

Midterm One

A201/A597/I210 Spring Semester 2005

Rawles Hall 100, 7-9pm (W 2/16)

Abstract

There are three parts to this exam. Please work carefully through the problems. The exam is closed book and closed notes. Write legibly and please sign your paper(s). You have two hours. Good luck and do well.

1 Calculations

The period T (in seconds) of an oscillating pendulum is given by the equation

$$T = 2\pi\sqrt{\frac{L}{g}}$$

where L is the length of the pendulum in meters, and g is the acceleration due to gravity in meters per second squared. Write a Java program to calculate the period of a pendulum of length L . The length of the pendulum will be specified by the user when the program is run. The acceleration due to gravity at the Earth's surface is $9.81 \frac{m}{s^2}$. Treat it as a constant in your program.

2 Decisions

The cost of sending a package by an express delivery service is \$10.00 for the first two pounds and \$3.75 for each pound or fraction thereof over two pounds. If the package weighs more than 70 pounds, a \$10.00 excess weight surcharge is added to the cost. No package over 100 pounds will be accepted. Write a program that reads the weight of a package in pounds and computes the cost of mailing the package. Be sure to handle the case of overweight packages. Here's how your program might work:

```
frilled.cs.indiana.edu%java PostOffice
Weight (lbs): 1.5
Less than 2 lbs. Mailing cost is 10 dollars.
frilled.cs.indiana.edu%java PostOffice
Weight (lbs): 2.5
  10 dollars for the first two pounds.
  1.875 dollars added for the weight that exceeds the 2 pounds.
Total mailing cost is 11.875 dollars.
```

```

frilled.cs.indiana.edu%java PostOffice
Weight (lbs): 65
    10 dollars for the first two pounds.
    236.25 dollars added for the weight that exceeds the 2 pounds.
Total mailing cost is 246.25 dollars.
frilled.cs.indiana.edu%java PostOffice
Weight (lbs): 71.5
    10 dollars for the first two pounds.
    260.625 dollars added for the weight that exceeds the 2 pounds.
    Over 70 pounds. Excess weight surcharge applies: 10 dollars.
Total mailing cost is 280.625 dollars.
frilled.cs.indiana.edu%java PostOffice
Weight (lbs): 90
    10 dollars for the first two pounds.
    330.0 dollars added for the weight that exceeds the 2 pounds.
    Over 70 pounds. Excess weight surcharge applies: 10 dollars.
Total mailing cost is 350.0 dollars.
frilled.cs.indiana.edu%java PostOffice
Weight (lbs): 102
Sorry, we can't mail packages over 100 lbs in weight.
frilled.cs.indiana.edu%

```

3 Loops

It is very common in science and engineering to work with large sets of numbers, each of which is a measurement of some particular property that we are interested in. A simple example would be the grades on the first test in a college course. Each grade would be a measurement of how much a particular student has learned in the course to date.

Much of the time, we are not interested in looking closely at every single measurement that we make. Instead, we want to summarize the results of a set of measurements with a few numbers that tell us a lot about the overall data set. Two such numbers are the *average*, or arithmetic mean, and the *standard deviation* of the set of measurements. The average or arithmetic mean of a set of numbers is defined as

$$\bar{x} = \frac{1}{N} \sum_{i=1}^N x_i$$

where x_i is sample i out of N samples. The standard deviation of a set of numbers has a more complicated definition and we won't need to worry about it on this exam.

Write a program that reads in a set of measurements and calculates the mean of the input data set. Expect the user to enter scores that could have a fractional part, or the word **done**. After each score entered the program should report the number and the sum of the scores entered thus far. When the user enters **done** the program reports the average and stops. Be sure to avoid dividing by zero. Don't forget to read the input as a string, so you can compare it before you parse it.

Here's how my program works:

```
frilled.cs.indiana.edu%java Mean
Enter value: 10
Score 1 entered: 10.0, current sum: 10.0
Enter value: 12.5
Score 2 entered: 12.5, current sum: 22.5
Enter value: -4.5
Score 3 entered: -4.5, current sum: 18.0
Enter value: done
The average of entered scores is: 6.0
frilled.cs.indiana.edu%java Mean
Enter value: 1.2
Score 1 entered: 1.2, current sum: 1.2
Enter value: 2.3
Score 2 entered: 2.3, current sum: 3.5
Enter value: 1.6
Score 3 entered: 1.6, current sum: 5.1
Enter value: done
The average of entered scores is: 1.7
frilled.cs.indiana.edu%java Mean
Enter value: done
No scores, no average. Thank you.
frilled.cs.indiana.edu%
```

Good luck and do well!