8 Assignment

Portfolio Problems

Finish all the lab for this week and include it in your portfolio.

Abstracting with Interfaces and Function Objects
Abstracting with Generics: Type Parameters

8.1 Problem

You will start this assignment with the given code. We will deal with two classes of data, Balloon and City. The goal will be to design common methods that work for both classes without changes.

Here is a brief inventory of the classes that are provided:

- City — the information includes the name, state, zip code, latitude, and longitude
- Balloon — the information includes the x and y coordinates of the center, the radius, and the color of the balloon
- AList<T>, MTList<T>, and ConsList<T> that you have seen already in the lab. It includes the filter method that consumes an ISelect<T> object and produces a list of all elements from this list that satisfy the given predicate.
- ISelect<T> interface that represents a select predicate
- Examples — the class with some examples of data and some tests already implemented

1. Design the following classes that implement the ISelect interface:
   - RedBalloon — that selects only the red balloons
   - SmallBalloon — that selects all balloons with the radius smaller that the value given to the constructor.
   - Below40th — that selects only the cities that are below 40th parallel of latitude
• InState — that selects only the cities in the given state.

Make sure you test all these classes.

2. Design and run tests for the method filter in the classes that represent a list of \(<T>\) by using all four classes that implement the ISelect\(<T>\) interface.

3. Add the following interface to your project:

```java
interface ShowMe<T>{
    public void display(T t);
}
```

Now design the following classes that implement the ShowMe interface:

• PrintBalloon that prints the balloon data as a String to the system output
• PaintBalloon that paints the balloon data in the Canvas
• PrintCity that prints the city data as a String to the system output
• PaintCity that paints the city as a small circle in the Canvas.

*Hint:* Compute the location of the city on a map of USA that would fit into your Canvas from its latitude and longitude. We will draw more cities later, so make sure you can use this code later.

4. Now design the method showAll in the classes that represent a list of \(<T>\). Test is by using all four classes that implement the ShowMe interface.

5. Java Collections Framework — the libraries we will soon use — provides the following interface:

```java
public interface Comparator<T>{
    /* produce int < 0 if op1 is before op 2
     * produce 0 if op1 is the same as op2
     * produce int > 0 if op1 is after op2
     * in your desired ordering
     */
    public int compare(T op1, T op2);
}
```
Design the following classes that implement the `Comparator<T>` interface with methods that perform the following comparisons:

- `B1HigherThanB2` that determines whether balloon-1 is closer to the top than balloon-2
- `B1SmallerThanB2` that determines whether balloon-1 has smaller radius than balloon-2
- `C1BeforeC2` that determines whether the name of the city-1 is lexicographically before the name of the city-2
- `C1StateBeforeC2` that determines whether the state of the city-1 is lexicographically before the name of the city-2

6. Design the `sort` method for the classes that represent a list of `<T>` using the given instance of the `Comparator`. Test your program (and all helper methods) using all four of the classes defined above.