HOWARD UNIVERSITY
DEPARTMENT OF SYSTEMS AND COMPUTER SCIENCE
FALL 2023

Object-Oriented Programming
Due: Friday, October 13nd by 6:00PM

In mathematics, a set is a **collection of elements**. The elements that make up a set can be any kind of mathematical objects: numbers, symbols, points in space, lines, other geometrical shapes, variables, or even other sets. The set with no element is the empty set; a set with a single element is a singleton. Additionally, a set cannot contain duplicates. Your task is to implement a class, IntegerSet, that contains only integers, given the specification below.

```
public class IntegerSet  {
        // Hint: probably best to use an array list.  You will need to do a little research
        private List<Integer> set = new ArrayList<Integer>();

        // Default Constructor
        public IntegerSet() {
        }

        // Constructor if you want to pass in already initialized
        public IntegerSet(ArrayList<Integer> set) {
                this.set = set;
        }

        // Clears the internal representation of the set
        public void clear() {…};

        // Returns the length of the set
        public int length() {…}; // returns the length

        /*
         * Returns true if the 2 sets are equal, false otherwise;
         * Two sets are equal if they contain all of the same values in ANY order.  This overrides
         * the equal method from the Object class.
         */
        public boolean equals(Object o) {…};

        // Returns true if the set contains the value, otherwise false
        public boolean contains(int value) {…};

        // Returns the largest item in the set; Throws a IntegerSetException if the set is empty
```

```
        public int largest()  {…};

        // Returns the smallest item in the set; Throws a IntegerSetException if the set is empty
        public int smallest()  IntegerSetException {…};

        // Adds an item to the set or does nothing it already there
        public void add(int item) {…}; // adds item to the set or does nothing if it is in set

        // Removes an item from the set or does nothing if not there
        public void remove(int item) {…};

        // Set union
        public void union(IntegerSet intSetb) {…};

        // Set intersection, all elements in s1 and s2
        public void intersect(IntegerSet intSetb) {…};

        // Set difference, i.e., s1 –s2
        public void diff(IntegerSet intSetb); // set difference, i.e. s1 - s2

        // Set complement, all elements not in s1
        public void complement(IntegerSet intSetb) {
        }

        // Returns true if the set is empty, false otherwise
        boolean isEmpty();

        // Return String representation of your set
        public String toString() {…};     // return String representation of your set
}
```

Your package structure should be:
org.howard.edu.lsp.assignment4 (contains your test code, call it **Driver.java** and **IntegerSet.java**)
org.howard.edu.lsp.assignment4.docs (contains your generated html documentation from your javadocs in your code)

Below is sample of how your driver should look. Your driver contains your main method and its primary function is to test your IntegerSet class. Every method in IntegerSet should be sufficiently tested and your output easy to read. Below is a small example of the granularity of how your output should look. Each operation on a method should show the contents of your IntegerSet before and after each operation. Part of your grade on this assignment is how expressive your output is.
…

```
IntegerSet set1 = new IntegerSet();
set1.add(1);
set1.add(2);
set1.add(3);

System.out.println("Value of Set1 is:" + set1.toString());
System.out.println("Smallest value in Set1 is:" + set1.smallest());
System.out.println("Largest value in Set1 is:" + set1.largest());

IntegerSet set2 = new IntegerSet();
set2.add(4);
set2.add(5);

System.out.println("Union of Set1 and Set2");
System.out.println("Value of Set1 is:" + set1.toString());
System.out.println("Value of Set2 is:" + set2.toString());
set1.union(set2);       // union of set1 and set2
System.out.println("Result of union of Set1 and Set2");
set1.toString();        // result of union of set1 and set2
```

The above format is just a template to use. At the end of the day your output should be an indicator that your program works for ALL methods in IntegerSet. You should create Driver.java that contains all of your test code.

This assignment requires a little research on your own. You need to figure out how to use an ArrayList as your set. Ask questions on Piazza if you have any questions

Finally, you are required to generate and submit the html documentation from the javdocs in your code. Once again, this will require a little research. For those using eclipse, this can typically be done within the IDE. Here, Google is your best friend.

There is **no collaboration** on this assignment. Questions may be directed to me or Piazza. Although, if someone figures out how to generate html documentation from your javadocs you may share it with the class on Piazza.

Below is the breakdown of how you will be evaluated:

Program correctness (75 pts.)

Documentation (javadocs and generation of html) (25 pts.)

Robust test cases. Make sure your output is clear and complete. It should look similar to the examples I provided above. When I run your program, the input and corresponding output

should be clear. I should not have to examine your code to determine if it is correct. Not adhering to these principles will result in significant deductions. (50 pts.)

One hint is that some of the set arithmetic can be found in as standard functionality on a ArrayList.

Please start this assignment early and ask questions!!