Matrix Multiplication in C

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A matrix is a collection of numbers organized in rows and columns, represented by a two-dimensional array in C. Matrices can either be square or rectangular. In this article, we will learn the multiplication of two matrices in the C programming language.

Example

```
Input:
mat1[][] = {{1, 2},
            {3, 4}}
mat2[][] = {{5, 6},
            {7, 8}}
Multiplication of two matrices:
{{1*5 + 2*7    1*6 + 2*8},
 {3*5 + 4*7    3*6 + 4*8}}
Output:
{{19, 22},
 {43, 50}}
```

Multiplication of two matrices is done by multiplying corresponding elements from the rows of the first matrix with the corresponding elements from the columns of the second matrix and then adding these products.

> ***Note**: The number of columns in the first matrix must be equal to the number of rows in the second matrix.*

C Program to Multiply Two Matrices

parameter in C?

C

```c
// C program to multiply two matrices
#include <stdio.h>
#include <stdlib.h>

// matrix dimensions so that we dont have to pass them as
// parametersmat1[R1][C1] and mat2[R2][C2]
#define R1 2 // number of rows in Matrix-1
#define C1 2 // number of columns in Matrix-1
#define R2 2 // number of rows in Matrix-2
#define C2 3 // number of columns in Matrix-2

void multiplyMatrix(int m1[][C1], int m2[][C2])
{
    int result[R1][C2];

    printf("Resultant Matrix is:\n");

    for (int i = 0; i < R1; i++) {
        for (int j = 0; j < C2; j++) {
            result[i][j] = 0;

            for (int k = 0; k < R2; k++) {
                result[i][j] += m1[i][k] * m2[k][j];
            }

            printf("%d\t", result[i][j]);
        }

        printf("\n");
    }
}

// Driver code
int main()
{
    // R1 = 4, C1 = 4 and R2 = 4, C2 = 4 (Update these
    // values in MACROs)
    int m1[R1][C1] = { { 1, 1 }, { 2, 2 } };

    int m2[R2][C2] = { { 1, 1, 1 }, { 2, 2, 2 } };
```

```
            printf("Please update MACROs value according to "
                   "your array dimension in "
                   "#define section\n");

            exit(EXIT_FAILURE);
        }

        // Function call
        multiplyMatrix(m1, m2);

        return 0;
    }
```

Output

```
Resultant Matrix is:
3    3    3
6    6    6
```

Complexity Analysis

Time complexity: *O(n^3). It can be optimized using Strassen's Matrix Multiplication*
Auxiliary Space: *O(m1 * n2)*

For more information, refer to the article – Program to multiply two matrices

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C Program to Generate Multiplication Table

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C Program to Generate Multiplication Table

In this article, we are creating a multiplication table in c which is a basic program for printing tables in c. We are printing multiplication tables of the number up to a given range. We will use the concepts of looping and...

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Transpose of a Matrix in C

In this article, we will learn how to write a C program to find the transpose of a matrix. The transpose of a matrix is a new matrix formed by interchanging its rows with columns. In simple words, the transpose of A[][...

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Add Matrix in C

Matrices are the collection of numbers arranged in order of rows and columns. In this article, we will learn to write a C program for the addition of two matrices. The idea is to use two nested loops to iterate over each...

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Matrix C/C++ Programs

C Program to check if two given matrices are identicalC program to find transpose of a matrixC program for subtraction of matricesC program for addition of two matricesC program to multiply two matricesC/C++...

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C Program to Rotate Matrix Elements

Here, we will build a C Program to rotate matrix elements with an approach to ring/rotate elements independently. Input: 1 2 3 4 5 6 7 8 9 Output: 4 1 2 7 5 3 8 9 6Approach We rotate all rings of elements on...

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C Program for Identity Matrix

Introduction to Identity Matrix : The dictionary definition of an Identity Matrix is a square matrix in which all the elements of the principal or main diagonal are 1's and all other elements are zeros. In the below image,...

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C Program To Find Normal and Trace of Matrix

Here, we will see how to write a C program to find the normal and trace of a matrix. Below are the examples:

How to access elements of a Square Matrix

A square matrix is a matrix which includes elements in the form of Rows and Columns. Below is an example of a 5x5 matrix. A Matrix is accessed by: Matrix_Name[row_index][column_index] Below are the various way...

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C Program to Print Boundary Elements of a Matrix

Here, we will print the boundary elements of a matrix using a C program: Input : 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 Output : 1 2 3 4 1 4 1 4 1 2 3 4Approach:Traverse the matrix from start to end.Assign an outer loop to poi...

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C Program to Compute the Sum of Diagonals of a Matrix

Here, we will compute the sum of diagonals of a Matrix using the following 3 methods: Using Conditional statementsTaking Custom Input from the user whilst using Conditional StatementsUsing Functions We will...

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How to Initialize a 2D Array in C?

In C, a 2D Array is a type of multidimensional array in which data is stored in tabular form (rows and columns). It has two dimensions so it can store the data and can expand in two directions. In this article, we will learn...

4 min read

C Program to Interchange Two Random Rows in a Matrix

In this article, we will write a C program to interchange two random rows in a matrix. Below are the inputs that will be taken from the user: The number of rows & columns in the matrixThe elements in the matrixThe...

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C Program to Traverse a Multi-Dimensional Array

Write a C program to traverse a given multi-dimensional array that contains N elements. Examples Input: arr[2][3] = {{1, 2, 3}, {4, 5, 6}}Output: 1 2 3 4 5 6 Input: arr[3][2] = {{-1, -2}, {0, 3}, {5, 7}}Output: -1 -2 0 3 5 7...

3 min read

How to Initialize a 3D Array in C?

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How to Initialize Array to 0 in C?

Initializing an array to zero is a common practice in programming to ensure that all elements start with a known value. In C, there are several ways to initialize an array to zero. In this article, we will explore different

C Program for Maximum size square sub-matrix with all 1s

Write a C program for a given binary matrix, the task is to find out the maximum size square sub-matrix with all 1s. Recommended: Please solve it on "PRACTICE" first, before moving on to the solution.Approach: Let th...

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C program to implement Adjacency Matrix of a given Graph

Given a undirected Graph of N vertices 1 to N and M edges in form of 2D array arr[][] whose every row consists of two numbers X and Y which denotes that there is a edge between X and Y, the task is to write C...

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How to Initialize Array of Pointers in C?

Arrays are collections of similar data elements that are stored in contiguous memory locations. On the other hand, pointers are variables that store the memory address of another variable. In this article, we will learn...

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