CSE 465
Spring 2023
Homework #8
100 points

Submit your code in a zipped-up folder.

Complete TriDiagonalMatrix.cs. A tridiagonal matrix is a sparse matrix, more specifically a band matrix. An N x N matrix A is called a tridiagonal matrix if A[i,j] = 0 whenever i + 1 < j or j + 1 < i. The following is an example of a 6 x 6 tridiagonal matrix:

```
1  2  0  0  0  0
3  4  5  0  0  0
0  6  7  8  0  0
0  0  9 10 11  0
0  0  0 12 13 14
0  0  0  0 15 16
```

Since tridiagonal matrices are sparse, it is important to devise a compact way to store them. The idea is to only store:

- the elements on the main diagonal in an array d;
- the elements directly below the main diagonal in an array a; and
- the elements directly above the main diagonal in an array c.

With this representation, assuming array indices start at 0, an N x N tridiagonal matrix would have the format:

```
d[0]   c[0]   0      0             ...          0            0            0
a[0]   d[1]   c[1]   0             ...          0            0            0
0      a[1]   d[2]   c[2]          ...          0            0            0
...                                ...          ...
0      0      0      0             ...          a[N-3]       d[N-2]       c[N-2]
0      0      0      0             ...          0            a[N-2]       d[N-1]
```

Instead of storing N * N elements, we only need to store 3*N - 2 elements. For instance, for a 31 x 31 matrix, there are 961 elements, 870 of which are zeros. With this approach, we only need to store the 91 elements on the main diagonal and directly above and below it.

Tridiagonal matrices are useful in specifying tridiagonal linear systems of equations, which have many applications, especially in physics (e.g., multistage countercurrent extractor).

The TriDiagonalMatrix class implements the IEnumerable interface. The associated enumerator is supposed to iterate over the whole tridiagonal matrix. This is done in a row major fashion, starting with element at row 0 and column 0, and includes all N x N elements of the matrix (i.e., includes the zeros below and above the band). For example, for the 6 x 6 tridiagonal matrix shown above, the enumerator is supposed to iterate over the matrix as follows:

```
1 2 0 0 0 0 3 4 5 0 0 0 0 6 7 8 0 0 0 0 9 10 11 0 0 0 0 12 13 14 0 0 0 0 15 16
```

Scoring:

	Undergraduate Students
TriDiagonalMatrix	80 p
TriDiagonalMatrixEnumerator	20 p
TOTAL	100 p

Compiled as: `mcs TriDiagonalMatrix.cs`
Run as: `mono TriDiagonalMatrix.exe`

There are test files provided for you: Tester1.cs – Tester13.cs.
Compiled as: `mcs TriDiagonalMatrix.cs Tester1.cs`
Run as: `mono TriDiagonalMatrix.exe`