**Coding in advance of the Feb 18, 2019 class**

Suppose that you have a two-column file. Each row of the file represents a different bin of data. The first column of the file gives the expected number of counts in the bin, in the model you are using; thus in this column you have positive real numbers. The second column of the file gives the observed number of counts in the bin; this in this column you have non-negative integers.

a. Recall that only *differences* between log likelihoods matter in Bayesian analyses. With that in mind, write a code that computes the log of the Poisson likelihood without the factorial of the number of observed counts in each bin, i.e.,

$$\ln \mathcal{L} = \ln \left[ \prod_i m_i^{d_i} e^{-m_i} \right] \tag{1}$$

for the data set given the model. Here the index $i$ runs over all the bins in your sample, $m_i$ is the model expected number of counts in bin $i$, and $d_i$ is the observed number of counts.

b. Write a code that computes the chi squared correctly, using the model variance. That is,

$$\chi^2 = \sum_i \frac{(d_i - m_i)^2}{m_i} \ . \tag{2}$$

c. Write a code that computes the chi squared in the fashion often employed in astronomy, using the data variance:

$$\chi^2 = \sum_i \frac{(d_i - m_i)^2}{d_i} \ . \tag{3}$$

Run all three of your codes on the data set data4_1.txt provided on the website. What answers do you get?

By the way, it will be important for you to use your $\chi^2$ and $\ln \mathcal{L}$ codes in other codes, so please write them as easily-incorporated subroutines (where the inputs are the data vector $d_i$ and the model vector $m_i$).