COMP 210, Spring 2000, Homework 0
Due Wednesday, February 2, 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).

1. (3 points) Hand evaluate the following Scheme expressions:
   a) (- (* 3 5) 20)
   b) (* pi (* 10 10))
   c) (+ 73 false)
   d) (* 3 4/3)
   e) (* 14 (2))
   f) (/ 17 0)
   g) (zero? (+ 2 -2))
   h) (and (zero? (- 3 (+ 2 2))) true)
   i) (cond
      ((zero? (sqrt 16)) false)
      (else (+ 3 10)))
   j) Given

```
;; fact:  num -> num
;; Purpose: compute N factorial
(define (fact n)
   (cond
     ((zero? n) 1)
     (else   (* n  (fact (sub1 n))))))
```

   Evaluate the expression

   (fact 4)

2. (3 points) Write the following Scheme programs, following the design methodology carefully. If you do not know, off the top of your head, the appropriate formula, you should consult a geometry textbook or similar reference. (Programs often require specific knowledge about the domain being modeled. This kind of domain-specific knowledge lies outside the scope of COMP 210—or any programming course.)

   Run your programs (in Dr. Scheme) on your test cases (developed following the design methodology) and hand in a printed copy of the work.

   a) The first program, named **Rectangle,** consumes two numbers, a length and a width. Rectangle computes the area of a rectangle with sides specified by length and width. Use the standard geometric formulas.

   b) The second program, named **Area-Under-Walls**, consumes 3 numbers, a length, a width, and a wall. Area-Under-Walls uses length and width as the outside measurements of a room, and wall as the thickness of the room's walls. Given these dimensions, Area-Under-Walls computes the area covered by the room's walls. (Yes, this seems unusual. It should compute that part of the building's floor that is hidden below the walls.)

c) The third program, named **Rectangular-Volume**, consumes 3 numbers, a length, a width, and a height. It computes the volume of a right-rectangular cylinder whose floor and ceiling have dimensions length and width, that is height units tall. (If length, width, and height are interior dimensions of a rectangular room, then Rectangular-Volume is the room's volume.)

3. (4 points) Write Scheme programs for the following conversions between different temperature scales. Follow the design methodology. Reuse programs when possible. Each program consumes a single number. That input argument is interpreted as a temperature in one of three scales—Kelvin, Celsius, or Fahrenheit. The program produces, as output, the equivalent temperature in another scale. Together, the six programs provide the full set of conversions.

    a) **F-to-C**: convert Fahrenheit temperature to Celsius temperature

    b) **C-to-F**: convert Celsius temperature to Fahrenheit temperature

    c) **F-to-K**: convert Fahrenheit temperature to Kelvin temperature

    d) **K-to-F**: convert Kelvin temperature to Fahrenheit temperature

    e) **C-to-K**: convert Celsius temperature to Kelvin temperature

    f) **K-to-C**: convert Kelvin temperature to Celsius temperature

Again, if you need domain-specific knowledge, such as the conversion formula for Kelvin to Celsius, consult standard references.

Run each program in Dr. Scheme on your test data. Hand in a printed copy of your work.