## Problem Set 3 Exercise #24: Square Matrix

**Reference:** Lecture 9 notes

**Learning objective:** Two-dimensional array

**Estimated completion time:** 45 minutes

**Problem statement:**

A **square matrix** is a 2D array where the number of rows and columns are the same.

Write a program **square_matrix.c** to read values of an $n{\times}n$ ($n \leq 10$) square matrix of integer values, and check whether the matrix is (a) a diagonal matrix, or (b) an upper-triangular matrix.

A **diagonal matrix** is a square matrix in which the elements outside the main diagonal ($\searrow$) are all zeroes, for example:

$$\begin{bmatrix} 3 & 0 & 0 \\ 0 & 4 & 0 \\ 0 & 0 & -2 \end{bmatrix} \qquad \begin{bmatrix} 12 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & -5 & 0 \\ 0 & 0 & 0 & 7 \end{bmatrix}$$

An **upper triangular matrix** (or right triangular matrix) is a square matrix U of the form:

$$U_{i,j} = \begin{cases} a_{i,j} & for\ i \leq j \\ 0 & for\ i > j \end{cases}$$

Written explicitly,

$$U = \begin{bmatrix} a_{0,0} & a_{0,1} & \cdots & a_{0,n-1} \\ 0 & a_{1,1} & \cdots & a_{1,n-1} \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & a_{n-1,n-1} \end{bmatrix}$$

Note that a diagonal matrix is also an upper triangular matrix.

**Sample run #1:**

```
Enter the size of the square matrix: 5
Enter elements row by row:
2 -1 3 4 1
0 7 5 -2 0
0 0 6 0 4
0 0 0 0 8
0 0 0 0 2
Given matrix is not a diagonal matrix.
Given matrix is an upper triangular matrix.
```

**Sample run #2:**

```
Enter the size of the square matrix: 4
Enter elements row by row:
0 0 0 0
0 3 0 0
0 0 1 0
0 2 0 3
Given matrix is not a diagonal matrix.
Given matrix is not an upper triangular matrix.
```