ICT Tool: - ‘C’ Language Program for Matrix Multiplication

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Abstract – In mathematics to solve matrix problems ,manually it is very difficult task to get the required output need to perform. Multiplication of two matrixes is only possible if first matrix has size m X n and other matrix has size n x r. Where m, n and r are any positive integer.

In the era of Information Communication Technology (ICT) .The ICT programming technique, it is easier task. One of the very popular programs in C programming is Matrix Multiplication. Multiplications mean successive addition. This paper discuss Matrix Multiplication in C **language, source code and methods with outputs. The source codes of program for Matrix Multiplication in C programming are to be compiled. Running them on Turbo C or available version and other platforms might require a few modifications to the code. You probably know how to multiply two matrices.**

Index Terms – Matrix, ICT, C lang., Turbo c, Positive Integer.

1. INTRODUCTION

Introduction to Matrix Multiplication:

One of the very popular programs in C programming is Matrix Multiplication. Multiplications mean successive addition. The manual method of multiplication procedure involves a large number of calculations especially when it comes to higher order of matrices, whereas a program in C can carry out the operations with short, simple and understandable codes.

Multiplication of two matrixes is defined as

$$[AB]_{i,j} = \sum_{s=1}^{n} A_{i,s}B_{s,j}$$

Where $1 \le i \le m$ and $1 \le j \le n$

Rule for Multiplication of two matrixes:

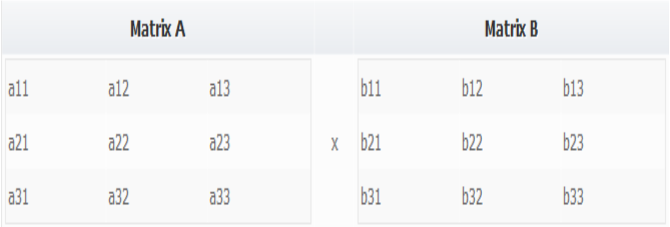
Rule: Multiplication of two matrixes is only possible if first matrix has size m X **n** and other matrix has size **n** x r. Where m, n and r are **any positive integer** Where $1 \le i \le m$ and $1 \le j \le n$

Method for matrix multiplication

This paper discuss Matrix Multiplication in C language, source code and methods with outputs. The source codes of program for Matrix Multiplication in C programming are to be compiled. Running them on Turbo C or available version and other platforms might require a few modifications to the code.

User probably know how to multiply two matrices. Following three fig-1 fig-2 fig-3 below which clearly show how matrix multiplication takes place. The same idea as shown in these pictures has been followed in the same order in the program source codes for Matrix Multiplication in C. (For matrix multiplication, the column of the first matrix should be equal to the row of the second.)

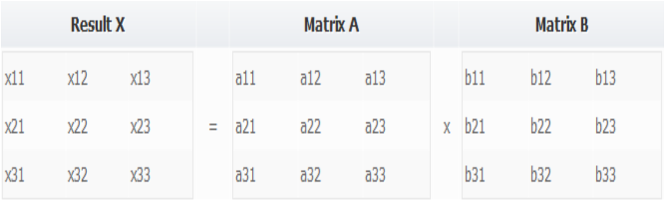
Consider two matrices A and B of order 3×3 as shown below. Let’s denote the elements of matrix A by *aij* and those of matrix B by *bij* as shown below. These *aij* and *bij* are asked as inputs in the form of arrays in C program for Matrix Multiplication.



Matrix A				Matrix B		
a11	a12	a13		b11	b12	b13
a21	a22	a23	x	b21	b22	b23
a31	a32	a33		b31	b32	b33

Fig-1

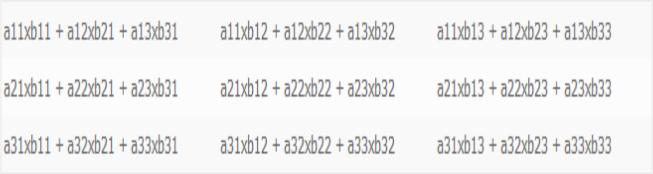
Let the resultant matrix upon multiplication of A and B be X with elements denoted by x*ij* as shown.



Result X				Matrix A				Matrix B		
x11	x12	x13		a11	a12	a13		b11	b12	b13
x21	x22	x23	=	a21	a22	a23	x	b21	b22	b23
x31	x32	x33		a31	a32	a33		b31	b32	b33

Fig-2

The matrix multiplication takes place as shown below, and this same procedure is is used for multiplication of matrices using C.



a11xb11 + a12xb21 + a13xb31	a11xb12 + a12xb22 + a13xb32	a11xb13 + a12xb23 + a13xb33
a21xb11 + a22xb21 + a23xb31	a21xb12 + a22xb22 + a23xb32	a21xb13 + a22xb23 + a23xb33
a31xb11 + a32xb21 + a33xb31	a31xb12 + a32xb22 + a33xb32	a31xb13 + a32xb23 + a33xb33

Fig-3

Solving the procedure manually would require nine separate calculations to obtain each element of the final matrix X. These nine separate calculations have been done using very few lines of code involving loops in this C program for Matrix Multiplication.

Matrix Multiplication simple Algorithm:

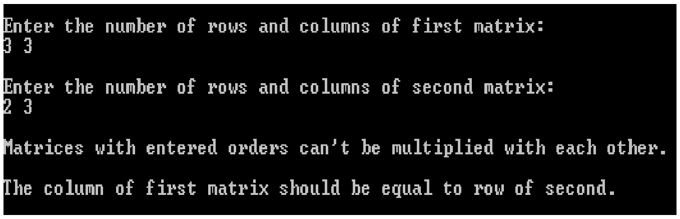
1. start
2. Declare variables and initialize necessary variables
3. Enter the element of matrices by row wise using loops
4. Check the number of rows and column of first and second matrices
5. If number of rows of first matrix is equal to the number of columns of second matrix, go to step 6. Otherwise, print matrix multiplication is not possible and go to step 3.
6. Multiply the matrices using nested loops.
7. Print the product in matrix form as console output.
8. Stop

C language source code:-Multiplication of two matrixes:

```
 #include <stdio.h>
#include<math.h>
#include<conio.h>
 int main()
{
   int m, n, p, q, c, d, k, sum = 0;
   int first[20][20], second[20][20], multiply[20][20];
  clrscr();
     printf("\nEnter the number of rows and columns of first matrix:\n");
   scanf("%d%d", &m, &n);
    printf("\nEnter the elements of first matrix\n");
   for (  c = 0 ; c < m ; c++ )
      for ( d = 0 ; d < n ; d++ )
         scanf("%d", &first[c][d]);
    printf("\nEnter the number of rows and columns of second matrix:\n");
   scanf("%d%d", &p, &q);
    if ( n != p )
   {
      printf("\nMatrices with entered orders can't be multiplied with each other.\n");
        printf("\nThe column of first matrix should be equal to row of second.\n");
   }
   else
   {
          printf("\nEnter the elements of first matrix:\n");
      for (  c = 0 ; c < m ; c++ )
         for ( d = 0 ; d < n ; d++ )
            scanf("%d", &first[c][d]);
       printf("\nEnter the elements of second matrix:\n");
      for ( c = 0 ; c < p ; c++ )
         for ( d = 0 ; d < q ; d++ )
            scanf("%d", &second[c][d]);
             for ( c = 0 ; c < m ; c++ )
      {
         for ( d = 0 ; d < q ; d++ )
         {
            for ( k = 0 ; k < p ; k++ )
            {
               sum = sum + first[c][k]*second[k][d];
            }
             multiply[c][d] = sum;
            sum = 0;
         }
      }
   printf("\nThe product of entered matrices is:\n");
     for ( c = 0 ; c < m ; c++ )
     {
        for ( d = 0 ; d < q ; d++ )
           printf("%d\t", multiply[c][d]);
         printf("\n");       }    }
 return 0;
}
```

Output of C program for matrix multiplication

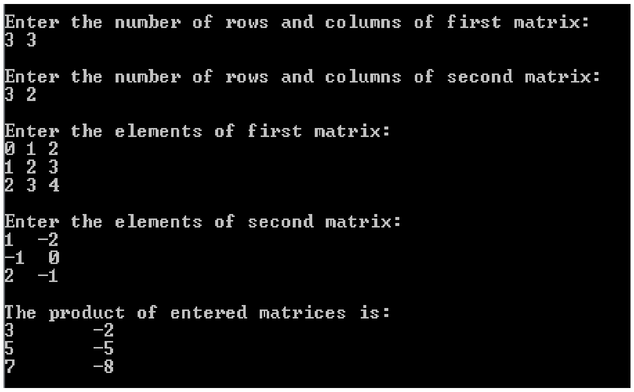
The above Matrix Multiplication in C program first asks for the order of the two matrices. If in the entered orders, the column of first matrix is equal to the row of second matrix, the multiplication is possible; otherwise, new values should be entered in the program fig-4.



```
Enter the number of rows and columns of first matrix:
3 3

Enter the number of rows and columns of second matrix:
2 3

Matrices with entered orders can't be multiplied with each other.

The column of first matrix should be equal to row of second.
```

Fig-4

The program then asks for the respective elements of the two matrices and multiplies them using loops as shown in the program. Finally, the resultant matrix obtained upon multiplication is printed. The final output screen is Fig-5:



```
Enter the number of rows and columns of first matrix:
3 3

Enter the number of rows and columns of second matrix:
3 2

Enter the elements of first matrix:
0 1 2
1 2 3
2 3 4

Enter the elements of second matrix:
1  -2
-1  0
2  -1

The product of entered matrices is:
3       -2
5       -5
7       -8
```

Fig-5

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