Ast 8110 (LSS & GL)
Fall 2022
Problem Set #1 (due Thursday September 22)

Given a distribution of galaxies on the 2D sky calculate their auto-correlation function using three different estimators. The bin size for your correltion function should be *at most* 5 length units. The boundaries of the region populated by galaxies is defined by the coordinates of the lower left and upper right points: $(-90, -80)$ and $(80, 90)$.

Generate between 10-30 random galaxy positions for every real galaxy (remembering to normalize by that number when calculating correlation functions). Calculate the correlation function for every one of the 3 estimators below. To calculate the uncertainty in your estimator, repeat the above experiment 10-30 times, and calculate the rms dispersion in $w(\theta)$ in every θ bin, for each of the 3 estimators.

(a) $w(\theta) = \frac{\langle DD(\theta) \rangle}{\langle RR(\theta) \rangle} - 1$

(b) $w(\theta) = \frac{\langle DD(\theta) \rangle}{\langle DR(\theta) \rangle} - 1$

(c) $w(\theta) = \frac{\langle DD(\theta) \rangle - \langle 2DR(\theta) \rangle + \langle RR(\theta) \rangle}{\langle RR(\theta) \rangle}$

For each of the 3 parts above, plot the correlation function and associated uncertainties.

!b