ESCI7205 hw9

**Due Tu., Nov 1, 2011.**

If you have any questions about exactly what you need to do, please contact me ASAP.

1) Using the numbers N (number between 3 and 10) and M (multiple of N between 100 and 500) you picked in class, use the Matlab function **rand** to make a vector with M random numbers. Use the Matlab **reshape** command to turn this vector into a matrix with N columns and the appropriate number of rows. Save this matrix into a file.

Write a vectorized (no loops allowed) Matlab program to calculate the average and the standard deviation of each column of the matrix you made in the first part. Read this matrix in from the file you made above. Your code should not depend on referencing the number of rows or columns explicitly (you “don't know” what the values are, use Matlab to calculate the values you need) or typing anything repeatedly some number of times.

Do not use the Matlab routines **mean** or **std** for the mean and standard deviation respectively, use the mathematical formulas for the mean

m= **sum**(x)/M,

where M is the number of points. You can use the Matlab **sum** command

and for the standard deviation

s=**sqrt**((**sum**(x-xave)^2)/M),

where M is either the number of points for the standard deviation or the number of points minus 1 for the bias free standard deviation. You can also use the matlab **sqrt** command.

We have seen a number ways to do this in a vectorized fashion in class. Comment **each line** of your code telling me why/what you are doing on that line. Pick one of the methods and be sure to explain what you are doing. Since there are more students than methods, there will be some common choices, but everyone should not pick the same method.

We are trying to learn how to vectorize here. Part of vectorizing is figuring out how to combine things that are initially the “wrong” sizes. We are also trying to get all the “meta-data” that we need (number of rows, columns, etc.) from the data structures holding the data so we don’t have to know those values explicitly or repeat writing code. Your code should still work for example if I give it a matrix with a different number of rows or columns.

2) This is a short exercise for Matlab. Vectorize the code – no loops. The vectorization in this case can make the code so it is easier to understand.

Calculate and plot the acceleration of gravity, g(r), from r=0 to r=4Re, for a planet that consists of a core and mantle (use radii of Rc =3480 km for the core and Re =6371 km for the planet, and densities of 11.5 g/cm3 for the core and 5 g/cm3 for the mantle). Compare the qualitative results from this planet to g(r) for the earth.

There are a number of ways to do this vectorization. Explain how you vectorized your code (this will include something on the math and something on how you will do the calculation with the data describing the earth).

Comment **each line** of your code telling me why/what you are doing on that line.

Useful information: G=6.6726 10-11 Nm2kg-2.

Acceleration of gravity as a function of radius **inside** a sphere of **uniform** density  : .

Acceleration of gravity as a function of distance **outside** a sphere of mass M: .

 and  are the masses as a function of radius when inside, and the total mass, when outside the earth.

The volume of a sphere is .

Ave dens whole earth 5.5 g/cm3.