Assignment 1
CSCI 3656
due January 20, 2011

1. Express the following decimal quantities in binary: 26, 3/8, 91, 39/64.
   Now express each as rounded normalized machine numbers with base 2 and 4 bits of precision.

2. Consider a hypothetical computer using base 2 floating point numbers with 9 bits of precision (including the 1 to the left of the binary point, i.e. N=8) and exponent in the range $[-7, 8]$. i.e. numbers have the form $q \times 2^p$ where $1 \leq q < 2$ and $-7 <= p <= 8$.
   a) Give a formula for the smallest positive normalized floating point number.
   b) What is the next floating point number after 1.0 ?
   c) What is the next floating point number after 99.0 ?

3. In IEEE single precision, there are 24 bits of precision, and relative rounding error is 2^{-24}.

   Write a program that assigns the value of 2^{-24} to a variable y and prints it out. Next, in single precision, make the assignment $x = 1.0 + k * y$ for $k = 0, .., 6$, and print the variable x each time.
   a) Explain why you get only 4 different numbers.
   b) Explain why you get the same result for $k = 3$ and $k = 4$.

   Turn in a listing of your program and its output, along with your answers. You should declare variables y and x as single precision (float). Print out about 20 digits of each output quantity. To print out 20 digits of a variable z in c++, a cout statement could look like this:

```
cout << setprecision(20) <<z<<endl;
```

   Alternatively, you could print x in a binary format.

Guidelines for Homework Assignments

We will be having homework assignments approximately weekly. You may discuss homework orally among yourselves, but what you hand in should be your own work. I will accept late homework for up to 5 calendar days. Points will be deducted for each day late.

On all computer assignments, unless otherwise indicated, you should turn in your program listing and your output, clearly labelled.