# ERV-5086

# Assignment 3

Use the manual “Risk Analysis in the Earth Sciences: A Lab Manual with Exercises in R” Version 3, which is in a module on your Canvas page, for the following readings and exercises. (Version 1.2 is available from Leanpub at <https://leanpub.com/raes>, but the page numbers and some details are different)

***Reading***

Read the Introductory chapter starting on Page 9.

## Exercise 1

Complete the exercise on Page 22. You do not need to use Swirl and you can either change your Colabs Runtime to R or figure out how to do the equivalent script in Python.

In addition to the histogram with mean = 5 and standard deviation = 2, produce a histogram (also based on 104 samples) with mean 0 and standard deviation 1 (the **standard** normal distribution). Finally, produce a histogram for just 10 samples from the standard normal distribution. Describe and discuss the differences in the histograms and the reasons for the differences in your writeup.

Use the formula for the Normal Distribution on Wikipedia (<https://en.wikipedia.org/wiki/Normal_distribution>) and plot it.

Here’s some R code:

a <- seq(-3,3, length.out = 100)

plot(a,1/(sqrt(2\*3.14))\*exp(-(a^2)), col = "red")

It’s fine to do this in Python if you prefer. Compare and contrast with your histograms above.

## Exercise 2

Complete the exercise on Page 32. Answer Question 1 on Page 32. Include code to compute the rates of change (for example *dT/dt* as a finite difference *[T(t+t) - T(t)]/ [t+t – t]* for the rate of temperature change with time discussed in Question 3 on Page 33). Plot the rates with the same time axes as the original data either on the same graph (with a separate y-axis for the rate) or as two graphs with the time axes vertically aligned so that the original data series and the rate curves can be easily compared. You don’t have to look up last ice age and preindustrial data. Describe and discuss the results.

## Exercise 3

Use the Tutorial beginning on Page 36 to implement the Galton Board.

If you are using R in Google Colabs, you might need the following code:

system("apt-get update -y")

system("apt-get install -y libmagick++-dev")

install.packages("magick")

library(magick)

install.packages("animation") # downloads the animation package from CRAN

require("animation") # loads the animation package.

Discuss your observations.

## Exercise 4

From Page 41: Generate histograms and Q-Q plots for two built-in data sets in R,

1. the waiting time between Old Faithful eruptions (faithful[, 2]), and

2. the sepal length of setosa irises on the Gaspe Peninsula (iris3[, 1, 1]).

Discuss your observations.