AST 475/875 Homework #1

Due Th, Aug 26th in class

You make an observation with a radio telescope. Your data is some event that consists of a single measured flux density f (to appease Prof. Hartmann we'll use units of Crabs!). Based on some knowledge of the instrument (let's say), you can model a data event as being distributed in a Gaussian fashion around the true flux density S with some variance σ^2. Let's say that a large body of previous work seems to have demonstrated the *a priori* number distribution of sources that you are looking at, and it is a power law in S

$$N(s) \propto CS^{-5/2}$$

where C is some normalization constant. If the noise level of your measurements is σ=1 Crab and your measurements are (in order): 2, 1.3, 3.0, 1.5, 2.0, and 1.8 Crab, then plot the relative probability densities (i.e. the posterior probability distribution for flux density S) for the true S of your source as a function of S after a) the first 2, b) the first 4, and c) the first 6 of your measurements.

Additional Info:

- Let us plot the posterior probabilities as a function of S on a single graph
- Let us restrict the S range to 1-3.5 Crabs
- Make sure in your numerical calculations that you do not sample the distribution too coarsely (i.e., if you're only connecting 2-10 points together for each curve, you probably need more)
- Lump all constants together, and normalize the relative posterior probabilities to of order 10^0 in the region where near-likely S value resides.
- Note or recall that for a Gaussian distribution characterized by a mean and most probable value μ and by variance σ^2:

$$prob(x) = \frac{1}{\sigma\sqrt{2\pi}} \exp\left[-\frac{1}{2\sigma^2}(x-\mu)^2\right]$$