PH 4130/PH 6130 Assignment 6

Deadline **9** March 2018 before **17:00 hrs**
Please show the source code for each of the problems.

1. In 1919, two expeditions sailed from Britain to test if the light deflection from stars agrees with Einstein's General Theory of Relativity. Einstein's theory predicts a value of 1.74 arc-seconds, whereas Newtonian gravity predicts a value exactly half of that. The team by Eddington obtained a value of 1.61 ± 0.40 arc-seconds, while the team by Crommelin reported a value of 1.98 ± 0.16 arc-seconds. Calculate the Bayes factor between General Relativity and Newtonian gravity from those data, assuming Gaussian likelihoods. (10 points)
   (For more information about these expeditions and associated controversies, check out arXiv:0709.0685)

2. For exercise 1 in arXiv:1008.4686, calculate the 68% and 95% joint confidence intervals on b and m.
   (Hint : Either use `emcee` followed by `plot_mcmc` code in `astroML.plotting` or use the `corner` module. Alternately, use the techniques of linear algebra and using the example shown in class during the discussion on frequentist analysis) (20 points)

3. Fit the data in Table 1 of arXiv:1008.4686 to a straight line, after including all the data points, (after ignoring σ_x and ρ_{xy}) using both maximum likelihood analysis and using a Bayesian analysis to identify the outliers, using the same procedure as in the second of Jake VanDerPlas blog article. Show graphically the best fit line using both maximum likelihood analysis and also using Bayesian analysis, including the outlier points. (30 points)