Question (1): (25-points) (a) Write, compile and run a C/C++ program which generates a table of error function (erf) and its derivatives for real arguments (z) between -3 and 3 in steps of 0.25. The error function is defined by the equation below (but is rarely evaluated by performing the integration).

$$\operatorname{erf}(z) \equiv \frac{2}{\sqrt{\pi}} \int_0^z e^{-t^2}\, dt.$$

(see http://mathworld.wolfram.com/Erf.html for information the error function)
The values in the table should be given with 5 decimal places. The table should have headers explaining what the columns are. Explain how you designed the program and give an example of the output.
(b) How would you change this program if 10 significant digits were required?
C/C++ source code should also be supplied

Question (2): (25-points).
Write a program that reads your name in the form <first name> <middle name> <last name> and outputs the last name first and adds a comma after the name, the first name, and initial of your middle name with a period after the middle initial. If the names start with lower case letters, then these should be capitalized. The program should not be specific to the lengths of your name (ie., the program should work with anyone's name.
As an example. An input of
thomas abram herring
would generate:
Herring, Thomas A.
Hints:
You might look for toupper and tolower as part of the ctype.h header file.

Question (3): (50-points) Write a C/C++ program that will compute the motion of a bicyclist and the energy used cycling along an oscillating, sloped straight-line path.   The path followed will be expressed as

$$H(x) = Sx + A\sin(2\pi x / \lambda) + B\cos(2\pi x / \lambda)$$

where *H(x)* is the height of the path above the starting height, *S* is a slope in m/m, *A* and *B* are amplitudes of sinusoidal oscillations in the path. The wavelength of the oscillations is λ. The forces acting on the bicycle are:

$$\text{Wind Drag} \quad F_d = 1/2 A_r C_d \rho V^2$$

$$\text{Rolling Drag} \quad F_r = M_r g C_r$$

where A_r is the cross-sectional area of the rider, C_d is the drag coefficient, r is the density of air and V is the velocity of the bike. For the rolling drag, M_r is the mass of the rider and bike, g is gravitation acceleration and C_r is rolling drag coefficient.

The bicyclist puts power into the bike by pedaling. The force generated by this power is given by

$$\text{Rider force} \quad F_r = P_r / V$$

where F_r is the force produced by the rider, P_r is power used by the rider and V is velocity that the bike is traveling (the force is assumed to act along the velocity vector of the bike). Your program can assume that the power can be used at different rates along the path. The energy used will be the integrated power supplied by the rider. Assume that there is maximum value to the rider force.

Your code should allow for input of the constants above (path and force coefficients). The program can assume a constant power scenario and constant force at low velocities.

As a test of your program use the following constants to compute:
   (a) Time to travel and energy used to travel 10 km along a path specified by
        S=0.001, A=5.0 m, B=0.0 m and λ= 2km, with constant power use of P_r
        =100Watts and a maximum force available of 20N.
   (b) The position and velocity of the bike tabulated at a 100-second interval.
Assume the following values

C_d = 0.9

C_r = 0.007

A_r = 0.67 m^2
r = 1.226 km/m^3
g = 9.8 m/s^2
M_r = 80 kg

Your answer to this question should include:
   (a) The algorithms used and the design of your program
   (b) The C/C++ program source code (I will compile and run your programs).
   (c) The results from the test case above.

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