CS1073 Lab #6 - Winter 2024

Due: Thursday, April 4th by 12:00 NOON in the Lab 6 submission folder in Desire2Learn. (Read the submission instructions at the end of this document carefully).

The purpose of this assignment is:

- to help develop your understanding of loops, and to have you begin working with arrays of primitive values.

Side Note: When repetition is required, we can employ loops, or we can use a technique called recursion (which you will learn about in CS1083). Your answers to these questions should use loops, not recursion.

This lab is to be done individually. What you hand in must be your own work. Incidents of plagiarism will be reported.

During the scheduled lab time, lab assistants and your instructor will be available to provide assistance (just put up your hand). If you have questions about the lab after the scheduled lab time, they should first be directed to a tutor/assistant during the scheduled help sessions later on Thursday. (Locations and times for all help sessions can be found on D2L). If you have attended the help sessions and the issue is unresolved, you may then contact your course instructor. You are NOT to discuss this lab with anyone else (including your classmates).

As always, be sure to include a Javadoc comment for every class (with @author information).

1. Nested Loop Exercise

Review the following code and draw the array and the values stored in it, and the determine the output that results from the following code:

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```
int[][] numbers = new int[3][7];
int count = 1;

//assigning values to the array
for(int i = 0; i < numbers.length; i++){
     for(int j = 0; j < numbers[i].length; j++){
          numbers[i][j] = count++;
     }
}

//printing the array
//(do not make any changes to this code)
for(int i = 0; i < numbers.length; i++){
     for(int j = 0; j < numbers[i].length; j++){
          System.out.print(numbers[i][j] + " ");
     }
     System.out.println();
}
```

Re-write the first nested loop (assigning values to the array) so that it produces the following output (do not make any changes to the second nested loop for printing):

```
1 4 7 10 13 16 19
2 5 8 11 14 17 20
3 6 9 12 15 18 21
```

Note the following restrictions: you cannot make any changes to the nested loop that prints the array.

Capture sample output for your solution.

2. Working with One-Dimensional Arrays of Primitive Values

a) Download and extract the zip file provided in D2L. You will find a file named **IntArrayUtil**. You are to complete the methods in the class according to the description provided and the examples provided here. This class contains the following four static methods:

```
public static int max(int[] arr)
```

This method returns the maximum value in the integer array passed in as a parameter.

For example, if max is called with an array containing:

13	10	21	20	18	11	16

The value 21 is returned.

`public static int[] join(int[] arrA, int[] arrB)`

This method joins one integer array after another and returns that as a new array. (The parameters themselves are not altered.)

For example, if testArray1 contains:

3	-4	6	9

and testArray2 contains:

16	11	18	20	21	10	13

Then `IntArrayUtil.join(testArray1, testArray2)` returns a new array containing:

3	-4	6	9	16	11	18	20	21	10	13

`public static int[] reverse(int[] arr)`

This method reverses the sequence of elements in an integer array and returns that in a new array. (The parameter itself is not altered.)

For example, if reverse is called with an array containing:

16	11	18	20	21	10	13

Then it returns a new array containing:

13	10	21	20	18	11	16

```
public static int alternatingSum(int[] arr)
```

This method computes and returns the alternating sum of all elements in the integer array that is passed in via its parameter.

For example, if alternatingSum is called with an array containing:

13	10	21	20	18	11	16

then it computes:
13 - 10 + 21 - 20 + 18 - 11 + 16 = 27 (and returns 27)

Recall: A static method is one that is called directly, using the class name.

No object needs to be constructed to call a static method. (The methods in the Math class are all static.)

Notes:

- You should not call any methods from the Java API in your solution to this question. (Solve the problems yourself, using loops.)
- For all of the methods in the IntArrayUtil class, you may assume that the input arrays are all full (i.e. no partially-filled arrays).

b) Write a test driver that thoroughly tests the four methods from part a. Use a few different test cases (arrays with different lengths & different contents).

Note: Your test driver should be in a separate class and file. In your test driver, print out the contents of the input arrays (the ones that you pass in as parameters), and also print the contents of the arrays that are returned from the first two methods as well as the number that is returned from the third method.

Be sure to include a Javadoc comment for your class (with @author information).

Capture sample output to hand in for marking

Submission instructions on next page…

Your electronic assignment submission (submitted via Desire2Learn) will consist of two files:

i. a written report. This should begin with a title page; just as we described in Lab #1, your title page should include: the course (CS 1073), your section (FR01B, FR02B, FR03B, FR04B, FR05B or FR06B), the lab number (Lab #6 in this case), your full name, and your UNB student number. That should be followed by two sections, with each part clearly identified with a section heading. Include:

   a. The source code and sample output for Question 1.

   b. The source code and sample output for Question 2.

   (Aside: Your source code should contain Javadoc comments, however, you do not need to include the .html files.)

   This written report should be prepared using a word processor. (Copy & paste your java source code & output into the report document and add appropriate headings.) The report document should then be stored as a SINGLE pdf file and submitted to the appropriate drop box on Desire2Learn. (This pdf will allow the marker to write comments directly on your work to give you better feedback.)

   Note: Please name this report as follows: **YourName_Lab6_Report.pdf**

ii. an archive file (.zip or .tar) that contains all of your work for this assignment. Make sure that your archive includes the complete source code (.java files - in case the marker wishes to compile & run your code) and the output (screen captures). This archive should be submitted as a single file to the appropriate drop box on Desire2Learn.

   Note: Please name this archive file as follows:
   YourName_Lab6_Archive.zip or **YourName_Lab6_Archive.tar**