EP 4130/PH 6130 Assignment 3

Deadline **30** January 2023 before **23:59 hrs**

First two problems have equal weightage of 25 points each. Last problem has a weightage of 10 points. Please show the source code used for each of the problems.

1. In class, we showed histograms of standard deviation and σ_G of bootstrap samples drawn from a Gaussian distribution with mean equal to 0 and standard deviation equal to 1. Draw a similar histogram of median of 10,000 bootstrap samples drawn from the same Gaussian distribution. According to `http://tinyurl.com/h6p43o8`, the standard deviation of the sample median of a Gaussian distribution is equal to $\sqrt{\frac{\pi}{2n}}$. Overlay a Gaussian distribution on top of the histogram with mean equal to the mean of the generated data sample and standard deviation equal to the standard deviation of the median (Hint: Look up `astroML.stats.median_sigmaG`. Also note that you don't have to draw 10,000 histograms, but only one histogram consisting of 10,000 bootstrap resamples.)

2. arXiv:1008.4686, Exercise 1 on Page 5, except the last sentence of the question related to σ_m^2. (Hint : Use χ^2 minimization to obtain best-fit values of b and m, instead of linear algebra. You can look up `curve_fit` function in scipy.)

3. Calculate the p-value for the four chi-square values for the plot shown in class from astroMl book which can be found at `https://www.astroml.org/book_figures_1ed/chapter4/fig_chi2_eval.html`.
(Hint : You can read off the χ^2 values from the graph by multiplying by D.O.F.)