Lecture 3 problems

1. Consider the fit of a model to some data with $\nu = 30$ degrees of freedom. If the minimum χ^2 of the fit is (a) 37.5 and (b) 52.1, what is the probability (p-value) of obtaining these values of χ^2 or higher if the model is correct?

2. See the following data file, which lists measurements $y_i \pm \Delta y_i$ for a series of variables x_i:

   http://astronomy.swin.edu.au/~cblake/modelfit.dat

   Consider fitting a model $y = ax + b$ to this dataset with parameters (a, b).

   (a) What is the minimum value of χ^2 and best-fitting values of a and b? Assess the goodness-of-fit of the model.

   (b) By constructing a plot of contours of constant χ^2 in the 2D parameter space (a, b), determine 68.27%, 95.45% and 99.73% joint confidence regions for the parameters a and b.

   (c) What is the correlation coefficient of a and b?

   (d) Determine the marginalized 1D probability distribution for a and b, and calculate the marginalized 68% confidence intervals.

   Consider a fit of the model $y = b$ to this dataset.

   (e) What is the minimum value of χ^2 and best-fitting value of b? Assess the goodness-of-fit of the model.

   (f) Use the Akaike information criterion to assess whether the data support the addition of the extra parameter a.