A8 (30 marks)

***Focus**: multi-dimensional arrays*

Use the following class to test the methods you develop in Q1 and Q2.

```
public class Test {

   public static void main(String[] args) {

      int[][] m1 = {  { 14, 11, 13, 12 },
                      { 18, 15, 13, 13 },
                      { 19, 16, 15, 17 } };

      int[][] m2 = {  { 54, 53, 51, 52 },
                      { 51, 59, 52, 56 },
                      { 53, 54, 52, 58 } };

      System.out.println("First array:");
      displayArray(m1);
      System.out.println("Second array:");
      displayArray(m2);

      /* write simple code to test your method and use
         displayArray to display the result if applicable  */

   }

   //write your methods code here.

   public static void displayArray(int[][] m) {

      for (int r = 0; r < m.length; r++) {
         for (int c = 0; c < m[r].length; c++)
            System.out.print(m[r][c] + " ");
         System.out.println();
      }
   }
}
```

For all questions, assume that we use only rectangular arrays (i.e., all rows have the same length).

1. [10 marks] Write code that finds the sum of two matrices. Use the following method header

```
public static int[][] addMatrix(int[][] a, int[][] b)
```

The rules for adding two matrices are:

- both matrices should have the exact same dimensions (i.e. height and width) – you need to check for this rule in your program.
- both matrices should have elements that have compatible types – you don't have to add extra code to check this rule in your method as it will only accept int arrays.

As seen in the image below, the resulting matrix elements should be the sum of the respective pair of elements from the two matrices (that are being added):

$$\begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{pmatrix} + \begin{pmatrix} b_{11} & b_{12} & b_{13} \\ b_{21} & b_{22} & b_{23} \\ b_{31} & b_{32} & b_{33} \end{pmatrix} = \begin{pmatrix} a_{11} + b_{11} & a_{12} + b_{12} & a_{13} + b_{13} \\ a_{21} + b_{21} & a_{22} + b_{22} & a_{23} + b_{23} \\ a_{31} + b_{31} & a_{32} + b_{32} & a_{33} + b_{33} \end{pmatrix}$$

Test your program using the **`Test`** class listed at the beginning of this assignment.

Sample run

```
First array:
14 11 13 12
18 15 13 13
19 16 15 17
Second array:
54 53 51 52
51 59 52 56
53 54 52 58

The addition of the above two arrays is
68 64 64 64
69 74 65 69
72 70 67 75
```

2. [10 marks] Write a method that returns the sum of all the elements in a specified column in a 2-D array using the following header:

```
public static int sumCol(int[][] m, int colIdx)
```

Test your program using the **`Test`** class listed at the beginning of this document.

Sample run

```
First array:
14 11 13 12
18 15 13 13
19 16 15 17
Second array:
54 53 51 52
51 59 52 56
53 54 52 58

The sum of the first column in the first array is: 51
```

3. [10 marks] Code an exam in Java that repeatedly asks the user to enter the capital for a province in Canada. Then, the program should report whether the answer is correct. Eventually, you must display how many answers the user guessed correctly.

   The requirements are as follows:

   - Use a 2D array to hold the provinces and their capitals (as implied by the table below)
   - Answers are not case-sensitive (e.g. Toronto and tOrOnto are considered the same)
   - You do not need to integrate the **`Test`** class (from page #1 above) in your code for this question.

Alberta	Edmonton
British Columbia	Victoria
Manitoba	Winnipeg
New Brunswick	Fredericton
Newfoundland and Labrador	St. John's
Nova Scotia	Halifax
Ontario	Toronto
Prince Edward Island	Charlottetown
Quebec	Quebec City
Saskatchewan	Regina

Sample run

```
What is the capital of Alberta? Edmonton
What is the capital of British Columbia? Victoria
What is the capital of Manitoba? WINNIPEG
What is the capital of New Brunswick? fredericton
What is the capital of Newfoundland and Labrador? St. John's
What is the capital of Nova Scotia? halifax
What is the capital of Ontario? TORONTO
What is the capital of Prince Edward Island? St. John's
What is the capital of Quebec? montreal
What is the capital of Saskatchewan? Regina
You got 8 question(s) right.
```

Submission Instructions

For this assignment, you need to do the following:

1. Create a Java project of which name consists of **your student number followed by the assignment number,** e.g., "1234567_A1".
2. Create one class for each question and write your answer inside that class. Your classes should have the same name as the question number (e.g., Q1)
3. After solving all questions, open your file explorer.
4. Navigate to your Java project folder (can be found inside your Eclipse workspace folder).
5. Locate the "src" folder for this project (the folder that includes the source code for all questions).
6. Zip the "src" folder and rename the zipped file to match your project name (e.g., 1234567_A1.zip).
7. Submit the zipped file **to Canvas.**

Note that you can resubmit an assignment, but the new submission overwrites the old submission and receives a new timestamp.