------------------------------------------------
Sum Of Diagonal elements : 3
----------------------------------------------------------

----------------------------------------------------------
Tranpose of the matrix is :
1 0 0
2 1 0
3 2 1
----------------------------------------------------------

Enter number of rows and columns in matrix 2: 3 3
Enter elments of matrix 2
Row 1:  1 2 3
Row 2:  4 5 6
Row 3:  7 8 9

----------------------------------------------------------
Addition of two matixes is :
2 4 6
4 6 8
7 8 10
----------------------------------------------------------
Subtraction of two matixes is :
0 0 0
-4 -4 -4
-7 -8 -8
----------------------------------------------------------

----------------------------------------------------------
Multiplication of two matrices is :
30 36 42
18 21 24
7 8 9
----------------------------------------------------------
```

Rectangular matrix:



```
PS C:\Users\DELL\OneDrive\Desktop\Labs> cd "c:\Users\DELL\OneDrive\Desktop\Labs\DSA LAB\LAB 4\" ; if ($?) { g++ matrix.cpp -o matrix } ; if ($?) { .\matrix }
Enter number of rows and columns in matrix : 2 3
Enter elments of matrix
Row 1:  1 2 3
Row 2:  4 5 6
----------------------------------------------------------
The matrix is a rectangular matrix. Triangular matrix does not exist.
----------------------------------------------------------

----------------------------------------------------------
The matrix is a rectangular matrix. Diagonal does not exist.
----------------------------------------------------------

----------------------------------------------------------
Tranpose of the matrix is :
1 4
2 5
3 6
----------------------------------------------------------

Enter number of rows and columns in matrix 2: 3 4
Enter elments of matrix 2
Row 1:  1 2 3 4
Row 2:  2 4 6 8
Row 3:  1 3 5 7

----------------------------------------------------------
Addition and Subtraction is not possible
----------------------------------------------------------

----------------------------------------------------------
Multiplication of two matrices is :
8 19 30 41
20 46 72 98
----------------------------------------------------------
PS C:\Users\DELL\OneDrive\Desktop\Labs\DSA LAB\LAB 4>
```

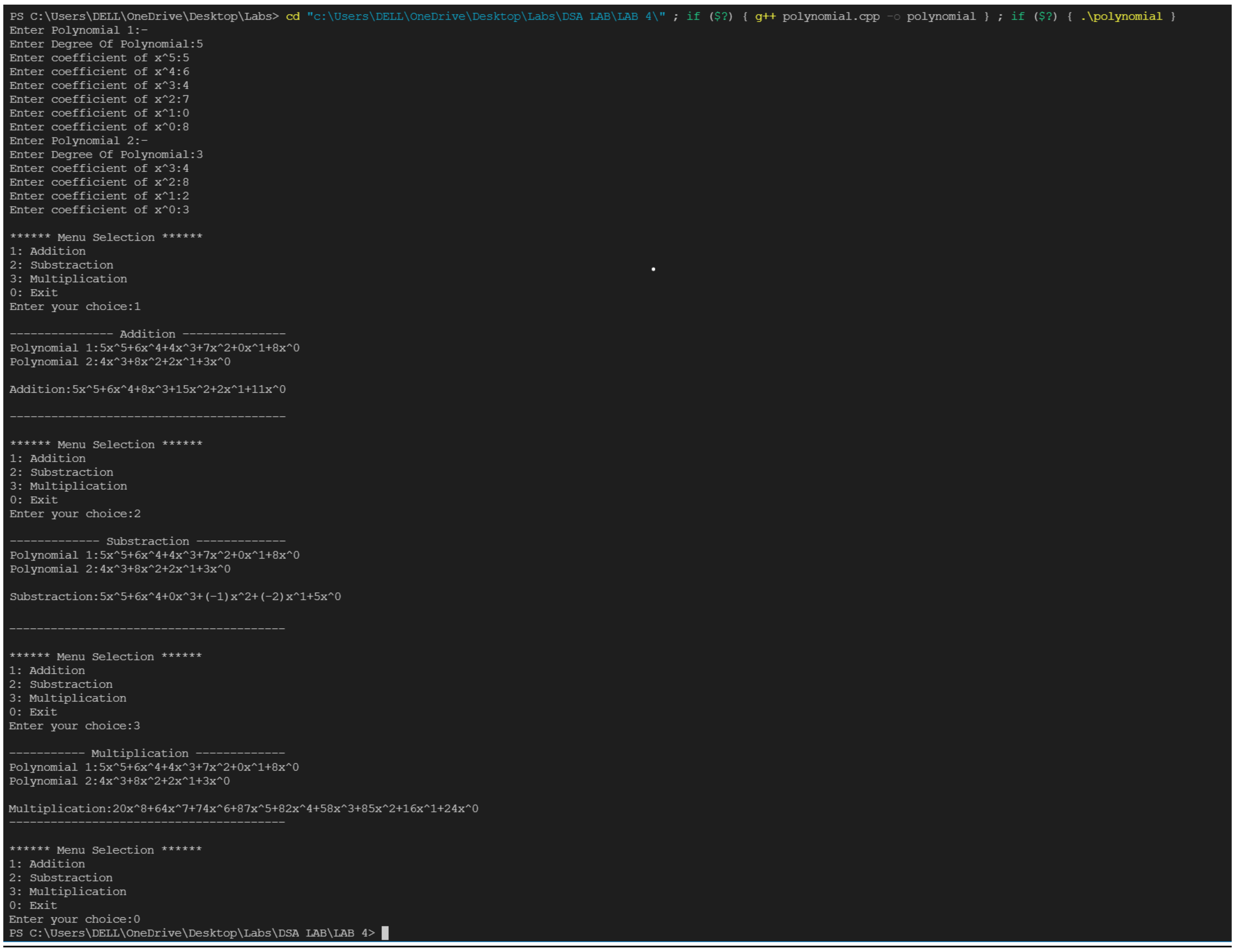
Question 2:

Code:

```
#include<iostream>
#include<stdlib.h>
using namespace std;

class poly {
public:
   int *coefficient, degree;
   //function declaration
   int getdata();
   int display(int *coefficient, int degree);
   void addition(poly p1, poly p2);
   void substraction(poly p1, poly p2);
   void multiplication(poly p1, poly p2);
};

int poly::display(int *coefficient, int degree) {
   int i, j;
   for (i = degree; i >= 0; i--) {
      if(coefficient[i] >= 0) cout << coefficient[i] << "x^" << i;
      else cout << "(" <<coefficient[i] << ")" << "x^" << i;
      if ((i - 1) != -1)
         cout << "+";
   }
   cout << "\n";
   return 0;
}

int poly::getdata() {
   int i;
   cout << "Enter Degree Of Polynomial:";
   cin >> degree;
   coefficient = new int[degree + 1];
   for (i = degree; i >= 0; i--) {
      cout << "Enter coefficient of x^" << i << ":";
      cin >> coefficient[i];
   }

   return 0;
}

void poly::addition(poly p1, poly p2) {
   int max, i;
   max = (p1.degree > p2.degree) ? p1.degree : p2.degree;
   int *sum = new int[max + 1];
   if (p1.degree == p2.degree) {
      for (i = p1.degree; i >= 0; i--)
         sum[i] = p1.coefficient[i] + p2.coefficient[i];
   }

   if (p1.degree > p2.degree) {
      for (i = p1.degree; i > p2.degree; i--)
         sum[i] = p1.coefficient[i];
      for (i = p2.degree; i >= 0; i--)
         sum[i] = p1.coefficient[i] + p2.coefficient[i];
   }

   if (p1.degree < p2.degree) {
      for (i = p2.degree; i > p1.degree; i--)
         sum[i] = p2.coefficient[i];
      for (i = p1.degree; i >= 0; i--)
         sum[i] = p1.coefficient[i] + p2.coefficient[i];
   }
   cout << "\nAddition:";
   display(sum, max);
   cout << "\n";
}

void poly::substraction(poly p1, poly p2) {
    int max, i;
    max = (p1.degree > p2.degree) ? p1.degree : p2.degree;
    int *diff = new int[max + 1];
    if (p1.degree == p2.degree) {
        for (i = p1.degree; i >= 0; i--)
            diff[i] = p1.coefficient[i] - p2.coefficient[i];
    }

    if (p1.degree > p2.degree) {
        for (i = p1.degree; i > p2.degree; i--)
            diff[i] = p1.coefficient[i];
        for (i = p2.degree; i >= 0; i--)
            diff[i] = p1.coefficient[i] - p2.coefficient[i];
    }

    if (p1.degree < p2.degree) {
        for (i = p2.degree; i > p1.degree; i--)
            diff[i] = -p2.coefficient[i];
        for (i = p1.degree; i >= 0; i--)
            diff[i] = p1.coefficient[i] - p2.coefficient[i];
    }
    cout << "\nSubstraction:";
    display(diff, max);
    cout << "\n";
}

void poly::multiplication(poly p1, poly p2) {
    int i, j, max;
    max = p1.degree + p2.degree;
    int *product = new int[max + 1]{0};

    for (i = p1.degree; i >= 0; i--)
        for (j = p2.degree; j >= 0; j--)
            product[i + j] += p1.coefficient[i] * p2.coefficient[j];
    cout << "\nMultiplication:";
    display(product, max);
}

int main() {
    int choice;
    poly p1, p2, p3;
    cout << "Enter Polynomial 1:-" << endl;
    p1.getdata();
    cout << "Enter Polynomial 2:-" << endl;
    p2.getdata();

    while (1) {
        cout << "\n****** Menu Selection ******" << endl;
        cout << "1: Addition\n2: Substraction\n3: Multiplication\n0: Exit" << endl;
        cout << "Enter your choice:";
        cin >> choice;
        switch (choice) {
            case 1:
                cout << "\n--------------- Addition ---------------\n";
                cout << "Polynomial 1:";
                p1.display(p1.coefficient, p1.degree);
                cout << "Polynomial 2:";
                p2.display(p2.coefficient, p2.degree);
                p3.addition(p1, p2);
                cout << "----------------------------------------\n";
                break;
            case 2:

                cout << "\n------------- Substraction -------------\n";
                cout << "Polynomial 1:";
                p1.display(p1.coefficient, p1.degree);
                cout << "Polynomial 2:";
                p2.display(p2.coefficient, p2.degree);
                p3.substraction(p1, p2);
                cout << "----------------------------------------\n";
                break;
            case 3:
```

```
            cout << "\n----------- Multiplication -------------\n";
            cout << "Polynomial 1:";
            p1.display(p1.coefficient, p1.degree);
            cout << "Polynomial 2:";
            p2.display(p2.coefficient, p2.degree);
            p3.multiplication(p1, p2);
            cout << "----------------------------------------\n";
            break;
          case 0:
            return 0;
          default:
            cout << "\n----------- Enter a valid choice -------------\n";
        }
    }
    return 0;
}
```

Input & Output:



```
PS C:\Users\DELL\OneDrive\Desktop\Labs> cd "c:\Users\DELL\OneDrive\Desktop\Labs\DSA LAB\LAB 4\" ; if ($?) { g++ polynomial.cpp -o polynomial } ; if ($?) { .\polynomial }
Enter Polynomial 1:-
Enter Degree Of Polynomial:5
Enter coefficient of x^5:5
Enter coefficient of x^4:6
Enter coefficient of x^3:4
Enter coefficient of x^2:7
Enter coefficient of x^1:0
Enter coefficient of x^0:8
Enter Polynomial 2:-
Enter Degree Of Polynomial:3
Enter coefficient of x^3:4
Enter coefficient of x^2:8
Enter coefficient of x^1:2
Enter coefficient of x^0:3

****** Menu Selection ******
1: Addition
2: Substraction
3: Multiplication
0: Exit
Enter your choice:1

--------------- Addition ---------------
Polynomial 1:5x^5+6x^4+4x^3+7x^2+0x^1+8x^0
Polynomial 2:4x^3+8x^2+2x^1+3x^0

Addition:5x^5+6x^4+8x^3+15x^2+2x^1+11x^0

----------------------------------------

****** Menu Selection ******
1: Addition
2: Substraction
3: Multiplication
0: Exit
Enter your choice:2

------------- Substraction -------------
Polynomial 1:5x^5+6x^4+4x^3+7x^2+0x^1+8x^0
Polynomial 2:4x^3+8x^2+2x^1+3x^0

Substraction:5x^5+6x^4+0x^3+(-1)x^2+(-2)x^1+5x^0

----------------------------------------

****** Menu Selection ******
1: Addition
2: Substraction
3: Multiplication
0: Exit
Enter your choice:3

----------- Multiplication -------------
Polynomial 1:5x^5+6x^4+4x^3+7x^2+0x^1+8x^0
Polynomial 2:4x^3+8x^2+2x^1+3x^0

Multiplication:20x^8+64x^7+74x^6+87x^5+82x^4+58x^3+85x^2+16x^1+24x^0
----------------------------------------

****** Menu Selection ******
1: Addition
2: Substraction
3: Multiplication
0: Exit
Enter your choice:0
PS C:\Users\DELL\OneDrive\Desktop\Labs\DSA LAB\LAB 4>
```