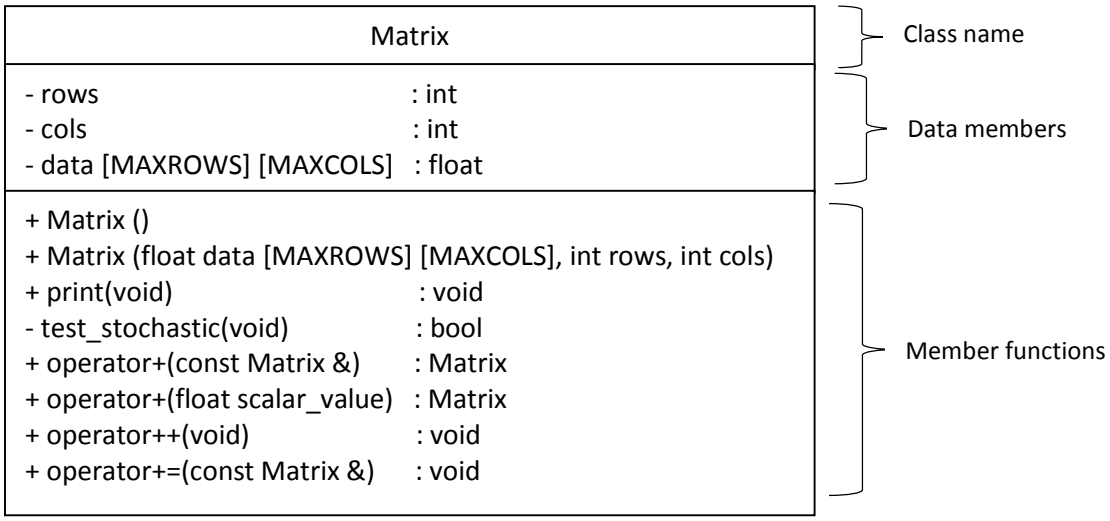
BLG252E - Object Oriented Programming

Homework-1

Assignment Date : 13.10.2015 Due Date : 03.11.2015 at 18:00

Write a C++ program to implement the Matrix class given in the UML diagram below.

The types of data members, and the return types of member functions are indicated after the column signs (:) .
Meanings of access symbols: - private , + public.



Define the constants MAXROWS and MAXCOLS (both 10) at the beginning of program.
The rows and cols data members are the actual dimensions of the matrix.

The overloaded operator functions of Matrix class:

Overloaded Operator	Operation Description	Explanations
+	Matrix addition	Function adds the given Matrix and itself, puts the result in a newly constructed Matrix object, then returns that new object.
+	Scalar addition	Function adds the given integer value to every element of itself, puts the result in a newly constructed Matrix object, then returns that new object.
++	Increment by 1	Function adds 1 to every element of itself, puts the result in itself.
+=	Matrix addition and assignment	Function adds the given Matrix and itself, puts the result in itself.

Note that some matrix operators (+, *, ==) require two matrices and the dimensions of the matrices must be the same. These overloaded operator functions should check the dimensions, if dimensions are not equal then the operation should not be performed.

Other member functions of Matrix class:

Function	Explanations
Default constructor	Function initializes rows and cols to zero.
Parametered constructor	Function takes parameters and initializes all data members of class.
print()	▪ Function displays the matrix on screen (each row at a new line). ▪ Within the print() function, also call the **test_stochastic()** function. If the returned result is true display "THIS MATRIX IS STOCHASTIC" message on screen, otherwise do not display any message. ▪ At the end of print() function, display "==========".
test_stochastic()	Function returns false if the matrix is not a square matrix (rows and cols should be equal). If it is a square matrix, then function performs a test (detailed below) and returns true if the matrix is stochastic, otherwise returns false. A square matrix X is called a Stochastic matrix if all its elements are nonnegative and the sum of the elements in each row is 1. $X = \begin{bmatrix} X_{11} & \cdots & X_{1N} \\ \vdots & \ddots & \vdots \\ X_{N1} & \cdots & X_{NN} \end{bmatrix}$ Thus, the matrix above will be a stochastic matrix if $X_{ij} \geq 0$ *for* $0 \leq i \leq n$, $0 \leq j \leq n$, and $\sum_{j=1}^{n} X_{ij} = 1$ *for i = 1, 2, 3, . . . ,n*

INPUT FILE

You are given a data file called **"MATRICES.TXT"** which contains several matrix data.

For each matrix, the following format is used:

- Number of rows and number columns (both integer) are given in leading line.
- Then the elements (float) of the matrix are given (row by row).

Example MATRICES.TXT file

```
3  3
0.2   0.5  0.3
0.1   0.3  0.6
0.6   0.0  0.4
4  4
3.5   6.4  2.7  9.0
7.4   0.8  9.4  -2.4
1.8   5.8  1.0  7.5
-4.5  1.7  3.2  5.6
3  3
6.1   5.9  1.4
-3.0  0.0  1.7
8.6   2.9  6.5
4  4
2.8   5.0  -4.6  3.5
8.1   6.3  1.7   6.2
-6.2  5.5  0.6   1.4
1.5   2.9  0.2   7.9
2  3
0.8   -3.7  6.5
1.6   7.4   2.1
```

MAIN PROGRAM

Do the following steps in main program.

1. Declare an array of Matrix objects (named **Mat**). (Maximum array size 20).
2. Program reads the "MATRICES.TXT" file and initializes the Mat array with the data from file.
3. Declare Result1, Result2 matrix objects.
4. Call + operator of Mat[0], with Mat[2], put result in Result1, call print() of Result1.
5. Call + operator of Mat[4], with scalar_value=70, put result in Result2, call print() of Result2.
6. Call ++ operator of Mat[2].
7. Call += operator of Mat[3], with Mat[1], putting result in Mat[3].
8. By looping, call print() function of each element of Mat array.