MINI-PROJECT REPORT

Matrix Calculator

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Introduction:

* Mathematical operations are a part of our daily lives. Everyday we will be involving with various types of calculations around us. Matrices is a mathematical entity where numbers are arranged in rows and columns. A lot of applications exist with matrices in real life. The major application lies in the software industry such as development of algorithms like path finder algorithms, image processing algorithms and many more.

* In this project, some of the basic matrix operations are presented where a user can select the operation to be performed on the matrix. Then the matrices with their size are entered. Note that only square matrices are being considered for the project.

Objective:

This project focuses on matrix operations on square matrices. The operations performed on a pair of square matrices are, addition, subtraction and multiplication. The operations performed on a single square matrix are, transpose, determinant and inverse.

Benefits:

A user who is working on a laptop or a desktop who would be working on matrix based calculations, can make use of this application as handy. A human being can find the output values of a matrix for a maximum of size 3 X 3, i.e 3 rows and 3 columns. If they try to solve the matrix for dimensions above 3 , the time consumed is large and verification that the solution is correct or not consumes extra time. Hence this tool can be used to cross check the matrix operations conducted.

Cost and Features:

* The cost for implementing a project involving matrix calculations is minimal to none. But the extension of matrix applications to various state of the art domains like machine learning, image processing, cryptography , path finder algorithms etc will have a research and development being done. And for the required calculations related to matrices, this program comes in handy.

Some of The features of the project:

* This program has dynamic memory allocation involved for allocating memory for the matrices, i.e 2 dimensional arrays. A structure is implemented for storing the input matrices. The user can select the operation to be performed by pressing a number on the keyboard. The significance of each number, i.e the operation which it performs will be displayed on the screen during the execution of the program.

Defining Our System:

* The system on the whole is viewed as a blackbox which accepts input of a single number. Then the mapping of the number is done so as to perform the appropriate function. Then the user will be prompted to enter the matrix size. After that the user is prompted to enter the matrix elements. The input is stored in 2D arrays which are dynamically allocated and passed to the respective functions. Then the output is printed on the screen. This whole process is in a loop until the user presses a key which will exit the program.

Who:
* Students who want to solve matrix related problems for their academic work
* Data science workers working on machine learning and deep learning applications which majorly involve matrices.
* Software engineers
* Researchers and mathematicians

What:
* Calculate the sum, difference, product of two matrices and also the determinant, transpose and inverse of a single matrix.

When:
* Students facing a difficulty in solving a matrix related problem, can use this program to conform their outputs.
* Researchers can use it for getting a quick calculation output.
* Comes to a great use when calculating for matrices of huge order.

Where:
* Students, employees and researchers all over the world.

How:
* This program can be executed in a system which has Linux or Windows operating system.

SWOT ANALYSIS

Strengths

To find the Sum, Difference, Product on a pair of Matrices.

To find the Det, Transpose, Inverse of a single Matrix.

No Limit for Dimension of the matrix.

Weaknesses

Limited Number of operations defined.

Restricted to only Square matrix.

The maximum Size of matrix is restricted to the maximum value

Opportunities

To solve large matrix problems.

Saves time on solving matrix problems in research applications.

Simple and Efficient Solution

Threats

Possible for Memory leaks.

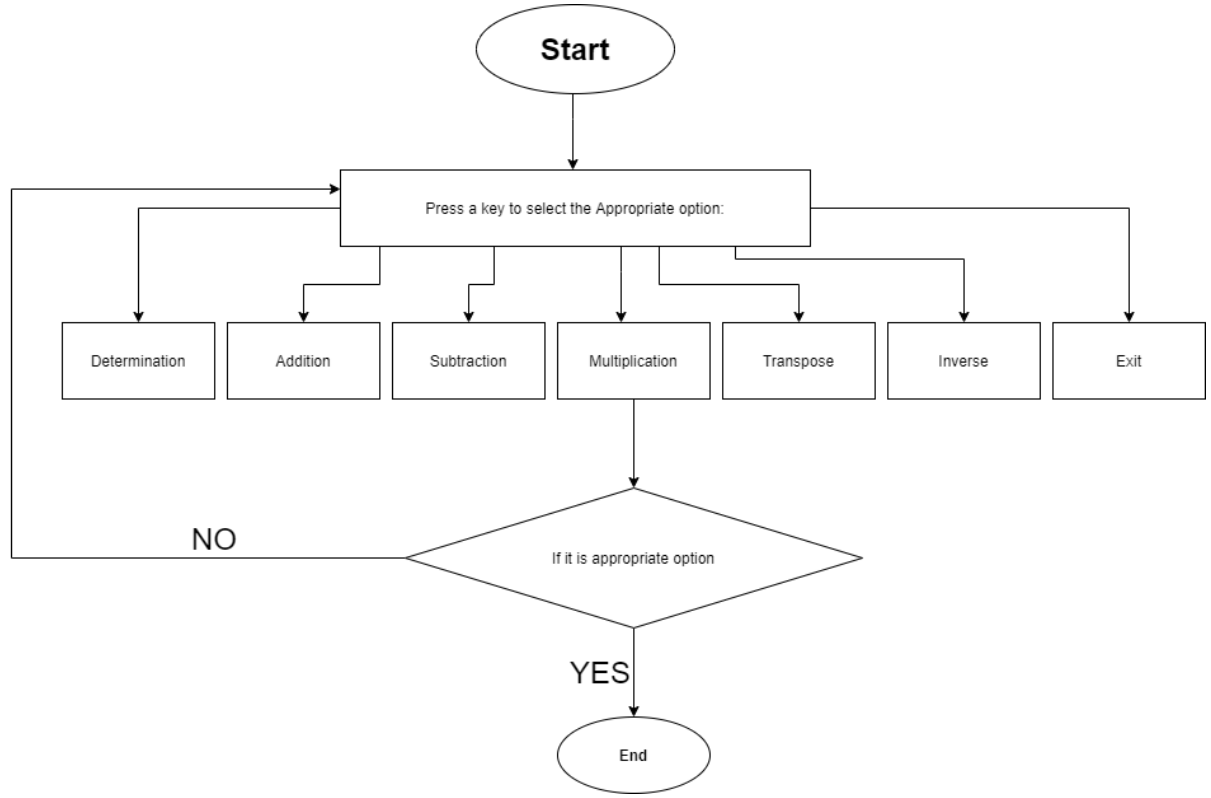
Possibility of SIGTRAP error in some systems.

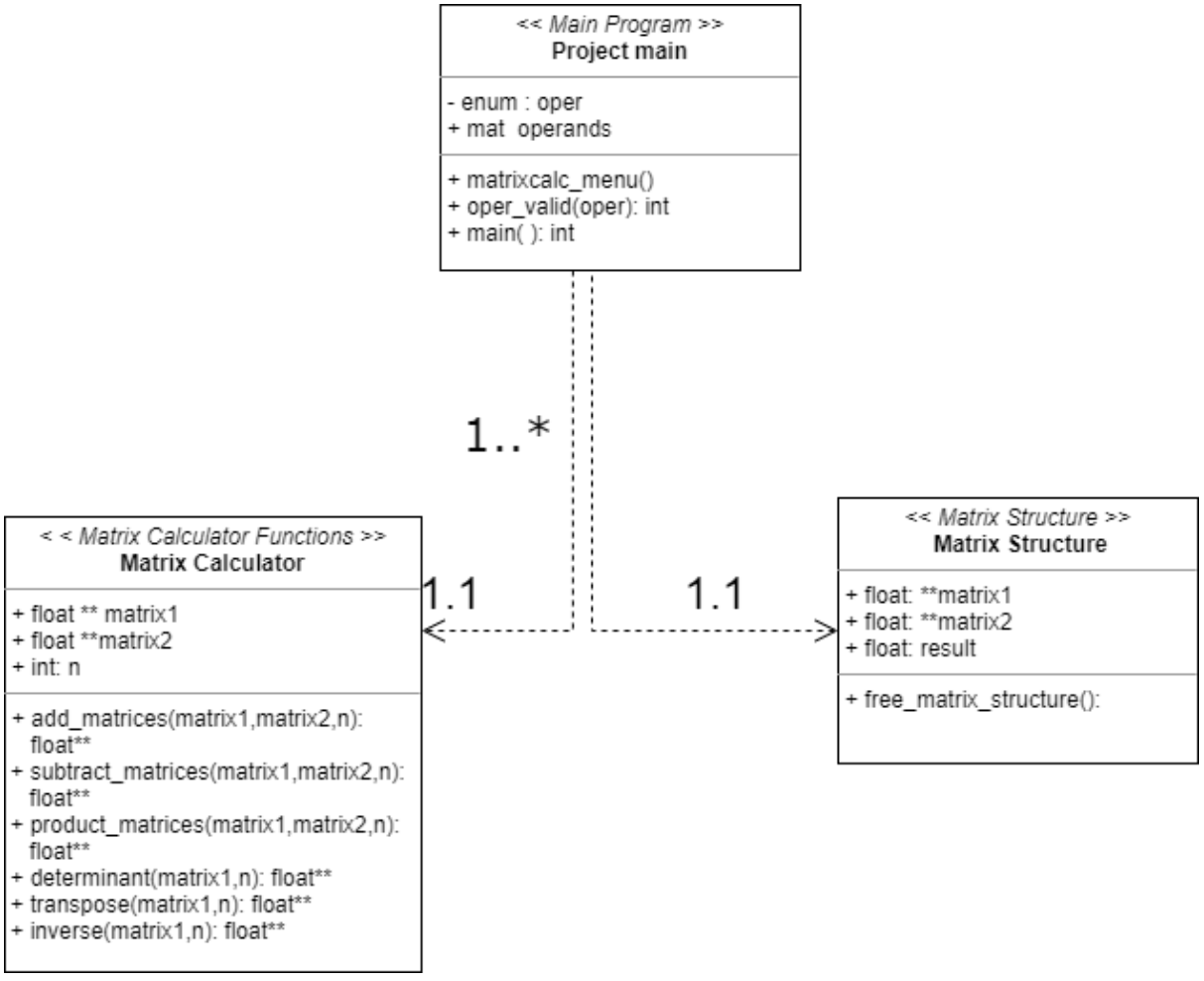
Availability of Better options in market.

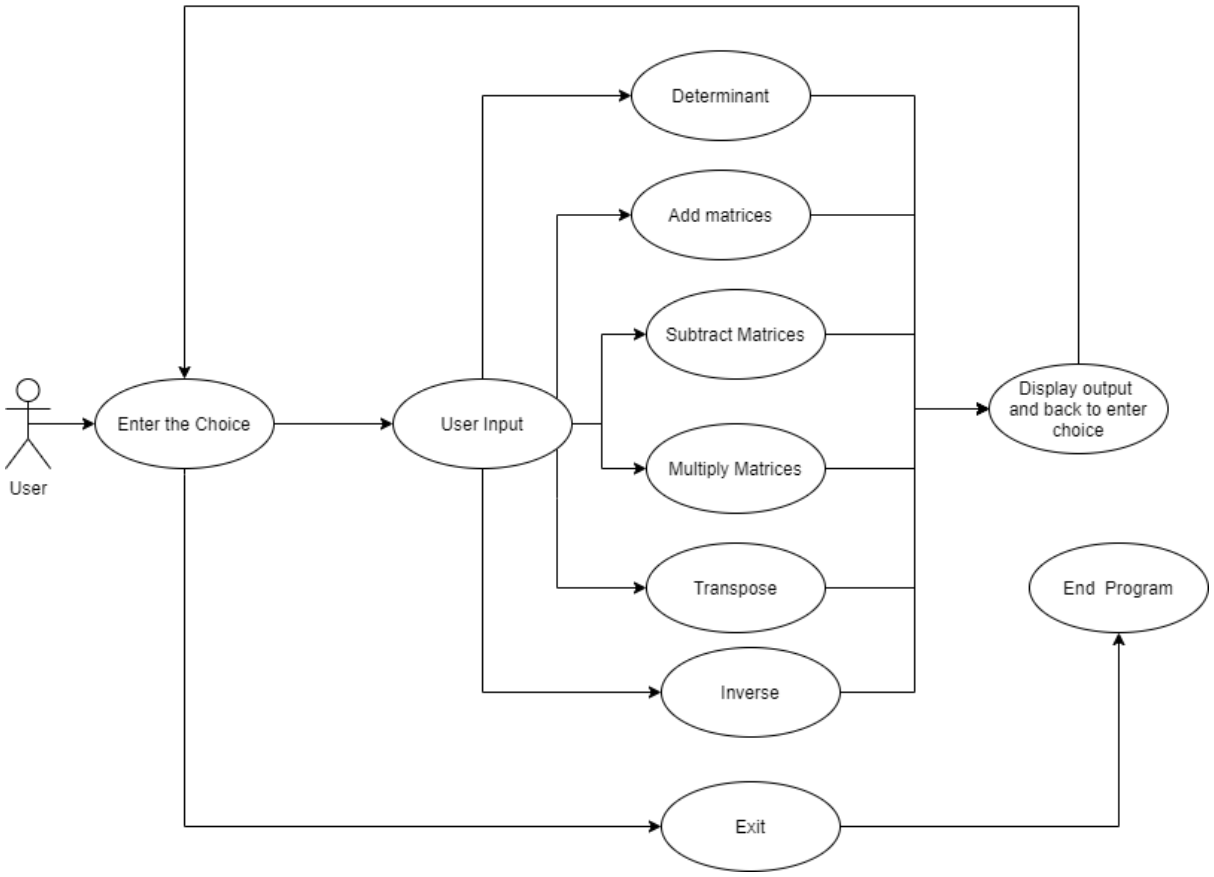
REQUIREMENTS

High Level Requirements	Low Level Requirements
User shall be able to specify the size of the matrix	User must specify the size of the matrix. The size specified is the dimensions of the square matrix
User shall be able to add the matrices	Addition of two matrices can be done 1) Both the matrices need to be of same size 2). The size entered in the beginning is same for both the matrices.
User shall be able to subtract the matrices	Subtraction of two matrices is implemented in the same manner as addition
User shall be able to multiply the matrices	Multiplication of two matrices is done on two square matrices of a specified size
User shall be able to find determinant, transpose and inverse of a matrix	The determinant of a single matrix of a specified size is implemented
	The transpose of a single matrix operation is implemented
	To find the inverse of a matrix, both the determinant function and the transpose functions are used in it. The condition that a matrix is invertible is to check if the determinant of the matrix is equal to 0

Architecture:



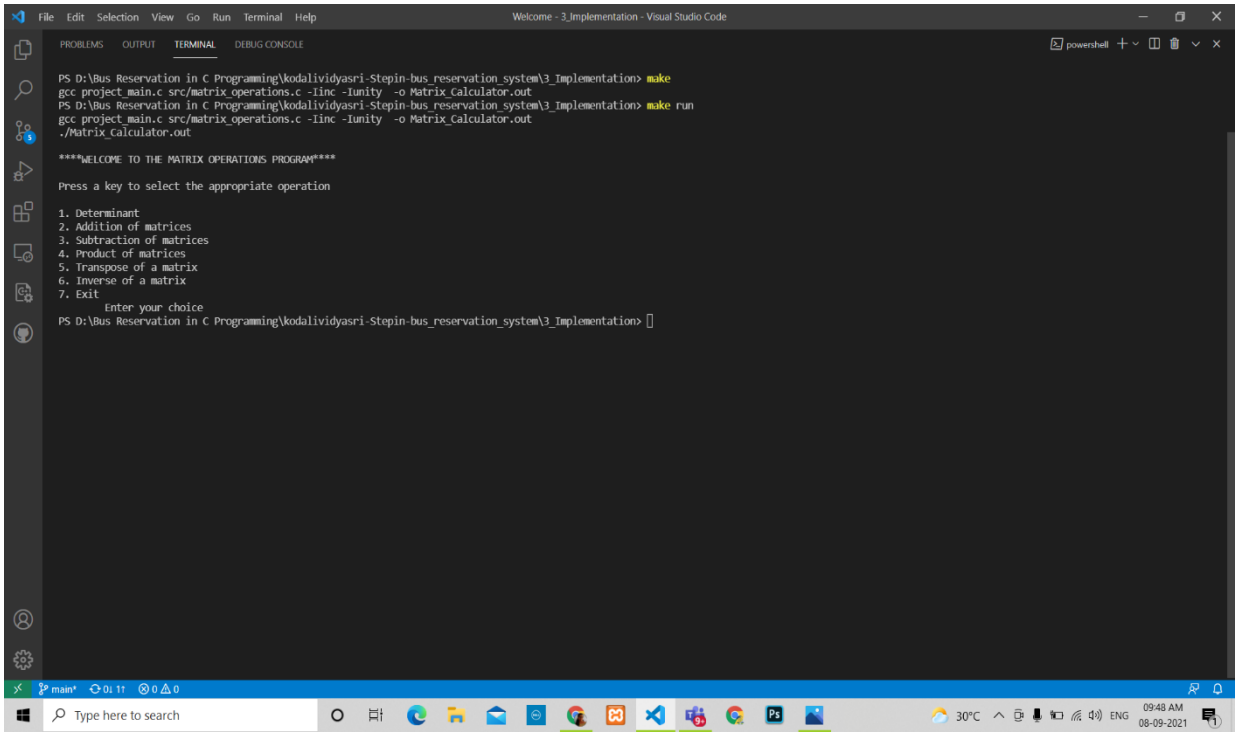


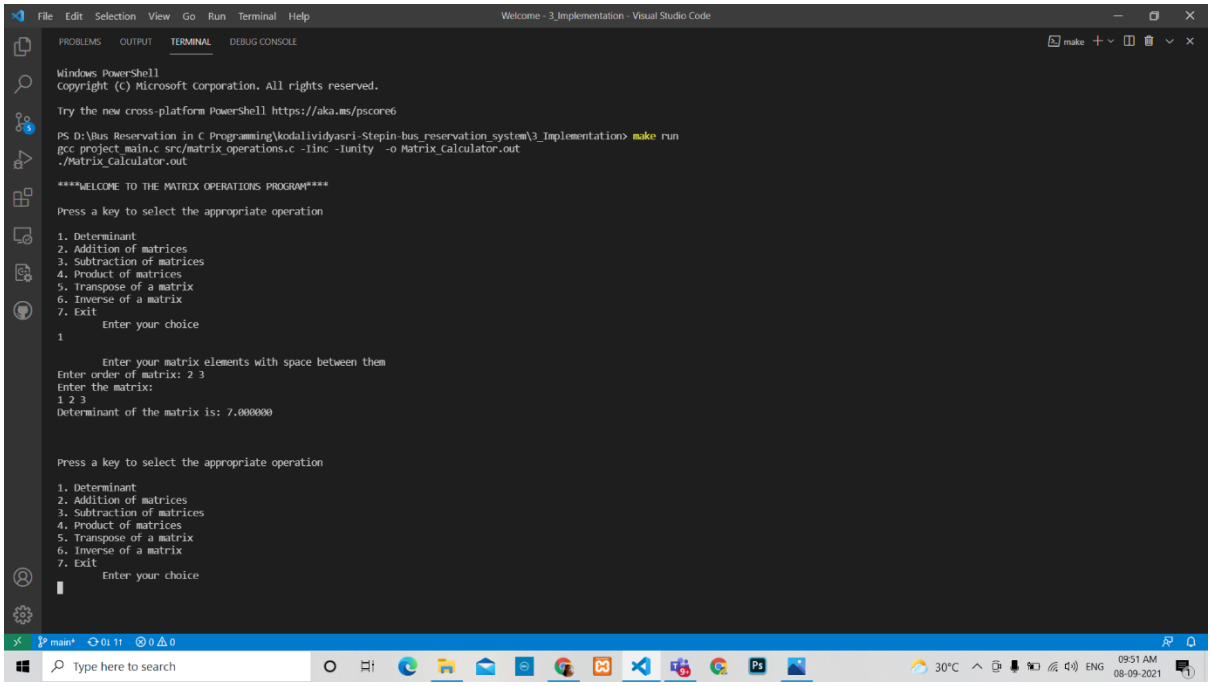

Determinant
Add matrices
Subtract Matrices
Multiply Matrices
Transpose
Inverse
Exit
User
Enter the Choice
User Input
Display output and back to enter choice
End Program

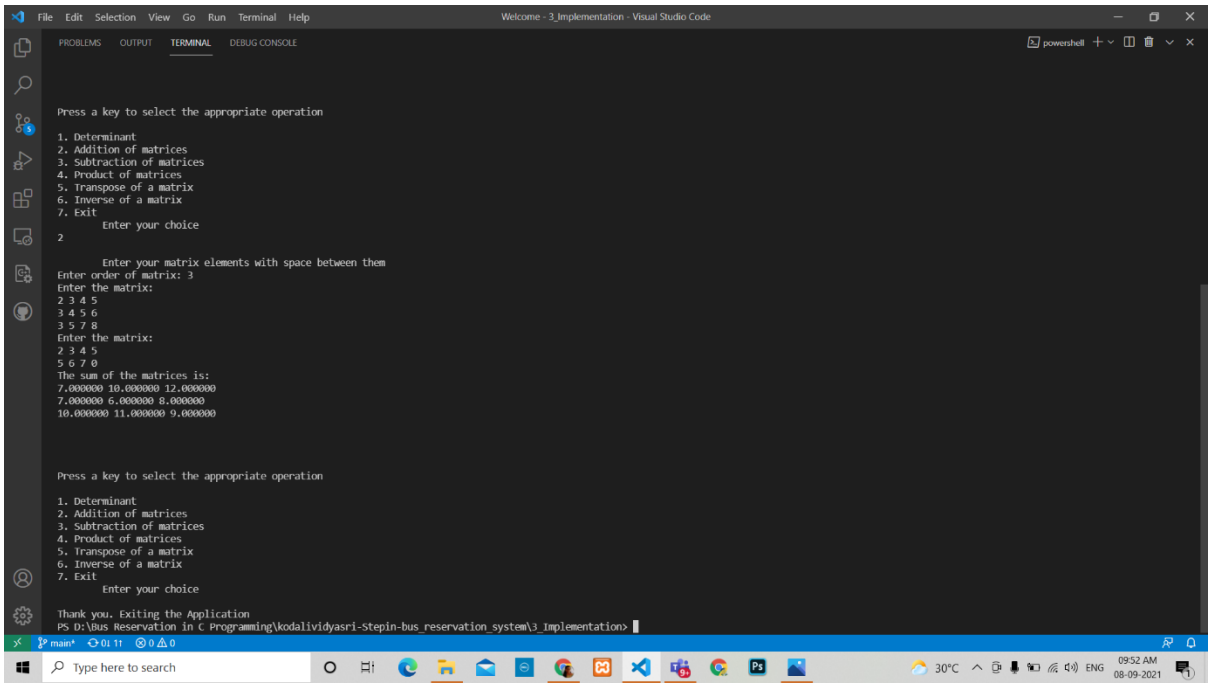
TEST CASES: -

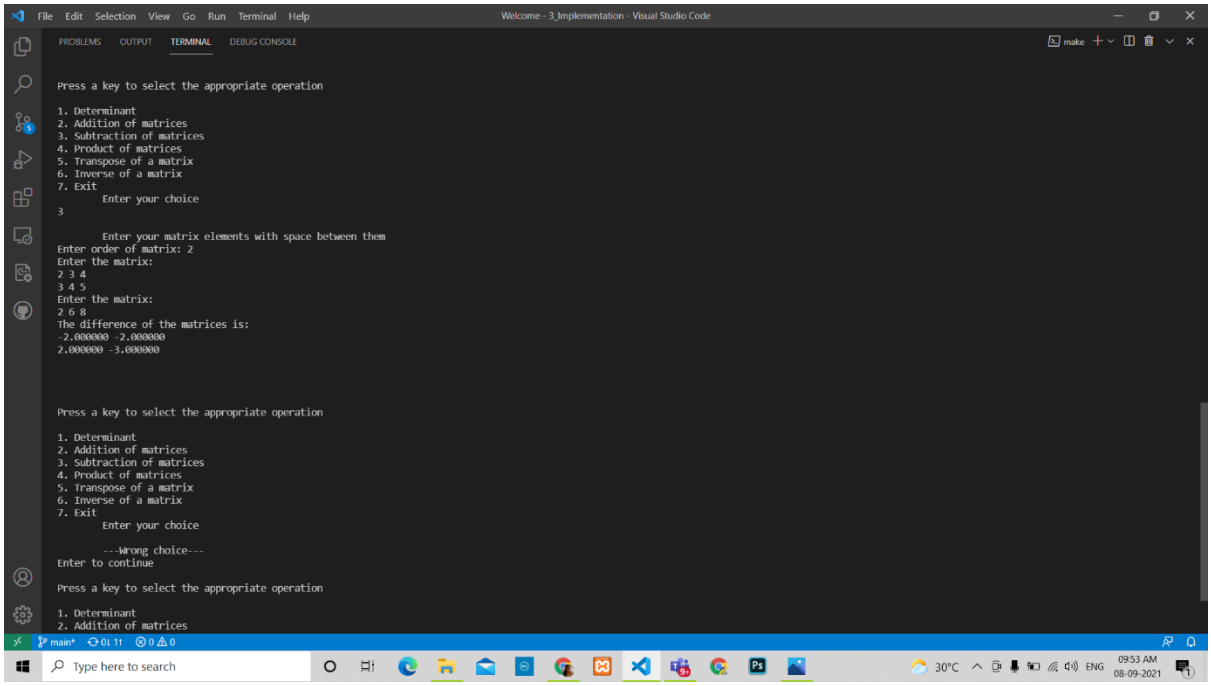
Test Cases	Description	Expected Input	Expected Output	Actual Output
1	tested addition of two matrices	matrix1, matrix2, n	Success	Success
2	tested subtraction of two matrices	matrix1, matrix2, n	Success	Success
3	tested multiplication of two matrices	matrix1, matrix2, n	Success	Success
4	tested determinant of a matrix	matrix1, n	Success	Success
5	tested transpose of a matrix	matrix1, n	Success	Success
6	tested inverse of a matrix	matrix1, n	Success	Success
7	tested power of -1 function	3	-1	-1
8	tested power of -1 function	2	1	1
9	Tested on functions which accept two matrices as input	matrix1, matrix2, n	Success	Success
10	Tested on functions which accept single matrix as input	matrix1, n	Success	Success
11	Tested on function which returns an integer value	3	-1	-1

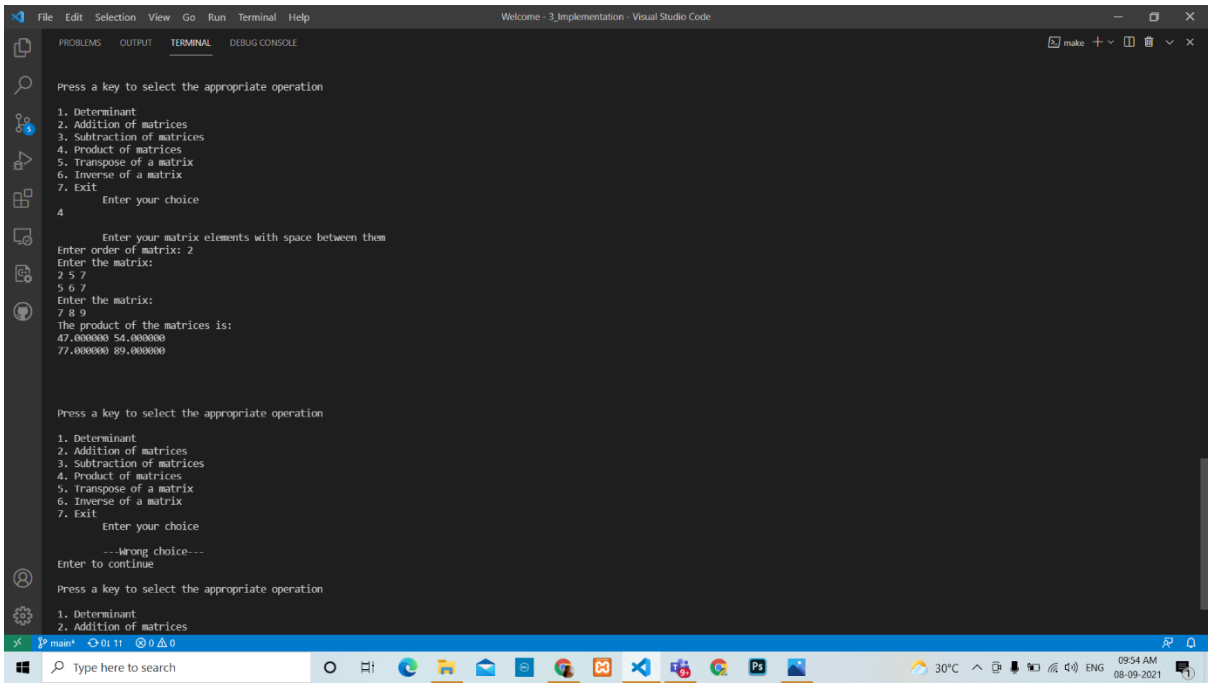
Output Images:

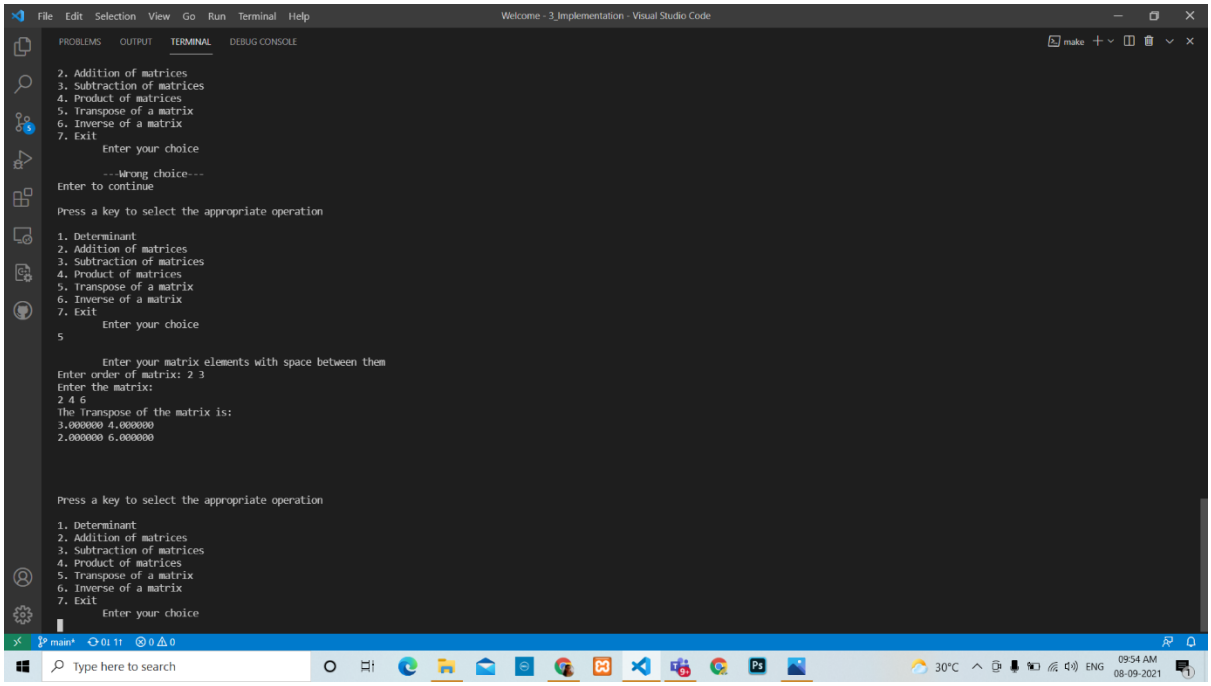


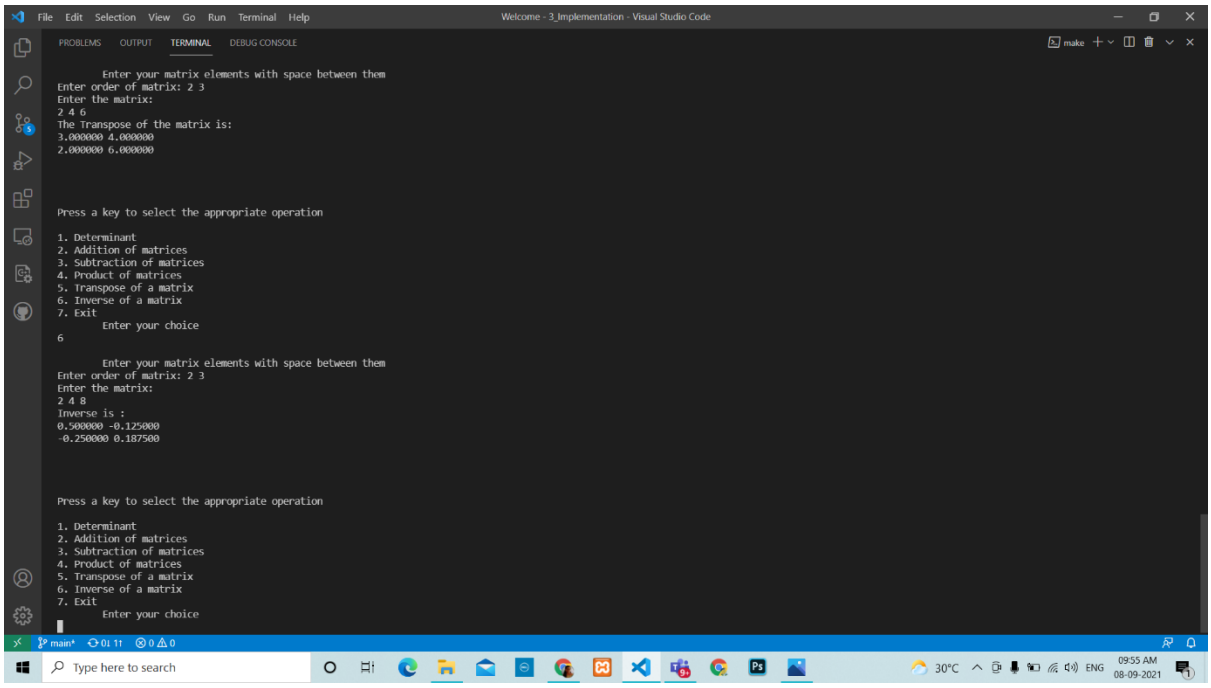

File Edit Selection View Go Run Terminal Help
Welcome - 3_Implementation - Visual Studio Code
PROBLEMS OUTPUT TERMINAL DEBUG CONSOLE
make
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.
Try the new cross-platform PowerShell https://aka.ms/pscore6
PS D:\Bus Reservation in C Programming\kodalividyasri-Stepin-bus_reservation_system\3_Implementation> make run
gcc project_main.c src/matrix_operations.c -Iinc -Iunity -o Matrix_Calculator.out
./Matrix_Calculator.out
****WELCOME TO THE MATRIX OPERATIONS PROGRAM****
Press a key to select the appropriate operation
1. Determinant
2. Addition of matrices
3. Subtraction of matrices
4. Product of matrices
5. Transpose of a matrix
6. Inverse of a matrix
7. Exit
Enter your choice
1
Enter your matrix elements with space between them
Enter order of matrix: 2 3
Enter the matrix:
1 2 3
Determinant of the matrix is: 7.000000
Press a key to select the appropriate operation
1. Determinant
2. Addition of matrices
3. Subtraction of matrices
4. Product of matrices
5. Transpose of a matrix
6. Inverse of a matrix
7. Exit
Enter your choice
main*
Type here to search
30°C
ENG
09:51 AM
08-09-2021

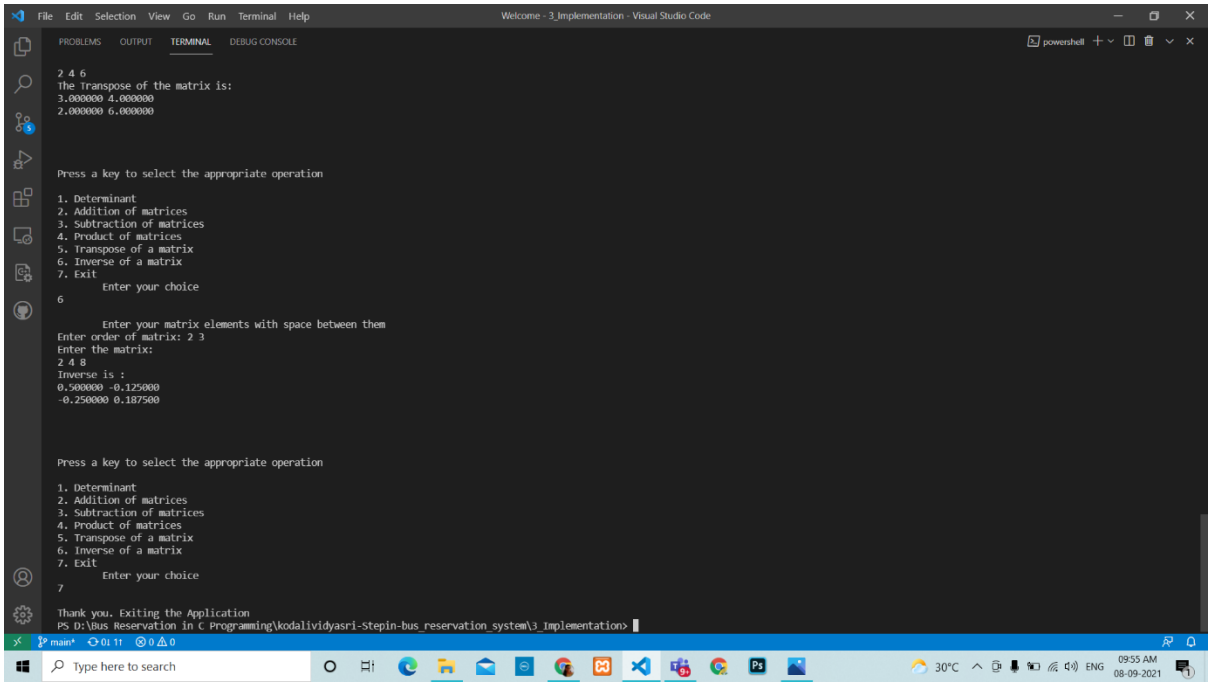

File Edit Selection View Go Run Terminal Help
Welcome - 3_Implementation - Visual Studio Code
PROBLEMS OUTPUT TERMINAL DEBUG CONSOLE
powershell
Press a key to select the appropriate operation
1. Determinant
2. Addition of matrices
3. Subtraction of matrices
4. Product of matrices
5. Transpose of a matrix
6. Inverse of a matrix
7. Exit
Enter your choice
2
Enter your matrix elements with space between them
Enter order of matrix: 3
Enter the matrix:
2 3 4 5
3 4 5 6
3 5 7 8
Enter the matrix:
2 3 4 5
5 6 7 0
The sum of the matrices is:
7.000000 10.000000 12.000000
7.000000 6.000000 8.000000
10.000000 11.000000 9.000000
Press a key to select the appropriate operation
1. Determinant
2. Addition of matrices
3. Subtraction of matrices
4. Product of matrices
5. Transpose of a matrix
6. Inverse of a matrix
7. Exit
Enter your choice
Thank you. Exiting the Application
PS D:\Bus Reservation in C Programming\kodalividyasri-Stepin-bus_reservation_system\3_Implementation>
main*
Type here to search
30°C
ENG
09:52 AM
08-09-2021


File Edit Selection View Go Run Terminal Help
Welcome - 3_Implementation - Visual Studio Code
PROBLEMS OUTPUT TERMINAL DEBUG CONSOLE
make
Press a key to select the appropriate operation
1. Determinant
2. Addition of matrices
3. Subtraction of matrices
4. Product of matrices
5. Transpose of a matrix
6. Inverse of a matrix
7. Exit
Enter your choice
3
Enter your matrix elements with space between them
Enter order of matrix: 2
Enter the matrix:
2 3 4
3 4 5
Enter the matrix:
2 6 8
The difference of the matrices is:
-2.000000 -2.000000
2.000000 -3.000000
Press a key to select the appropriate operation
1. Determinant
2. Addition of matrices
3. Subtraction of matrices
4. Product of matrices
5. Transpose of a matrix
6. Inverse of a matrix
7. Exit
Enter your choice
---Wrong choice---
Enter to continue
Press a key to select the appropriate operation
1. Determinant
2. Addition of matrices
main*
Type here to search
30°C
ENG
09:53 AM
08-09-2021


File Edit Selection View Go Run Terminal Help
Welcome - 3_Implementation - Visual Studio Code
PROBLEMS OUTPUT TERMINAL DEBUG CONSOLE
make
Press a key to select the appropriate operation
1. Determinant
2. Addition of matrices
3. Subtraction of matrices
4. Product of matrices
5. Transpose of a matrix
6. Inverse of a matrix
7. Exit
Enter your choice
4
Enter your matrix elements with space between them
Enter order of matrix: 2
Enter the matrix:
2 5 7
5 6 7
Enter the matrix:
7 8 9
The product of the matrices is:
47.000000 54.000000
77.000000 89.000000
Press a key to select the appropriate operation
1. Determinant
2. Addition of matrices
3. Subtraction of matrices
4. Product of matrices
5. Transpose of a matrix
6. Inverse of a matrix
7. Exit
Enter your choice
---Wrong choice---
Enter to continue
Press a key to select the appropriate operation
1. Determinant
2. Addition of matrices
main*
Type here to search
30°C
ENG
09:54 AM
08-09-2021


File Edit Selection View Go Run Terminal Help
Welcome - 3_Implementation - Visual Studio Code
PROBLEMS OUTPUT TERMINAL DEBUG CONSOLE
make
2. Addition of matrices
3. Subtraction of matrices
4. Product of matrices
5. Transpose of a matrix
6. Inverse of a matrix
7. Exit
Enter your choice
---Wrong choice---
Enter to continue
Press a key to select the appropriate operation
1. Determinant
2. Addition of matrices
3. Subtraction of matrices
4. Product of matrices
5. Transpose of a matrix
6. Inverse of a matrix
7. Exit
Enter your choice
5
Enter your matrix elements with space between them
Enter order of matrix: 2 3
Enter the matrix:
2 4 6
The Transpose of the matrix is:
3.000000 4.000000
2.000000 6.000000
Press a key to select the appropriate operation
1. Determinant
2. Addition of matrices
3. Subtraction of matrices
4. Product of matrices
5. Transpose of a matrix
6. Inverse of a matrix
7. Exit
Enter your choice
main*
Type here to search
30°C
ENG
09:54 AM
08-09-2021


File Edit Selection View Go Run Terminal Help
Welcome - 3_Implementation - Visual Studio Code
PROBLEMS OUTPUT TERMINAL DEBUG CONSOLE
make
Enter your matrix elements with space between them
Enter order of matrix: 2 3
Enter the matrix:
2 4 6
The Transpose of the matrix is:
3.000000 4.000000
2.000000 6.000000
Press a key to select the appropriate operation
1. Determinant
2. Addition of matrices
3. Subtraction of matrices
4. Product of matrices
5. Transpose of a matrix
6. Inverse of a matrix
7. Exit
Enter your choice
6
Enter your matrix elements with space between them
Enter order of matrix: 2 3
Enter the matrix:
2 4 8
Inverse is :
0.500000 -0.125000
-0.250000 0.187500
Press a key to select the appropriate operation
1. Determinant
2. Addition of matrices
3. Subtraction of matrices
4. Product of matrices
5. Transpose of a matrix
6. Inverse of a matrix
7. Exit
Enter your choice
main*
Type here to search
30°C
ENG
09:55 AM
08-09-2021


File Edit Selection View Go Run Terminal Help
Welcome - 3_Implementation - Visual Studio Code
PROBLEMS OUTPUT TERMINAL DEBUG CONSOLE
powershell
2 4 6
The Transpose of the matrix is:
3.000000 4.000000
2.000000 6.000000
Press a key to select the appropriate operation
1. Determinant
2. Addition of matrices
3. Subtraction of matrices
4. Product of matrices
5. Transpose of a matrix
6. Inverse of a matrix
7. Exit
Enter your choice
6
Enter your matrix elements with space between them
Enter order of matrix: 2 3
Enter the matrix:
2 4 8
Inverse is :
0.500000 -0.125000
-0.250000 0.187500
Press a key to select the appropriate operation
1. Determinant
2. Addition of matrices
3. Subtraction of matrices
4. Product of matrices
5. Transpose of a matrix
6. Inverse of a matrix
7. Exit
Enter your choice
7
Thank you. Exiting the Application
PS D:\Bus Reservation in C Programming\kodalividyasri-Stepin-bus_reservation_system\3_Implementation>
main*
Type here to search
30°C
ENG
09:55 AM
08-09-2021