COMP 210, Spring 2000, Homework 1
Due Wednesday, February 9, 2000 at the start of class

Before you start the homework, you should remind yourself of our General Advice, Advice on Homeworks, and Grading Guidelines. All are available from the class web site (http://www.owlnet.rice.edu/~comp210).

For this assignment, you should follow <u>all</u> the steps of the design methodology and include the results of each step as comments or code in the final materials that you submit. (For example, write your template as a comment—at the appropriate point in the development sequence—and copy it over when you fill it in.)

1. (3 pts) **General Problem Solving**
   Houston drivers love to drive fast. Most drivers accelerate quickly from a standing stop to the de-facto speed limit of 80 miles per hour (mph) and maintain that constant speed. Write a Scheme function that takes as parameters the acceleration (in mph per second) of a car and an elapsed driving time in seconds and returns the distance traveled (in feet) by the car. I strongly suggest that you use several helper functions to aid in making your program more readable.

   Hint: Most physics book contain a formula relating acceleration to distance traveled. You may wish to double-check your solution against these inputs:

   (houston-driver-distance 6 5) = 110
   (houston-driver-distance 10 10) = 704

2. (2 pts) **Cartesian Distance**
   In Lab this week, you developed a data definition for points on a plane (a point in two dimensions). Write a program, `distance`, that consumes two points and produces the distance between the two points. Include the data definition for points in your answer. (It can follow the lab lecture.)

   If you need additional information on geometry, consult one of the standard references.

3. (3 pts) **Programs on Lists**
   Write down a data definition for lists of numbers. Now, develop the following programs that consume a list of numbers:

   a) A function `all-positive?` that returns `true` if and only if every number in the list is greater than or equal to zero.

   b) A function `count-positives` that returns the number of positive numbers in the list.

   c) A function `mostly-positive` that returns true if the list contains more positive numbers (≥ 0) than negative numbers (< 0).

4. (2 pts) **Digital Telephone Directory**

Once a year, the local telephone company publishes a directory. For our purposes, the directory is a list of pairs. The pair consists of a symbol, called the <u>key</u>, and a phone number, represented as a number.

a) Write out the data definitions for this simple online phone directory. You should have one data definition for pairs and a second data definition for directories.

b) Write a program `lookup` that consumes a symbol and a phone directory and produces a phone number. The program `lookup` should examine the list for a key that matches the symbol given as input. If it finds a key that matches the input symbol, it returns that phone number. If no matching record is found, it returns zero.

Be sure to create a reasonable set of test data and enter it in the definitions window of DrScheme.

Schemers sometimes call a directory in this form an association list.