Phys 205 – Computational Physics, Fall 2003
Homework #1

Due Date: Friday Sep 12, 5pm

Notes:
• Submit your homeworks (programs in C, sample output files, and files with explanations) using the turnin program on faraday.physics.arizona.edu
• Homework problems will get full credit only if: (a) the C programs compile successfully, (b) the programs have self-explanatory comments and variable names, and (c) the programs have proper indentation.
• No credit will be give to late homeworks.

The aim of this first homework set is to help you get comfortable with writing your own C programs and also demonstrate some limitations of numerical calculations.

1. Range of floating point numbers
Write a program that computes and prints successive powers of 2, with the exponent ranging from 1 to 1000. Use only variables of type float (i.e., single precision) in your program and find out the largest number that can be accommodated in this type. Can you think of any physical quantity that might be larger than this number?

2. Loops in C
Write a program that calculates the factorial of a number, i.e., N!. What is the largest number, the factorial of which you can calculate? Hint: Use only variables of type float to avoid unnecessary complications.

3. Approximate forms of functions
The sine of an angle can be approximated by the Taylor series
\[
\sin x \simeq x - \frac{x^3}{3!} + \frac{x^5}{5!} + \ldots + (-1)^{n+1} \frac{x^{2n-1}}{(2n-1)!} + \ldots ,
\]
where the angle x is in radians. Write a program that calculates the approximate sine of an angle using only the first n terms and then compares it with the sine of the angle calculated using the function sin of C. How many terms do you need in order for the two results to be the same in 5 significant digits, for an angle of 1 degree? How about for 60 degrees? Hint: Convert the program that you wrote earlier for the factorial into a function and include it in the current program; also pay attention to the units!