

Homework 4: Shape Array & Sort

Due date: September 16, 2024 (Mon)

For this homework, you will further modify the Shape class and subclasses from the previous homework assignment, and you will make a driver to instantiate and sort various shapes. In other words, you will write one more class to test your other classes.

Specification

Shape class - You must modify the Shape class to be **abstract** and provide the following methods:

```
public abstract double getArea();  
public abstract double getPerimeter();
```

Here, we introduce a new keyword, abstract. Don't panic! More information about abstract classes and abstract methods can be found here (<https://docs.oracle.com/javase/tutorial/java/land/abstract.html>). Please spend some time to read as you work on this assignment, and we will discuss abstract classes in lecture 8 to solidify your understanding of them with this practice.

Modify the Rectangle, Square, Circle, Octagon, and Hexagon classes from the previous homework to provide the implementations of the abstract methods in the new Shape class.

When toString() is called on a subclass of Shape, it must return a String with the following format: <shape> <area> <perimeter>. Areas and perimeters must be printed with at least one digit to the left of the decimal point and exactly three digits to the right of the decimal point.

ShapeSortTest class - This class is the driver class which accepts from the command line a list of shapes, of any length, formatted as <letter><size>, where <letter> can be either C for circle, S for square, H for hexagon or O for octagon and <size> is an integer (but you could make doubles work if you like). For circle, size would be the radius, for square, octagon and hexagon, size is the length of a side. (We will not be testing Rectangle objects in ShapeSortTest.)

Here's a sample command line: `java ShapeSortTest C10 S85 H77 H19 C100 S12 O10`

The class stores references to these shapes in an array of Shape (similar to StockHoldingTest2) and sorts the objects in ascending order of area of Shape and prints information out in sorted order, one shape per line using the toString() method. It then re-sorts the objects in descending order of

perimeter of Shape, and prints them out again, in the same format. (You may add extra blank lines and whitespace for improved readability.)

Notes

- Be sure to use `Math.PI` in the computation of the area/perimeter, if necessary, so that your lower-order digits are correct. As you do, review lecture 6 and think about static variables.
- When sorting an array of objects, you swap the positions of objects that are out of order. Note that you can swap the references to the objects. You don't need to swap (copy/change) the instance variables, themselves. Refer to lectures 5 and 6 if you have any doubt about this.
- Do not put your homework file(s) in a package.
- Do not include extraneous code in your Java files.

Turning-in Your Work

Place all your .java files into a ZIP file called `homework4.zip`. Use WinZip, 7-Zip, or Compress option (with right-clicking on the java files). The following ZIP command can be used to do this:

```
zip homework4.zip *.java
```

Make sure to zip only .java files. **Do not zip a directory or folder that contains the required java files.** Submit your `homework4.zip` file using AutoLab (<https://autolab.andrew.cmu.edu>).

Grading

AutoLab will grade your assignment as follows:

- Java files exist and compile: 5 points
- Shape class is abstract, and subclass updated accordingly: 10 points
- Test cases from Homework #3 still work: 10 points
- ShapeSortTest class tests: 50 points
- Follows coding conventions: 10 points
 - We'll deduct one point for each coding convention issue detected.
- Author tag in a JavaDoc comment at beginning of file: 5 points

AutoLab will show you the results of its grading within approximately one or two minutes of your submission. You may submit multiple times so as to correct any problems with your assignment. Autolab uses the last submission as your grade.