COMP 200: Elements of Computer Science
Fall 2004
Homework 2, Due Wednesday, September 15, 2004

Follow the homework guidelines posted on the website

This homework requires you to program using Dr. Scheme. You can find Dr. Scheme on the Owlnet PC and MacIntosh machines. (If you have trouble, contact the laboratory assistants.) Alternatively, you can download Dr. Scheme for your home machine from http://www.drscheme.org.

Follow the design methodology, as outlined in the lecture notes. Hand in your test data, your code from Dr. Scheme (use the Print Definitions option) and the result of testing your code (use the Print Interactions option). You may work with a partner on this assignment, within the guidelines given on the website.

Getting Started with Simple Computation

1. The area of a circle is given by the formula πr^2, where r is the radius of the circle. Design a small program named **Area** that takes as input the radius of a circle and produces as output the circle's area.
2. Consider the area of a washer — a disc with a circular hole in its center. Develop a program named **Washer** that takes two arguments, an outside radius and an inside radius, and produces as output the area of the corresponding washer.
3. A right circular cylinder is defined by two measurements: the radius of its base and its height. Develop a program named **Cylinder** that takes as input the radius of a cylinder's base and its height and produces as output its volume.

Conditionals

4. The graduated income tax applies different tax rates to dollars that you earn, depending on the total number of dollars that you earn in a single year. While the limits move each year, the rules are roughly:
   - 10% tax rate on income up to $7,000
   - 15% tax rate for income between $7,001 and $28,400
   - 25% tax rate for income between $28,401 and $68,800
   - 28% tax rate for income between $68,801 and $143,500
   - 33% tax rate for income between $143,500 and $311,950
   - 35% tax rate for income above $311,950 (>= 311951)

Develop a scheme program Taxes that takes as input a number representing someone's income. Taxes should return the number of dollars that the person would owe, under this set of tax rates.

Note that the tax rate applies to incremental dollars. The first $7,000 of anyone's income is taxed at 10%. The next $21,400 is taxed at 15%, and so on. Your program should return the person's total tax liability.

Structures

5. In class, we defined a structure called ***point*** as

```
; a point is a structure
;   (make-point x y)
;  where x and y are numbers
(define-struct point (x y))
```

   Develop a program, **midpoint,** that takes as arguments two points and produces as a result a point that is the midpoint of the line defined by the two argument points. (The arguments form the endpoint of the line.)