MIT AITI Lab 7: Modifiers, Scope, and Packages

0. This lab will cover material presented in lectures 10 and 11 and is due by **4pm on Thursday, June 23rd**. No late labs will be accepted unless there are extenuating circumstances. You may wish to read chapters 2 and 5 in Bruce Eckel's "Thinking in Java" to supplement the lecture material. You will be tested on this material on the upcoming exam.

1. In this lab, you will be given three files: Lab7.java, Tester.java, and ArrayList.java. The latter two files contain several compile-time and runtime bugs related to modifiers, scope, and packages. They should not contain any functional or logical bugs. Your job is to debug the provided code and reproduce the expected output.

2. You will **NOT** need to modify or type-in the class Lab7 – it does not contain bugs (we hope). It is given here for your convenience:

```java
import aiti.util.ArrayList;
import aiti.Tester;

public class Lab7 {
    public static void main(String[] args) {
        ArrayList al = new ArrayList();
        ArrayList al2 = new ArrayList();
        Tester.compare(new Integer(2),
            new Integer(ArrayList.numInitialized()));
        al.add("Hello");
        al2.add("World");
        al.add(new Integer(100));
        al2.add(new Double(-2.0e-2));
        Tester.compare(new Integer(100), al.get(1));
        Tester.compare("Hello", al.get(0));
        Tester.compare("World", al2.get(0));
        Tester.compare(new Double(-2.0e-2), al2.get(1));
        al.add("World");
        al.add(new Double(2e2));
        Tester.compare(new Double(2e2), al.get(3));
        for (int i = 0; i < al.size(); i++)
            System.out.print(al.get(i) + " ");
        System.out.println();
        for (int i = 0; i < al2.size(); i++)
            System.out.print(al2.get(i) + " ");
        System.out.println();
        System.out.println("This should cause an error
        and halt:");
        Tester.compare("Aaaaargh!", al.get(1));
    }
}
```

3. The class Tester will be used by Lab7 to test whether ArrayList is behaving correctly. You may wish to first substitute a working ArrayList class for the buggy ArrayList used by Lab7 in order to first get Tester working. The buggy Tester.java code is as follows:

```java
/**
 * This class will compare two objects.
 * If they differ, it outputs an error message and halts.
 */
import java.lang.*;
import java.util.ArrayList;
package aiti;

class Tester {
    public static void compare(Object expected,
                               Object received) {
        if (expected.equals(received)) return;
        else outputError(expected, received);
    }

    private void outputError(Object expected,
                             Object received) {
        (new Error("Expected: " + expected +
                " Received: " + received +
                " Exiting now.")).printStackTrace();
        System.exit(0);
    }
}
```

4. The file ArrayList.java contains two classes: ArrayList and UtilityArray, which both contain modifier, package, or scope related errors. Your job is to fix these errors. The buggy ArrayList.java as follows:

```java
package aiti.util;

public class ArrayList {
    private UtilityArray a;
    public ArrayList() { a = new UtilityArray(1); }
    public void add(Object o) { a.add(o); }
    public Object get(int i) { return a.get(i); }
    public int size() { return a.size(); }
    public int numInitialized() { return a.initialized; }
}
```

```java
class UtilityArray {
    final static int initialized = 0;
    public int nextInsert = 0;
    static private Object[] data;

    private UtilityArray(int initialSize) {
        this.data = new Object[initialSize];
        int initialized = this.initialized+1;
    }

    int size() { return nextInsert; }

    Object get(int i) {
        if (i < nextInsert) return data[i];
        else return null;
    }

    void add(Object o) {
        if (data.length <= nextInsert) {
            /* Grow the Array */
            Object[] temp = new Object[data.length * 2];
            System.arraycopy(data, 0,
                             temp, 0, data.length);
            this.data = temp;
        }
        data[nextInsert++] = o;
    }
}
```

5. The expected output of Lab7 with debugged Tester and ArrayList files is as follows:
```
> java Lab7
Hello 100 World 200.0
World -0.02
This should cause an error and halt:
java.lang.Error: Expected: Aaaaargh! Received: 100 Exiting
now.
        at aiti.Tester.outputError(Tester.java:14)
        at aiti.Tester.compare(Tester.java:10)
        at Lab7.main(Lab7.java:29)
```

6. Fix the bugs in the code and demonstrate an execution to a staff member. **Do not** blindly copy someone's bug fixes. We will quiz you on the spot and you will not receive credit unless you are able explain your code adequately.

EC.S01 Internet Technology in Local and Global Communities
Spring 2005-Summer 2005