20.5 Program 2c: Transpose

Objectives

* Create a user-defined Java class that manipulates 2-dimensional arrays.
* Write a Java program that tests the user-defined class.
* Develop programs using an IDE.
* Upload both the user-defined class and the driver class for grading.

Background Reading

* ZyBook: 6. Arrays, 7. Objects and Classes, 12.2 format()

General Instructions

In this lab, you will create two class files: one class that contains methods to transpose a 2-dimensional array, and another class that instantiates a Transpose object and calls its methods. The latter is a **test driver** or sometimes called a **client** program. Note that there is no **main()** in Transpose and none of its method headers contain the word **static**.

If the terminology to "instantiate" an object is unfamiliar, recall that creating a new Scanner or Random object instantiates it, in other words, this process creates a new instance of the Scanner or Random class, and that instance is referred to as an object.

Instructions for Transpose.java class

* Write a Java class **Transpose.java** that can create an 2-dimensional array, print it, and print it with the rows and columns transposed. The program should:
  + createPatterned2DArray(int rows, int cols) Creates a two-dimensional array and returns it filled with whole numbers such that the elements have the following pattern:  
      
    Row 1: 10+numRows\*1+ 0, 10+numRows\*1+1,10+numRows\*1+2, …  
    Row 2: 10+numRows\*2+ 0, 10+numRows\*2+1, 10+numRows\*2+2, …  
    Row 3: 10+numRows\*3+ 0, 10+numRows\*3+1, 10+numRows\*3+2, …
  + print2DArray(int[][] a) : Prints the array by row where each element printed has a minimum width of 4 spaces and is left-justified. Use System.out.format(). [Note: format() is identical to printf() that you used before.] End each row with a newline and complete the output with a blank line.
  + print2DArrayTransposed(int[][] a) : Prints the array transposing rows and columns maintaining the format where each element printed has a minimum width of 4 spaces and is left-justified. Use System.out.format(). End each row with a newline and complete the output with a blank line.

Sample Transpose output where input is 3 5

13 14 15 16 17

16 17 18 19 20

19 20 21 22 23

13 16 19

14 17 20

15 18 21

16 19 22

17 20 23

Sample Transpose output where input is 1 4

11 12 13 14

11

12

13

14

Sample Transpose output where input is 5 3

15 16 17

20 21 22

25 26 27

30 31 32

35 36 37

15 20 25 30 35

16 21 26 31 36

17 22 27 32 37

Note there are *no* static methods in class Transpose.

Instructions for TestTranspose.java class

* Write a test driver program that has two methods: main() and getId()
  + main() : This method
    - reads in the number of rows and the number of columns for a two-dimensional array.
    - instantiates an instance of Transpose.
    - calls the instantiated object's createPatterned2DArray saves the result to a 2-D array reference variable.
    - calls the instantiated object's print2DArray
    - calls the instantiated object's print2DArrayTransposed
  + getId() : similar to a method used in previous labs, this method returns a string and is *not* called from your program but graded by the autograder.

Program 2c, StudentFirstName StudentLastName

Turning in the programs

* When you are satisfied with the programs (or are out of time and want some partial credit), upload the source files Transpose.java and TestTranspose.java.
  + See the "Uploading source file to ZyBooks lab" video on our course web site for help.
* Your program will be graded automatically against the requirements.
* You may submit as many times as necessary.
* The automatic grading program is very specific. If you feel you have the correct solution but are not receiving full credit, please
  + Carefully review the output -- you might need to scroll all the way to the right to find what is wrong with a particular output.
  + Verify you have the correct names for the program itself and all methods.
  + Check your calculations by hand: was there a logic error?
  + Review the requirements: did you miss a step? misinterpret a requirement?
  + If all these check out, contact the T.A. for assistance.