CS101: Lab #17
Arrays Part II

This lab will focus on populating and traversing a two-dimensional array (matrix).

Consider a 3 by 3 square containing values V_1 to V_9 as shown below; conveniently, these values can be represented using a matrix (two-dimensional array).

V_1	V_2	V_3
V_4	V_5	V_6
V_7	V_8	V_9

A square is said to be *row semi-magic* if the values in each of the rows sum to the same value:

$$(V_1 + V_2 + V_3 = V_4 + V_5 + V_6 = V_7 + V_8 + V_9).$$

A square is said to be *column semi-magic* if the values in each of the columns sum to the same value:

$$(V_1 + V_4 + V_7 = V_2 + V_5 + V_8 = V_3 + V_6 + V_9).$$

A matrix is said to be *magic* if the matrix is semi-magic in terms of its rows and its columns. Complete the three corresponding methods that determine if the given matrix is column semi-magic, row semi-magic, and magic. ***You may not assume the input matrix has a particular number of sides.***

As a positive test example, use the following magic matrix.

1	5	9
8	3	4
6	7	2

We verify that the matrix is magic by noting that

```
1 + 5 + 9 =

8 + 3 + 4 =

6 + 7 + 2 = 15

          = 1 + 8 + 6

          = 5 + 3 + 7

          = 9 + 4 + 2
```

Implement a `Matrix` class with a matrix as an attribute and the necessary methods. The constructor should throw an exception if the input matrix is not square.

Also implement a `Tester` class that constructs and initializes a Matrix object and tests whether the matrix is magic.

```
// Description: Determines if a square matrix is row semi-magic
// Parameters:
// Assumptions: matrix is square
// Returns:     TRUE/FALSE whether the matrix attribute is row semi-magic
public boolean rowSemiMagic()
```

```
// Description: Determines if a square matrix is column semi-magic
// Parameters:
// Assumptions: matrix is square
// Returns:     TRUE/FALSE whether the matrix attribute is column semi-magic
public boolean columnSemiMagic()
```

```
// Description: Determines if a square matrix is magic
// Parameters:
// Assumptions: matrix is square
// Returns:     TRUE/FALSE whether the matrix attribute is magic
public boolean magic()
```