Project 2 due week of February 2. You must make an appointment to visit my office during the week of Feb. 2 (or earlier), at a mutually agreeable time, in order to demonstrate the programming part of this project for me.

1. The IEEE single precision format is,

$$(-1)^s 2^{c-127}(1+f), \tag{1}$$

where c is 8 bits and f is 23 bits. Convert the following numbers to IEEE single precision format (note: calculating the 10 most significant binary digits of f is sufficient; it is not necessary to calculate all 23 digits):

$$452 \qquad 0.00321 \qquad -21.66$$

2. Let,

$$N(h) = \frac{\ln(x+1+h) - \ln(x+1)}{h}, \tag{2}$$

where x is a constant.

a. find

$$\lim_{h\to 0} N(h) \tag{3}$$

b. use 3 digit chopping arithmetic to evaluate $N(0.01)$ when $x = 1.0$.

c. replace the numerator of (2) with its third order Taylor series, expanded about $h_0 = 0$, simplify the resulting overall fraction, and then repeat part (b).

d. The "actual" value for $N(0.01)$, when $x = 1.0$, is $N(0.01) = 0.4987541511$. Find the relative error for the values obtained in parts (b) and (c).

3. Let,

$$M(h) = \frac{\sqrt{x+h} - \sqrt{x}}{h}, \tag{4}$$

where x is a constant.

a. find

$$\lim_{h\to 0} M(h). \tag{5}$$

Assume $x > 0$.

b. Write a computer program that outputs h, $M(h)$, and $M(0)$ to the screen for $h = 10^{-n}$, $n = 1, 2, 3, \ldots, 20$. Assume $x = 1$. $M(0)$ is $\lim_{h\to 0} M(h)$. Also, your program should output $\log(h)$ and $\log(|M(h) - M(0)|)$ for each line item, to a file. Plot the data from the file. Your program should be configurable so that if a flag is set one way, then all floating point arithmetic is single precision, and if the flag is set another way, then all floating point arithmetic is double precision. From the results predict the precision of your computers' floating point arithmetic.