Homework X

1. [15 points]
Louden's Sample language provides only for testing if an expression is greater/less than zero. But this allows us to immediately test e.g., x>y by using the expression x-y. For each of the following conditions write a Sample expression e that accomplishes testing of integer values x and y -- that is, e>0 if the condition is true and e≤0 if the condition is false -- and explain why they work:

(a) x≥y
(b) x=0
(c) x≠0

2. [15 points]
Write a program fragment in Louden's Sample language that reads three integer values and prints out the value of their maximum. Your program should work correctly for positive, negative, and zero values. You should test your program thoroughly using the 'runSample' interpreter, reading three values and writing the value of the maximum, and submit a script showing your results to directory Hwk10 for class c111.

3. [30 points]
Write a program fragment in Louden's Sample language to compute the (integer) cube root c of a given integer value n. That is, c is to be the *ceiling* of $\sqrt[3]{n}$, so $(c-1)^3<n$ and $n\leq c^3$ for all values of n. You should test your program thoroughly using the 'runSample' interpreter, reading a value for n and writing the value for c, and submit a script showing your results to directory Hwk10 for class c111.

4. [40 points]
Use the axiomatic semantics (proof rules) for Sample given by Louden (and reformatted for readability on the class Web page) to prove the program fragment below for computing the integer square root of integer variable n is correct with respect to the given pre/post-conditions.

```
          {n≥1}
    sqrt:= 1;
      while n-sqrt*sqrt do
      sqrt:= sqrt+1
      od
  { sqrt^2≥n /\ (sqrt-1)^2<n }
```