STARFISH SCHOOL

A Virtual Bootcamp for Astronomy Graduate Students

SESSION 5 EXERCISES

Version 3.1

Exercise 1

1. Generate a random variable follow a **uniform distribution** between 0 and 50
2. Generate a random variable follow a **normal distribution** with mean = 100 and standard deviation of 50
3. 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

4. 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 $-\infty$ 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