STARFISH SCHOOL

A Virtual Bootcamp for Astronomy Graduate Students

SESSION 2 EXERCISES

Version 3.0

Exercise 1

1. Write a function (in Python and R) that takes your height as input (L_0) and computes your height **L** if you were travelling at **v=0.3c**.

   You may need to know the following equations for Lorentz contraction:

$$L = L_0 \,/\, \gamma(v)$$

$$\gamma(v) \equiv \frac{1}{\sqrt{1 - {v^2}/{c^2}}}$$

Exercise 2

1. Generate 100 random numbers from a Gaussian distribution
2. Generate 100 000 random numbers from a Gaussian distribution and show that they are much better approximated by a Gaussian distribution (i.e., plot a Gaussian curve).
   HINT: In R, look up `?rnorm`

   The following equation may be useful to you for a Gaussian distribution:

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2}$$

Group Exercise

1. In Python

    a. Read in the data from the data file A provided
    b. Change the precision of the data file (reduce the floating point precision to 1 decimal place, or make them integers)
    c. Apply a 50% Gaussian scatter to the data points
    d. Make a plot of your data and save it to file B
    e. Save the data to a text file

2. In R

    a. Read in that text file B that you saved in the step above
    b. Compute the summary statistics of the data
    c. Plot the data
    d. Plot the five number summary statistics (hint: look up `?boxplot`)
    e. Read in the original data file A used in the step above
    f. Compare the summary statistics of the A data with the B data
    g. Make a plot and save it to file
    h. Save original data A to file with increased precision