Computer Systems & Programming

Instructor: Dr. Talha Shahid

Lab+Home Tasks of Lab Manual 9

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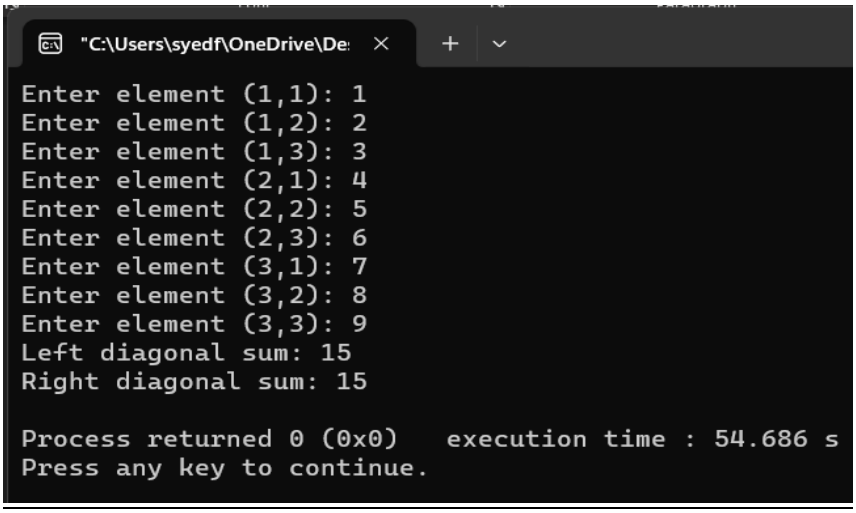
Lab Task# 1:

Make 2D Array in C++ and print left diagonal and right diagonal sum of a 3x3 matrix.

Code:

```
#include <iostream>
using namespace std;
const int N = 3;
int main() {
int matrix[N][N];
for (int i = 0; i < N; i++) {
for (int j = 0; j < N; j++) {
cout << "Enter element (" << i + 1 << "," << j + 1 << "): ";
cin >> matrix[i][j];
    }
  }

int leftDiagonalSum = 0;
for (int i = 0; i < N; i++) {
leftDiagonalSum += matrix[i][i];
  }

for (int i = 0; i < N; i++) {
rightDiagonalSum += matrix[i][N - 1 - i];
  }
cout << "Left diagonal sum: " << leftDiagonalSum << endl;
cout << "Right diagonal sum: " << rightDiagonalSum << endl;
return 0
}
```

Result:



Lab Task# 2:

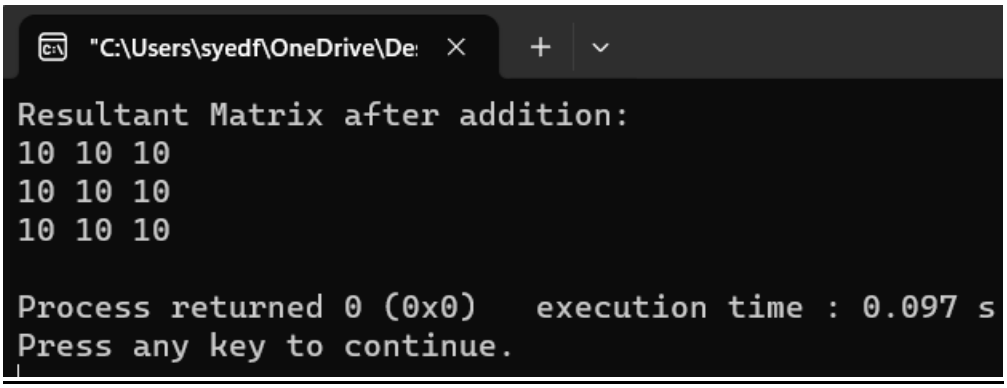
Write a function to add two 2D arrays of size 3x3.

Code:

```
#include <iostream>
using namespace std;
void addMatrices(int matrix1[3][3], int matrix2[3][3], int result[3][3]) {
   for (int i = 0; i < 3; i++) {
      for (int j = 0; j < 3; j++) {
         result[i][j] = matrix1[i][j] + matrix2[i][j];
      }
   }
}
int main() {
   int matrix1[3][3] = { {1, 2, 3},
                         {4, 5, 6},
                         {7, 8, 9} };
   int matrix2[3][3] = { {9, 8, 7},
                         {6, 5, 4},
                         {3, 2, 1} };
   int result[3][3];
   addMatrices(matrix1, matrix2, result);

   cout << "Resultant Matrix after addition:" << endl;
   for (int i = 0; i < 3; i++) {
      for (int j = 0; j < 3; j++) {
         cout << result[i][j] << " ";
      }
```

```
    cout << endl;
  }
 return 0;
}
```

Result:



Lab Task# 3:

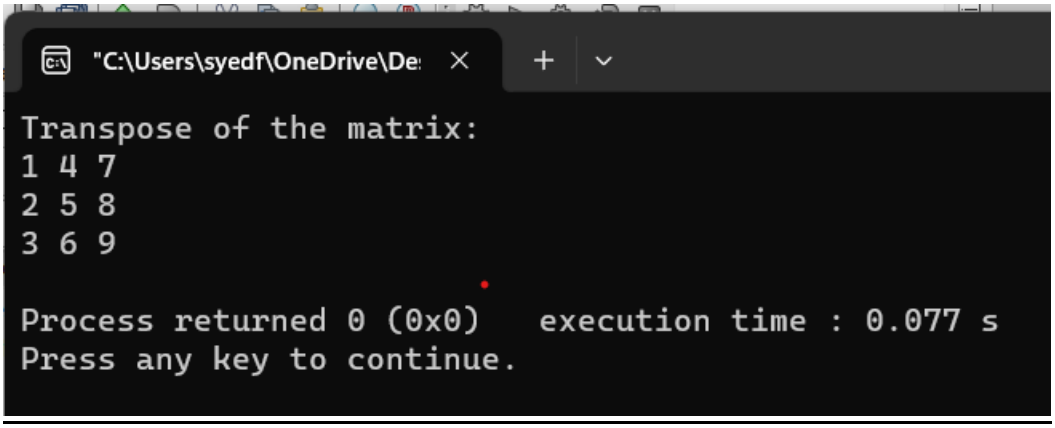
Using 2D arrays in C++, take transpose of a 3x3 matrix. Make a transpose function.

Code:

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

void transpose(int a[3][3]) {
  int trans[3][3];
  for(int i=0; i<3; i++) {
    for(int j=0; j<3; j++) {
      trans[i][j] = a[j][i];
    }
  }
  cout << "Transpose of the matrix: " << endl;
  for(int i=0; i<3; i++) {
```

```
      for(int j=0; j<3; j++) {
         cout << trans[i][j] << " ";
      }
      cout << endl;
   }
}
int main() {
   int a[3][3] = {{1, 2, 3}, {4, 5, 6}, {7, 8, 9}};
   transpose(a);
   return 0;
}
```

Result:



Lab Task# 4:

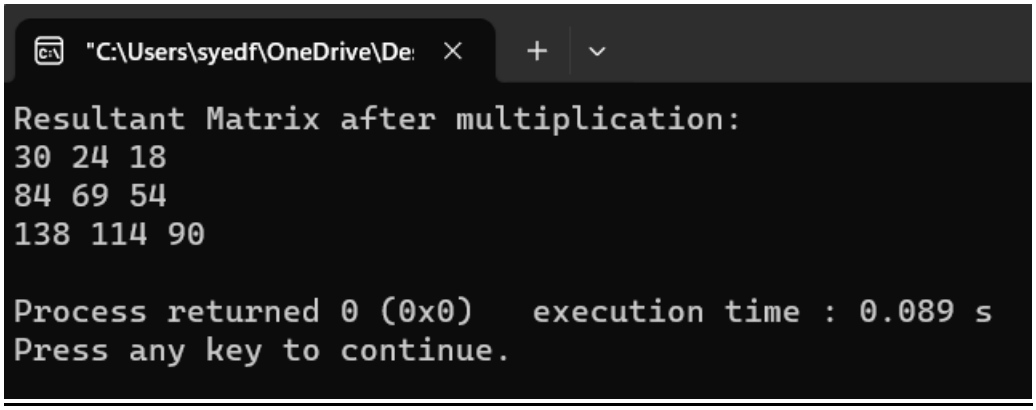
Using 2D arrays in C++, implement 3x3 matrix multiplication. Make a function.

Code:

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

void multiplyMatrices(int matrix1[3][3], int matrix2[3][3], int result[3][3]) {
    for (int i = 0; i < 3; i++) {
        for (int j = 0; j < 3; j++) {
            result[i][j] = 0;
            for (int k = 0; k < 3; k++) {
                result[i][j] += matrix1[i][k] * matrix2[k][j];
```

```
            }
        }
    }
}

int main() {
    int matrix1[3][3] = { {1, 2, 3},
                          {4, 5, 6},
                          {7, 8, 9} };

    int matrix2[3][3] = { {9, 8, 7},
                          {6, 5, 4},
                          {3, 2, 1} };

    int result[3][3];

    multiplyMatrices(matrix1, matrix2, result);

    cout << "Resultant Matrix after multiplication:" << endl;
    for (int i = 0; i < 3; i++) {
        for (int j = 0; j < 3; j++) {
            cout << result[i][j] << " ";
        }
        cout << endl;
    }

    return 0;
}
```

Result:



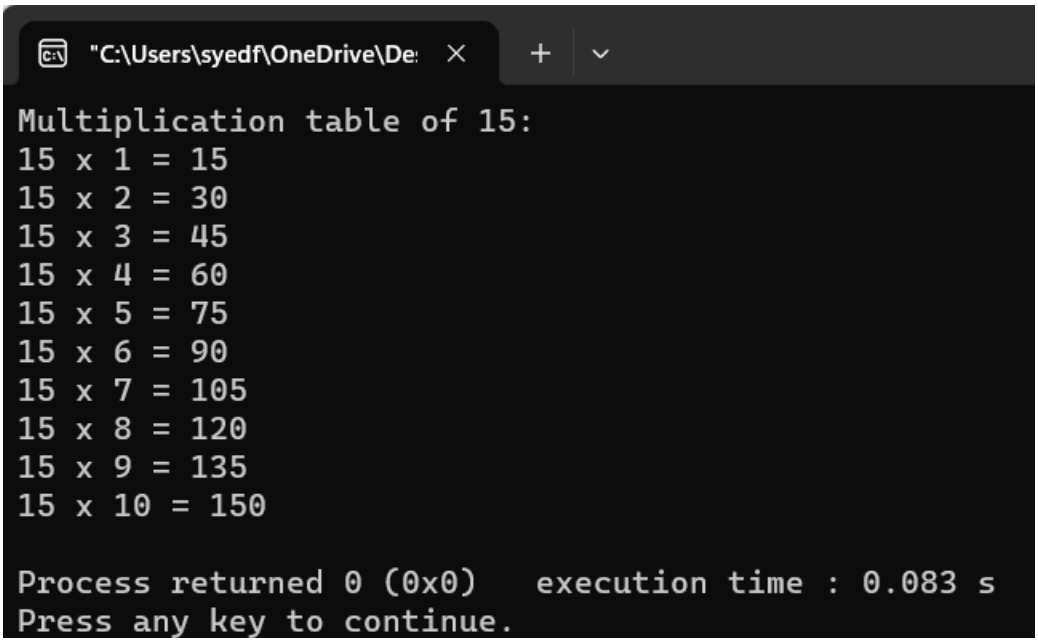
Lab Task# 5:

Print the multiplication table of 15 using recursion.

Code:

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

void printTable(int num, int multiplier = 1) {
    if (multiplier <= 10) {
        cout << num << " x " << multiplier << " = " << num * multiplier << endl;
        printTable(num, multiplier + 1);
    }
}

int main() {
    int number = 15;

    cout << "Multiplication table of " << number << ":" << endl;
    printTable(number);

    return 0;
}
```

Result:



Home Task# 1:

Write a C++ program to take inverse of a 3x3 matrix using its determinant and adjoint.

Code:

```
#include <iostream>

using namespace std;

double det(int A[3][3]) {
  return A[0][0] * (A[1][1] * A[2][2] - A[2][1] * A[1][2])
      - A[0][1] * (A[1][0] * A[2][2] - A[2][0] * A[1][2])
      + A[0][2] * (A[1][0] * A[2][1] - A[2][0] * A[1][1]);
}

void adj(int A[3][3], int adjMat[3][3]) {
  adjMat[0][0] = A[1][1] * A[2][2] - A[2][1] * A[1][2];
  adjMat[0][1] = A[0][2] * A[2][1] - A[0][1] * A[2][2];
  ... // remaining assignments for adjMat
}

bool inv(int A[3][3], double invMat[3][3]) {
  double d = det(A);
  if (d == 0) {
    cout << "Matrix is singular, no inverse exists." << endl;
    return false;
  }
  int adj[3][3];
  adj(A, adj);
  for (int i = 0; i < 3; ++i) {
    for (int j = 0; j < 3; ++j) {
      invMat[i][j] = adj[i][j] / d;
    }
  }
  return true;
}

int main() {
  int mat[3][3] = {{4, 7, 2}, {2, 6, 3}, {1, 5, 4}};
```

```
  double invMat[3][3];
  if (inv(mat, invMat)) {
    cout << "Inverse of the matrix:" << endl;
    for (int i = 0; i < 3; ++i) {
      for (int j = 0; j < 3; ++j) {
        cout << invMat[i][j] << " ";
      }
      cout << endl;
    }
  }
  return 0;
}
```

Output: