To insure that you receive partial credit whenever possible, be sure to show all your work. Remember: the exam is closed book, and cellphones, calculators, sliderules, notes, talking, etc., are not permitted. All parts of questions are worth 5 points, unless otherwise noted.

The FishTank class is given at the end of this exam.

a. Create a driver class, TankDriver, that includes a statement that creates a FishTank object called myTank, with owner Jill, capacity 20, and that is 40% filled.

b. The first statement in the FishTank constructor is: this.owner=owner; In a few sentences at most, explain what this means.

c. Add a method to the FishTank class called gallonReport, which prints to the console the integer number of gallons of water in the tank. You may either round this amount up or down. Thus if the number of gallons, computed exactly, is 11.7, your code may print either 11 or 12.

d. Add a static method called greatCap to the FishTank class. This method should be passed an array of FishTank objects as a parameter, and should return the object in the array with the greatest capacity. In case of ties, any FishTank object with greatest capacity will do. If tanks is an array of FishTanks in the driver class you’ve created above, write a method call to the greatCap method applied to the tanks array, and assign the result of that call to a FishTank variable called bigTank. (Hint: to make a method static, begin the header line with “public static…”)

e. (15) Using inheritance, extend the FishTank class to a HeatedFishTank class. This class should add one new boolean attribute, hasHeater. When this attribute is false, the FishTank does not have a heater. Your extension should add a get and a set method for this attribute. The HeatedFishTank constructor should take four parameters, owner, cap, frac, and heated.

f. Suppose you make a HeatedFishTank object, t, in the driver class, and then you add this statement: System.out.println(t.toString()); Explain what happens when the driver executes this statement.

g. Finally, write a static method in the HeatedFishTank class called avCap, which is passed an array of HeatedFishTank objects, and reports the average capacity of the tanks in the array that have heaters. If none of the tanks has a heater, your method should return 0.0.

2. The GreetPanel and WordDriver classes are given at the end of this exam.

a. Sketch the DisplayWindow when you run the WordDriver/GreetPanel application.

b. The application prints “Hello” when you click the Greeting button. Describe what happens when you click the button multiple times.

c. When you run WordDriver, what object serves as the listener for the greeting button?

d. If you change the call to drawstring in paintComponent to g.drawString(“hello”, vPos, 200), what happens when you click the “Greet” button repeatedly?

e. (15) Now add a new “flip” button to the WordDriver/GreetPanel application. The flip button works this way. The application begins, as before, by printing “hello” whenever you click on Greet. Then, when you click on “flip”, the application will print “goodbye”, and will continue printing “goodbye” on every “Greet” click, until you click flip again. Thus the flip button switches the displayed method back and forth between hello and goodbye.
3. Is there anything wrong with this method definition – and if so, what? In particular, does it compile? Does it compute the average properly?
   
   ```java
   public int averageOfTwo(int a, int b){ return (a + b)/2;}
   ```

4. Suppose you want the `FishTank` class to implement the `Comparable` interface, with comparisons based on capacity: one tank precedes another if the first has smaller capacity. Do this implementation (note: you don’t need to rewrite the entire class – just provide the relevant changes / additions. Also: you need to implement the `compareTo` method here: `public int compareTo(Object other){..}`)

5. In a few sentences at most, explain what an abstract class is.

6. Rewrite the for loop, below, as a while loop:
   
   ```java
   for (int j = 0; (( j < 10) || (j % 2 == 0)); j++)
       System.out.println(j);
   ```

   ```java
   public int averageOfTwo(int a, int b){ return (a + b)/2;}
   ```
public class WordDriver{

    public static void main(String[] args){
        DisplayWindow d = new DisplayWindow();
        GreetPanel p = new GreetPanel();
        d.addPanel(p);
        d.showFrame();
    }
}