Midterm & TBS Review: Part Two

A202/A598/I211 Fall Semester 2005
Geology Building Room 126

Take this paper home, study it, try to sketch clear directions for the solutions to these problems, and bring it back on Thursday. It will count as 5% of your exam grade. The format is precisely that of the Test of Basic Skills and of the Midterm Exam (except for them being closed book exams).

**Problem One.** Implement a class `Car` with the following properties: A car has a certain fuel efficiency (measured in miles/gallon or liters/km—pick one) and a certain amount of fuel in the gas tank. The efficiency is specified in the constructor, and the initial fuel level is 0. Supply a method `drive` that simulates driving the car for a certain distance, reducing the fuel level in the gas tank. Also supply methods `getGas`, returning the current fuel level, and `addGas` to tank up. Sample usage:

```java
Car myHybrid = new Car(49); // 49 miles per gallon
myHybrid.addGas(20); // Tank 20 gallons
myHybrid.drive(100); // Drive 100 miles
System.out.println(myHybrid.getGas()); // Print fuel remaining
```

(This is problem 3.6 on page 99 in the text).

**Problem Two.** Write a program that translates a number between 0 and 4 into the closest letter grade. For example, the number 2.8 (which might have been the average of several grades would be converted to B-). Break ties in favor of the better grade; for example, 2.85 should be a B.

This is problem 6.9 on page 227 in the book. The suggestion there is to use a class `Grade` with a method `getLetterGrade`. Feel free to either use their suggestion or to implement it in any way it works for you. Here’s another, simpler example: C+ is 2.3 and B- is a 2.7 (the numeric values of A, B, C, D, F are 4, 3, 2, 1 and 0. There is no F+ or F-. A plus sign increases the numeric value by 0.3 and a minus sign decreases it by 0.3). Given all this let’s suppose we have to turn 2.4 into a letter grade. Since 2.4 is between 2.3 (C+) and 2.7 (B-) we know that we need to choose between these two. We always choose the closest. In this case: 2.3 is closest to 2.4 and therefore 2.4 must be recorded as a C-. The tie example here is when we are given 2.5 which is equally apart from 2.3 and 2.7 and the rule says: choose the better grade, in this case B-.
Problem Three.

Program the following simulation: Darts are thrown at random points onto the square with corners (1, 1) and (-1, -1). If the dart lands inside the unit circle (that is, the circle with center (0, 0) and radius 1), it is a hit. Otherwise it is a miss. Run this simulation and use it to determine an approximate value for $\pi$: count the number of hits and divide by the total number of tries. Multiply by 4 and you should get the value you’re looking for. (Can you see why?).

This is 7.16 on page 274.

Good luck and do well!