Problem Set 3 Exercise #24: Diagonal of Square Matrix

Reference: Lecture 8 notes

Learning objective: Two-dimensional array

Estimated completion time: 45 minutes

Problem statement:

[CS1010 AY2012/13 Semester 1 Exam, Q3]

Write a program **PS3_Ex24_DiagonalMatrix.java** for the following two tasks.

(a)   A ***descending diagonal matrix*** is a square matrix where the diagonal values are in decreasing consecutive numbers and all the non-diagonal values are 0. Matrices *A* and *B* below are examples of descending diagonal matrices, while matrices *C* and *D* below are not (because the diagonal values are not decreasing consecutively for *C* and one of the non-diagonal values is non-zero for *D*).

$$A = \begin{bmatrix} 8 & 0 & 0 & 0 \\ 0 & 7 & 0 & 0 \\ 0 & 0 & 6 & 0 \\ 0 & 0 & 0 & 5 \end{bmatrix} \qquad B = \begin{bmatrix} 0 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & -2 \end{bmatrix}$$

$$C = \begin{bmatrix} 19 & 0 & 0 & 0 \\ 0 & 18 & 0 & 0 \\ 0 & 0 & 16 & 0 \\ 0 & 0 & 0 & 15 \end{bmatrix} \qquad D = \begin{bmatrix} 0 & 0 & 0 \\ 1 & -1 & 0 \\ 0 & 0 & -2 \end{bmatrix}$$

Write a static method **isDescDiagonal()** that takes in a square matrix and returns true if it is a descending diagonal matrix, or false otherwise.

```
int isDescDiagonal(int[][] mtx)
```

(b)   An ***anti-diagonal matrix*** is a square matrix where all the values are zeroes except those on the anti-diagonal, i.e. those running from the lower left corner to the upper right corner. There is no restriction on what values can appear on the anti-diagonal.

Matrices *E* and *F* below are anti-diagonal matrices while matrix *G* is not because one of the non-anti-diagonal values is non-zero.

$$E = \begin{bmatrix} 0 & 0 & 0 & 9 \\ 0 & 0 & 1 & 0 \\ 0 & 8 & 0 & 0 \\ 5 & 0 & 0 & 0 \end{bmatrix} \qquad F = \begin{bmatrix} 0 & 0 & 3 \\ 0 & -1 & 0 \\ -2 & 0 & 0 \end{bmatrix} \qquad G = \begin{bmatrix} 0 & 0 & 0 & 3 \\ 0 & 0 & 6 & 0 \\ 0 & 3 & 0 & 0 \\ 1 & 0 & 0 & 2 \end{bmatrix}$$

Write a static method **isAntiDiagonal()** that takes in a square matrix and returns true if it is an anti-diagonal matrix, or false otherwise.

```
int isAntiDiagonal(int[][] mtx)
```

Sample run #1:

```
Enter the size of the square matrix: 3
Enter elements row by row:
0  0  0
0 -1  0
0  0 -2
Given matrix is a descending diagonal matrix.
Given matrix is not an anti-diagonal matrix.
```

Sample run #2:

```
Enter the size of the square matrix: 4
Enter elements row by row:
0 0 0 9
0 0 1 0
0 8 0 0
5 0 0 0
Given matrix is not a descending diagonal matrix.
Given matrix is an anti-diagonal matrix.
```