PH 4130/PH 6130 Assignment 1

Deadline **24** January 2018 before **17:00 hrs**

All problems (Except the last) have equal weightage of 10 points each. The last problem has 20 points. Please show the source code used for each of the problems.

1. Consider the joint probability density for two continuous variables x and y given by :

$$f(x,y) = \begin{cases} x+y & 0 \leq x \leq 1; 0 \leq y \leq 1 \\ 0 & \text{otherwise} \end{cases}$$

   Calculate the marginal pdf $f(x)$ and $f(y)$ as well as the conditional probabilities $f(x|y=0.2)$ and $f(x|y=0.4)$. With these marginal probabilities create a plot analogous to the book figure 3.2, which was also shown in class.

2. Create 1000 draws from a normal distribution of mean of 1.5 and standard deviation of 0.5. Plot the pdf. Calculate the sample mean, variance, skewness and kurtosis of these samples.

3. Plot a Cauchy distribution with μ=0 and γ=1.5 superposed on the top of a Gaussian distribution with μ=0 and σ=1.5. Use two different line styles to distinguish between the Gaussan and Cauchy distribution on the plot and also indicate these in the legends.

4. The following were the measurements of mean lifetime of K meson (as of 1990) (in units of 10^{-10} s) :
   $0.8920 \pm 0.00044; 0.881 \pm 0.009; 0.8913 \pm 0.00032; 0.9837 \pm 0.00048; 0.8958 \pm 0.00045$. Calculate the weighted mean lifetime and uncertainty of the mean.

5. Download the eccentricity distribution of exoplanets from the exoplanet catalog `http://exoplanet.eu/catalog/`. Look for the column titled e, which denotes the eccentricity. Draw the histogram of this distribution. Then redraw the same histogram after Gaussianizing the distribution using Box-transformation either using `scipy.stats.boxcox` or from first principles using the equations shown in class or in arXiv:1508.00931