CSCI 2202 Computer Modelling for Scientists
Lab A   Due: 11 Mar 2021

- **Reading Data Files:**
- **Fitting Regression Lines to data**

(1) Write a function `readDatFile(inFile)` to read in the coffee cooling data. The function should take a *filename* as a parameter (input by the user) and should return the `numpy arrays` x, y containing the data.

(2) **Using Regression to Determine Model Parameters:**

(a) The file `coffeeCooling.txt` alongside, holds the `time, Temp` data for coffee cooling. Create a program that reads the data from the file and using `matplotlib.pyplot` To scatter-plot the data. Use the `pyplot` functions `xlabel( ), ylabel( )` to label the axes approriately.

(b) A model of coffee cooling in a room at $T_0 = 22^oC$ is:
$\Delta T = T_{n+1} - T_n = -k(T_n - T_0)$. Use the function `scipy.stats.linregress(x,y)` (usage: `slope, intercept, r_value, p_value, std_err = stats.linregress(x,y)`), to make a fit of the coffee data given above. Make a plot of the regression line fit, superposed on a scatter plot of ΔT_n v/s $T_n - T_0$.

(3) **Fitting a Power Law Function** Small nanoparticles of soot suspended in water start to aggregate when salt is added. The average radius r of the aggregates is predicted to grow as a power law in time t according to the equation $r = r_0 t^n$. (The data is in the file `sootAggregation.txt`. The columns are: *time (mins)*, *Avg. Radius (nm)*, *Uncertainty in Radius (nm)*). Taking the logarithm of this equation gives $\ln r = n \ln t + \ln r_0$. Thus the data should fall on a straight line if $\ln r$ is plotted vs $\ln t$. Fit a regression line to the data using $\ln r = n \ln t + \ln r_0$ and find values for n and r_0.