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Computer Systems

Matrix Multiplication Program in C (Provided Two forms of matrix multiplication using user input and scanning files)

This C program takes an integer input between 1 and 10 or two file paths as input. If the user provides an integer, the program generates two random matrices of size N by N, where N is the input integer. It then multiplies these matrices and displays the random generated matrices as well as the resulting matrix. If the user provides file paths, the program expects the matrix to be stored in the files with the size of each matrix specified in the first line, separated by a space. For example, for a 2 by 3 matrix, the first line of the file should contain ‘2 3’, followed by the actual matrix on the next lines. The program performs error checks for matric dimensions and file access.

Code:

#include <stdio.h>

#include <stdlib.h>

#include <time.h>

void RandomMatrix( int matrix[10][10], int size)

{

    for (int i = 0; i <size; i++)

    {

        for(int j = 0; j < size; j++)

        {

            matrix[i][j]= rand() % 10;

        }

    }

}

void SeeMatrix(int matrix[10][10], int size)

{

    for(int i = 0; i < size; i++)

    {

        for(int j = 0; j < size; j++)

        {

            printf("%d ", matrix[i][j]);

        }

        printf("\n");

    }

}

void MultiplyMatrix(int mt1[10][10], int mt2[10][10], int answr[10][10], int row1,int col1, int row2,int col2)

{

    for(int i = 0; i < row1; i++)

    {

        for(int j = 0; j < col2; j++)

        {

            answr[i][j]=0;

            for(int k = 0; k < col1; k++)

            {

                answr[i][j] = answr[i][j] +mt1[i][k]\*mt2[k][j];

            }

        }

    }

}

void ReadMatrixFromF(const char \*file, int matrix[10][10], int \*row, int \*col)

{

    FILE \*fp = fopen(file, "r");

    if(fp)

    {

        fscanf(fp, "%d %d", row, col);

        printf("Matrix read from file :\n");

        for (int i = 0; i < \*row; i++)

        {

            for(int j = 0; j < \*col; j++)

            {

                fscanf(fp, "%d", &matrix[i][j]);

                 printf("%d ", matrix[i][j]);

            }

            printf("\n");

        }

        fclose(fp);

    }else

    {

        printf("Error with file %s\n", file);

    }

}

int main()

{

    srand((unsigned int)time(NULL));

    int size;

    int matrix1[10][10], matrix2[10][10], answrMatrix[10][10];

    int rw1,cl1,rw2,cl2;

    printf("\n");

    printf("\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\n");

    printf("Enter a integer between 1 - 10 to specify the size of randomly\n");

    printf("generated matrices for multiplication. Alternatively, input the file path of two files containing matrices.\n");

    printf("Ensure each file starts with the size of the matrix, for example\n");

    printf("for a 2 by 3 matrix the first line of the file should contain '2 3' followed by\n");

    printf("the actual matrix on the next.\n");

    printf("\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\n");

    if (scanf("%d", &size) == 1)

    {

        if(size > 0 && size <= 10)

        {

            RandomMatrix(matrix1, size);

            RandomMatrix(matrix2, size);

            MultiplyMatrix(matrix1, matrix2, answrMatrix, size,size,size,size);

            printf("\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\n");

            printf("Matrix 1 =\n");

            SeeMatrix(matrix1, size);

            printf("\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\n");

            printf("\nMatrix 2 =\n");

            SeeMatrix(matrix2, size);

             printf("\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\n");

            printf("\nOutput Matrix =\n");

            SeeMatrix(answrMatrix, size);

            printf("\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\n");

        }

        else

        {

            printf("INVALID!!!!!: Size must be between 1 to 10.\n");

        }

    }

    else

    {

        char file1[50], file2[50];

        scanf("%s %s", file1, file2);

        ReadMatrixFromF(file1, matrix1, &rw1, &cl1);

        ReadMatrixFromF(file2, matrix2, &rw2, &cl2);

        if (cl1 != rw2)

        {

            printf("ERROR!!!: Matrices dimensions are not correct for multiplication.\n");

            printf("ERROR!!!:The number of columns in the first matrix is the same as the number of rows in the second matrix) \n");

            return 1;

        }

        MultiplyMatrix(matrix1, matrix2, answrMatrix, rw1,cl1,rw2,cl2);

        FILE \*answrFile = fopen("matrix3.txt", "w");

        if(answrFile)

        {

            fprintf(answrFile, "%d by %d Matrix\n", rw1, cl2);

            for(int i = 0; i < rw1; i++)

            {

                for(int j = 0; j < cl2; j++)

                {

                    fprintf(answrFile, "%d ", answrMatrix[i][j]);

                }

                fprintf(answrFile, "\n");

            }

            fclose(answrFile);

            printf("\n Success! Matrix multiplication performed and result is saved to a file called matrix3.txt\n");

        }

        else

        {

            printf("ERROR!!!: Unable to open the output file.\n");

            return 1;

        }

    }

    return 0;

}