STARFISH SCHOOL

A Virtual Bootcamp for Astronomy Graduate Students

WEEK 3 EXERCISES

Version 2.0

Exercise 1 (Optional)

1. Plot the PDF for the χ^2 distribution, for different values of the degrees of freedom (N) of that distribution.
2. Compare this to the normal distribution.
3. What do you notice about the two distributions?
4. Now compare the normal distribution to the log normal distribution for a range of values of the mean and variance. How do the mean and variance of the log normal distribution map onto the mean, variance of the normal distribution?

Exercise 2

1. Use the accept-reject approach to transform numbers generated from a uniform distribution into those following the distribution P(x) = (1/(e-1))exp(x) for 0<x<1 and 0 elsewhere
    a. Draw two random samples x*, y* from the U(0,1) distribution
    b. If y* < *c* f(x*), keep x* [remember the normalization *c* here]
    c. If not, draw another two random samples from the distribution
    d. Continue until you have 100 samples
    e. Histogram the samples and over plot the PDF

2. Use CDF sampling to do the same thing above.
    a. To do this, compute the CDF F(X) by integrating the PDF P(x) from -∞ to X
    b. Then find the inverse $F^{-1}(X)$of the CDF.
    [HINT: Remember an inverse function $F^{-1}(x)$ is such that $F(F^{-1}(x)) = x$]
    c. Draw a random samples x_1 from the U(0,1) distribution
    d. Then the variable $y = F^{-1}(x_1)$ will have the probability distribution you seek
    e. Continue until you have 100 samples
    f. Histogram the samples and over plot the PDF