

CS 2510 Exam 5 – Summer 2012

Name: _____

Student Id (last 4 digits): _____

- Write down the answers in the space provided.
- You may use all syntax of Java that we have studied in class.
- For tests you only need to provide the expression that computes the actual value, connecting it with an arrow to the expected value. For example `s.method()` -> `true` is sufficient.
- Remember that the phrase “design a class” or “design a method” means more than just providing a definition. It means to design them according to the **design recipe**. You are *not* required to provide a method template unless the problem specifically asks for one. However, be prepared to struggle if you choose to skip the template step.

Score		45
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Good luck!

Problem 1

Develop an implementation of `Comparator<Posn>` that orders Cartesian-coordinates by their distance from the origin in such a way that the further away from the origin, the smaller the position is considered. So for example, there is no position larger than (0,0).

You may rely on the following definition of `Posn`:

```
// Represents (x,y) in Cartesian-coordinate system
class Posn {
    Integer x;
    Integer y;
    Posn(Integer x, Integer y) {
        this.x = x;
        this.y = y;
    }
}
```

Problem 2

Design a method:

```
<T> Boolean isSorted(ArrayList<T> ls, Comparator<T> c)
```

that determines if the given array list is in ascending sorted order according to the given comparator.

Problem 3

Here is a data definition for pairs:

```
// Represents a pair of A and B.
class Pair<A,B> {
  A left;
  B right;
  Pair(A left, B right) {
    this.left = left;
    this.right = right;
  }
}
```

Design a method:

```
<A,B> Comparator<Pair<A,B>> lexi(Comparator<A> ca,
                                   Comparator<B> cb)
```

that consumes a comparator for As and a comparator for Bs and produces a comparator for pairs of As and Bs that is the *lexicographic order*. Mathematically speaking, the lexicographic order of a pair is defined as follows:

$$(a, b) \leq (a', b') \text{ if and only if } a < a' \text{ or } (a = a' \text{ and } b \leq b')$$

