COP 3330 Exam #2
Spring 2007
3/22/07

Lecturer: Arup Guha
Name: _____

1) (8 pts) What is the output of the following program?

```
public class vartest {

	private static int a;
	private int b;

	public vartest(int c, int d) {
		a = c;
		b = d;
	}

	public void increment() {
		a++; b++;
	}

	public String toString() {
		return "a = "+a+" b ="+b;
	}

	public static void main(String[] args) {
		vartest a = new vartest(1, 2);
		System.out.println(a);
		vartest b = new vartest(3, 5);
		System.out.println(b);
		a.increment();
		System.out.println(a);
		System.out.println(b);
	}
}
```

_____
_____
_____
_____

2) (6 pts) In the class above in question 1, one of the methods overrides a previously defined method. Which method is it? What would happen to the output in the program if this method were removed? Why would this happen?

3) (20 pts) Complete the add and multiply methods for the complex number class below. Remember that a complex number is of the form a + bi, where a and b are real numbers and i = $\sqrt{-1}$. Both methods should add the current object to other and return the result as a new complex object.

```
public class complex {

	private double real;
	private double imaginary;

	public complex() {
		this.real = 0;
		this.imaginary = 0;
	}

	public complex(double r, double i) {
		this.real = r;
		this.imaginary = i;
	}

	public complex add(complex other) {









	}

	public complex multiply(complex other) {









	}

	public String toString() {
		return this.real + " + " + this.imaginary + "i";
	}
}
```

4) (10 pts) Let items be of the type ArrayList<Object>. Some of the elements in items are of type complex, but some of them are not. Write a segment of code that calculates the sum of all of the complex objects stored in items and stores that result in a complex object called sum.

5) (10 pts) Consider designing a program that managed a library of books. In designing this program, consider the following classes:

1) Title Page (manages the information on a title page of any publication)
2) Body (manages the information in the body of any publication)
3) Index (manages the information in the index of any publication)
4) Publication (manages the information for any publication)
5) Magazine (a specific type of Publication)
6) Book (another specific type of Publication)
7) Textbook (a specific type of Book)
8) Referencebook (another specific type of Book)
9) Series (a collection of Publication)

Draw an abbreviated UML diagram (don't show any instance variables or methods for any class) that captures the relationships between these classes.

For generalization (inheritance), use an arrow with a triangle, where the triangle points to the base class.

For aggregation (HAS-A), use an arrow with a diamond, where the diamond points to the more complex class. Do NOT fill in any of the diamonds. (Essentially, don't worry about weak or strong aggregation.)

6) (8 pts) Let words be an array of String. Write a segment of code that **uses an iterator** to print out each of the Strings in words that only contains lowercase letters.

7) (10 pts) The overall goal of questions 7 and 8 is to write a program that reads in test data and print out a histogram for one of the tests. In this question, you'll write the code to read in the data from a file into a two dimensional array. Here's the file format:

The first line of the file contains a single positive integer n, representing the number of tests given in the class.
The next n lines contain the test data for each test (test 0 through test n-1).
On each line, the first positive integer k represents the number of students who took that test. The next k integers on the same line represent the scores of the k students.

Fill in the code below so that it reads in the data from the file data.txt into the array testdata. You will write one line of code for each slot given.

```
import java.util.*;
import java.io.*;

public class teststats {

      public static void main(String[] args) throws IOException {

            Scanner fin = new Scanner(new File("data.txt"));
            int[][] testdata;

            int numtests = fin.nextInt();

            _____________________________

            for (int i=0; i<numtests; i++) {

                  ____________________________________________

                  ____________________________________________

                  ____________________________________________

                        ____________________________________

            }
            fin.close();

            // Rest of the program is here.
      }
}
```

8) (10 pts) Below you'll fill in code for the part titled, "Rest of the program is here," from the program on the previous page. In this part of the program, you'll prompt the user for which test they want histogram data. Then you'll calculate the frequency data for that particular test and then, print out the histogram. The histogram should group the test scores in 10 groups: 0-10, 11-20, 21-30, …, 91-100. (Notice that the first group is 0-10 and not 1-10.) The histogram should show one star per each test in that group. All the stars for a test are on one line. Complete the code segment below. You will fill in one line of code for each blank given.

```
Scanner stdin = new Scanner(System.in);
System.out.print("For which test do you want a histogram");
System.out.println(" (0-"+(numtests-1)+")?");

int answer = stdin.nextInt();

int[] freq = new int[10];
for (int i=0; i<10; i++) freq[i] = 0;

// Set up the frequency array.
for (int i=0; i<testdata[answer].length; i++) {
      if (testdata[answer][i] == 0)

            _____________________________________________
      else
            _____________________________________________
}

// Print out the histogram.
for (int i=0; i<10; i++) {

      // Prints the row header.
      if (i == 0)
            System.out.print("0 - 10\t");
      else
            System.out.print(10*i+"- "+10*(i+1)+"\t");

      // Print out the correct number of stars for this row.

      _____________________________________________________

            _____________________________________________

      _____________________________________________________
}
```

9) (16 pts) What is the output of the program on the handout? (Hint: there will be exactly 16 lines of output. Also, note that the constructors produce a total of 10 lines of output.)

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

10) (2 pts) In what month does the majority of the basketball phenomenon known as "March Madness" take place?

_____

Scratch Page – Please carefully label any work you would like graded on this page.