Problem Set 1

Assigned: Sept. 7
Due: Sept. 14

In homework assignments that ask you to write Java code, such as exercises 1 and 2 below, you only have to write the code on your submitted homework; you don’t have to get it running. Therefore, you will lose only a small part of the credit for minor errors that would actually prevent it from running, like trivial syntax errors. Of course, a good way to be sure you’ve got the right answer is to get it running.

On problems that ask you what a given piece of code will do, such as exercise 3, it is 100% OK to code it up and see what it does do. However, it is critical that you should understand why it does what it does; otherwise, you will not be able to answer the question on the exam, where you don’t have the option of running it.

Students who are not registered for the honors section will not receive credit for doing the honors exercise.

Exercise 1

Augment the classes Rectangle and LocatedRect in the files of those names as follows:

A. For both Rectangle and LocatedRect write two methods that rotate the rectangle by $90^\circ$ counterclockwise around the lower left-hand corner:
   
   – A destructive method, R.DestRotate(). This modifies R itself to be the result of the rotation. It returns R itself.
   
   – A non-destructive method, R.NonDestRotate(). This returns a new rectangle which is the result of rotating R, but leaves R unchanged.

B. Suppose you have written a program that contains calls to R.DestRotate(). You decide to rewrite every such call as R = R.NonDestRotate(). Have you changed what the program does? Either give an argument that the new code does the same thing as the old code, or give an example where the new code does something different.

C. Write a method R.Intersect(Q) that returns the intersection of located rectangles R and Q. If R and Q do not intersect, the method should return null

Note: In all three parts, and in all future assignments that ask you to write code that returns a specified value, your method must return the value specified, not print it out or set a global variable.

Exercise 2

Suppose you want to modify the definition of Person in Person.java to record the person’s spouse. Assume that a person has at most one spouse. Write the code that you would need to:

• Add a data field spouse.
• Add a method getSpouse()
• Add a method setSpouse(P). When you call Q.getSpouse(P); that should both mark P as the spouse of Q and mark Q as the spouse of P.
Exercise 3

Consider the code for Hwk1Ex3.java on the attached handout.

A. What does this output?
B. Explain the output.

Honors Exercise

The idea behind the method setParent(P) is that it should maintain the integrity constraint that, if \( P \) is the mother or father of \( Q \) then \( Q \) is a child of \( P \). However, as written, this code is breakable.

A. Describe how an external program can create a set of Person objects that do not satisfy the constraint. Your solution to this part should not involve any changes to the file Person.java.

B. Write an improved definition of setParent that fixes this problem.