Lab 04
Matrix Addition

Objective:

Write a program that creates two matrices of whole numbers and then adds them!

$$\begin{bmatrix} 4,1 \\ 8,7 \end{bmatrix} + \begin{bmatrix} 1,3 \\ 2,4 \end{bmatrix} = \begin{bmatrix} 4+1,\ 1+3 \\ 8+2,\ 7+4 \end{bmatrix} = \begin{bmatrix} 5,4 \\ 10,11 \end{bmatrix}$$

<u>Lab Solution</u>

Requirements:
- Functionality. (80pts)
  - No Syntax, Major Run-Time, or Major Logic Errors. (80pts*)
    - *Code that cannot be compiled due to syntax errors is nonfunctional code and will receive no points for this entire section.
    - *Code that cannot be executed or tested due to major run-time or logic errors is nonfunctional code and will receive no points for this entire section.
  - Only use Arrays to represent the Matrices. (80pts*)
    - *Any other data structure such as LinkedLists, ArrayLists, etc. will result in no points awarded for this entire section.
  - Creating the Matrices. (20pts)
    - We assume that our matrices only have only two dimensions (a 2D Array).
    - Users must be able to specify the sizes of each Matrix – both length and width of both.
    - All the above must apply for full credit.
  - Populating the Matrices. (20pts)
    - Users must be prompted to enter the individual values of each matrix (called *components*).
    - They must be prompted value's position (the indices) is being entered.
    - All the above must apply for full credit.
  - Adding the Matrices. (20pts)
    - The program must check to see if the length and width of one matrix matches the length and width of the other matrix. If they do not match, then the user must be prompted with an error message and the program must exit.
    - The program must create a resulting matrix that is the same length and width.
    - The program must add the values *component wise* and store the results in the resulting matrix.

- - Example. If we assume we have two matrices, A and B, and a resulting matrix C, then C[0][0] = A[0][0] + B[0][0], C[0][1] = A[0][1] + B[0][1], etc.
      - All the above must apply for full credit.
    - Printing the Results. (20pts)
      - The contents of both matrices entered by the user and the contents of the resulting matrix must be shown to the user.
      - Components of each should be shown in their appropriate rows and columns.
      - All the above must apply for full credit.
- Coding Style. (10pts)
  - Readable Code
    - Meaningful identifiers for data and methods.
    - Proper indentation that clearly identifies statements within the body of a class, a method, a branching statement, a loop statement, etc.
    - All the above must apply for full credit.
- Comments. (10pts)
  - Your name in the file. (5pts)
  - At least 5 meaningful comments in addition to your name. These must describe the function of the code it is near. (5pts)

Example Dialog:

```
Welcome to the matrix adder program!
Please enter the length and width of the
first matrix
2
2
Enter value at index 0 0
4
Enter value at index 0 1
1
Enter value at index 1 0
8
Enter value at index 1 1
7

Please enter the length and width of the
second matrix
2
2
Enter value at index 0 0
```

```
1
Enter value at index 0 1
3
Enter value at index 1 0
2
Enter value at index 1 1
4

4 1
8 7
+
1 3
2 4
=
5 4
10 11
```

Solution Tests:
1. Is your name written as a comment in all source files?
2. Does the solution compile (no syntax errors)?
3. If the user creates the following matrices

$$\begin{bmatrix} 4, 1 \\ 8, 7 \end{bmatrix} \quad \begin{bmatrix} 1, 3 \\ 2, 4 \end{bmatrix}$$

Does the program output
4 1
8 7
+
1 3
2 4
=
5 4
10 11

4. If the user creates the following matrices

$$\begin{bmatrix} 1, 2 \\ 3, 4 \end{bmatrix} \quad \begin{bmatrix} 5, 6 \\ 7, 8 \end{bmatrix}$$

Does the program output

1 2
3 4
+
5 6
7 8
=
6 8
10 12

5. If the user creates the following matrices

$$\begin{bmatrix} 1,2,3 \\ 4,6,5 \end{bmatrix} \begin{bmatrix} 5,6 \\ 7,8 \end{bmatrix}$$

Does the program output
Invalid Dimensions. These cannot be added.

Lab Report

1. Create a section named "Problem" and describe this lab's problem in your own words. (10pts).
2. Create a section named "Solution Description" and describe how the code solves the problem in your own words. (10pts).
3. Create a section named "Problems Encountered" and describe the various syntax, run-time, and logic errors that were encountered while implementing the solution. (10pts).
4. Draw a flow chart of the solution and include that in the proposed solution section
5. Is it possible to have "ragged" / "jagged" arrays in Java?
6. Given the following code snippet, are there any kind of errors? If so, name the types, where, and how this code can be fixed. Otherwise, what does this code *exactly* print to the console?

```java
int[][] a = new int[5][5];
for(int i=0;i<a.length;i++)
{
    for(int j=0;j<a[i].length;j++)
    {
        a[i][j] = i*a.length+j;
    }
}
for(int i=0;i<a.length;i++)
{
    for(int j=0;j<a[i].length;j++)
    {
        System.out.print(a[i][j]+" ");
    }
    System.out.println();
}
```

7. Given the following code snippet, are there any kind of errors? If so, name the types, where, and how this code can be fixed. Otherwise, what does this code

exactly print to the console?

```java
char[][] board = new char[3][3];
for(int i=0;i<board.length;i++)
{
    for(int j=0;j<board[i].length;j++)
    {
        if(i == j)
        {
            board[i][j] = 'X';
        }
        else
        {
            board[i][j] = 'O';
        }
    }
}
for(int i=0;i<board.length;i++)
{
    for(int j=0;j<board[i].length;j++)
    {
        System.out.print(board[i][j]+" | ");
    }
    System.out.println();
}
```

8. Given the following code snippet, are there any kind of errors? If so, name the types, where, and how this code can be fixed. Otherwise, what does this code *exactly* print to the console?

```java
int[][] array = new int[3][2];
for(int i=0;i<array.length;i++)
{
    for(int j=0;j<array.length;j++)
    {
        array[i][j] = 4;
    }
}
for(int i=0;i<array.length;i++)
{
    for(int j=0;j<array.length;j++)
    {
        System.out.print(array[i][j]+" ");
    }
    System.out.println();
}
```

9. Given the following code snippet, are there any kind of errors? If so, name the types, where, and how this code can be fixed. Otherwise, what does this code *exactly* print to the console?

```
int[][] w = {{1,2,3,4},{3,2,1},{5,6,7,8,9},{2}};
for(int i=0;i<w.length;i++)
{
    for(int j=0;j<w[i].length;j++)
    {
        System.out.print(w[i][j]+" ");
    }
    System.out.println();
}
```

10. Given the following code snippet, are there any kind of errors? If so, name the types, where, and how this code can be fixed. Otherwise, what does this code *exactly* print to the console?

```
double[][] values = new double[5][];

for(int i=0;i<values.length;i++)
{
    values[i] = new double[i+1];
    for(int j=0;j<values[i].length;j++)
    {
        values[i][j] = i*values.length+j;
    }
}
for(int i=0;i<values.length;i++)
{
    for(int j=0;j<values[i].length;j++)
    {
        System.out.print(values[i][j]+" ");
    }
    System.out.println();
}
```

Finally:
Upload the source code (.JAVA File Extension) and written lab report (.DOC, .DOCX, or .PDF file extension) to the CSCE Dropbox.