PHYS-4007/5007: Computational Physics
Problem Set 1 (Due: 14 September 2011)

1. (20 pts) Write a program in both Fortran 77 and IDL that does the following:

   - Asks the user to enter their name (first and last in that order) and year-of-birth (as a four-digit number).
   - Calculates the square of their year-of-birth and the square-root of their year-of-birth.
   - Prints their name, year-of-birth, year-of-birth squared, and the square-root of their year-of-birth to the screen in the format:

     Last Name, First Name: nnnn n.nnnEee nn.nnn

     where year-of-birth is printed as a four-digit integer, year-of-birth squared is printed in scientific notation, and the square-root of year-of-birth as a real number in floating point notation. Make sure that the ':' mark appears after the name and before the numbers. For example, for me the output would look like:

     Luttermoser, Donald: 1957 3.830E06 44.238

2. (30 pts) Write a code in IDL that calculates the maximum height obtained ($y_{\max}$), down range distance ($x_{\max}$), and total time of flight (T) for a projectile launched with an initial velocity $v_\circ$ and projection angle $\theta_\circ$ in degrees. Your code should request the user to input both $v_\circ$ and $\theta_\circ$ and output $y_{\max}$, $x_{\max}$, and T with no more than 4 significant digits after the decimal point. Assume the projectile is launched from ground level and ignore air resistance and the Earth's spin. (*Hint*: Don't forget that trigonometric functions in IDL require the angle to be in radians. Useful system variables one can use include !PI, !RADEG, and !DTOR.)

3. (20 pts) Write a code in IDL that makes two plots to the screen: (a) Show the sine of a ten-thousand element array ranging from 0, 0.1, 0.2, 0.3, ..., to 999.9 radians. Make sure that you label the axes appropriately (*i.e.*, '$\sin(x/10)$' for the y axis and 'x' for the x-axis label). (b) Now show a plot of the function $y = \sin(n\pi/10) * \exp(-n/300)$, where n is a 1001 element array ranging from 0 to 1000. Make sure you label the axes following the protocol mentioned in (a). (*Hint*: Useful IDL functions and commands to use include FINDGEN, SIN, and PLOT. Note that !PI is the single-precision system variable for π.)

You do not need to write anything on paper for this assignment. Just email your Fortran 77 and IDL codes (as attachments) to me at **lutter@etsu.edu** by the due date listed above.