Matrix Calculator
Comp 150/170

You are to write a program called <u>matrix.cpp</u> that will read in 4x4 matrices from the keyboard (as shown below) and then allow the user to specify matrix algebra operations to be performed on them. The operations are add, subtract, scalar multiply, transpose, and matrix multiply. Each time an operation is performed; the resulting matrix will be added to the list of matrices and can then be used in one of the subsequent operations. There will never be more than 25 matrices altogether.

The program should first ask the user for the number of initial matrices and then allow them to be entered. Then the program should loop, asking each time for an operation to be performed. The choices which may be entered for the operation are: 'Q' or 'q' which means quit, '+' which means add, '-' which means subtract, '*' which means scalar multiply, 'T' or 't' which means transpose, 'D' or 'd' which means display, and 'X' or 'x' which means matrix multiply.

Your program should follow the example below as closely as possible (spacing, capitalization, etc.):

```
How many initial matrices? 2              Result is matrix 4:
                                            Row 1: 6 8 0 2
Enter matrix 1:                             Row 2: 6 2 2 4
  Row 1? 2 4 0 1                            Row 3: 2 0 4 -2
  Row 2? 3 0 1 2                            Row 4: 0 2 4 2
  Row 3? 1 0 1 -1
  Row 4? 0 1 2 0                          Operation? t

Enter matrix 2:                           Matrix for T? 4
  Row 1? 1 0 0 0
  Row 2? 0 1 0 0                          Result is matrix 5:
  Row 3? 0 0 1 0                            Row 1: 6 6 2 0
  Row 4? 0 0 0 1                            Row 2: 8 2 0 2
                                            Row 3: 0 2 4 4
Operation? +                               Row 4: 2 4 -2 2

 First matrix for +? 1                    Operation? x
Second matrix for +? 2
                                           First matrix for X? 1
Result is matrix 3:                       Second matrix for X? 3
  Row 1: 3 4 0 1
  Row 2: 3 1 1 2                          Result is matrix 6:
  Row 3: 1 0 2 -1                           Row 1: 18 13 6 11
  Row 4: 0 1 2 1                            Row 2: 10 14 6 4
                                            Row 3: 4 3 0 -1
Operation? *                               Row 4: 5 1 5 0

Scalar value for *? 2                     Operation? Q
      Matrix for *? 3
```

You may assume that all values used are integers. When you print a row, place one space between each integer.

NOTE: Your instructor will work examples in class to explain all of the required matrix operations. All of them are very simple except for matrix multiplication, and we will help you with the code for that in class.

Make certain to use functions to break up the program into smaller pieces where appropriate. Grading emphasis will be given to program correctness and internal program documentation (**<u>use good variable names</u>**). Make sure you use constants for the number of rows and columns of the matrices throughout the program.

<u>Structure your program so the matrices are stored in a 3D array and each matrix operation function works on 2D arrays.</u> Provide data validation for **all** input.