

**Computer Science/Mathematics 451.1**  
**Assignment One**  
**Due 10 September 2007**

1. Give algorithms to compute

(a)  $f(x) = x^{-2}(1 - \cos x)$

(b)  $f(x) = x - \sin x$

for  $x$  near zero.

2. Given the equation  $x^2 - 40 * x + 1 = 0$ , find its roots to five significant digits using five digit decimal arithmetic. Use  $\sqrt{399} \approx 19.975$ , correctly rounded to five digits. [Hint: Scale the 2 out of the numerator and denominator.]
3. Consider the expression

$$f(x) = \sqrt{1 - x^2} - \sqrt{1 + x^2}.$$

Rearrange  $f(x)$  in a manner so that it will be computed accurately for small  $x$ . Give a good approximate value for  $f(10^{-7})$ . At about what value of  $x$  will your algorithm produce  $f(x) = 0$  due to underflow in single precision IEEE arithmetic?

4. Exercise 2, p. 7 of Turner.
5. Exercise 1, p. 19 of Turner. Do only symmetric rounding (a correctly rounded result).