Terms, topics, or concepts you should be familiar with:

p-value
frequentist vs Bayesian approaches
Bayes theorem
reproducibility crisis
statistic
parameter
continuous variable
discrete variable
nominal variable
ordinal variable
experimental vs observational studies
μ
σ
$\bar{Y}$
s
blinding
pseudoreplication
biological vs technical replicates
outliers
confounding variables
common faults in plots
sample
population
transformation
parametric
non-parametric
interaction
MCMC

R skills you should have

Create matrices, vectors, dataframes, and lists
Subset each of these objects
Read and write csv files
Make a high quality plot of 1, 2, or 3 variables that have a mix of continuous and discrete values
Perform a permutation or Monte Carlo test
Perform and correctly interpret the statistical tests mentioned below

R functions you should handle with ease:

binom.test
chisq.test
t.test (single sample, two sample, paired)
aov
lm
glm
for
if
sample
ways of testing values > < >= ! == etc.

Example Problems

Download the newts.repro.csv data from the website. This file contains data for matings of male newts it has their tank number, length, mass, number of mates and number of offspring. What are the important predictor(s) of offspring number?

Download the gnatocerus.male.csv data from the website this contains information on the horn size, body size, number of matings, and grandchildren of each beetle. Describe how body size effects horn size. What is the best predictor of number of grandchildren and number of mates?

Download the hiC.data.csv file from the course website. This file contains contact and size information for all chromosomes in a rattlesnake genome. Contacts are the data that we get from Hi-C sequencing and describe the fact that two pieces of DNA were close together spatially in a nucleus of a cell. Chromosomes can be divided into macro and micro based on their sizes these are indicated with the code “ma” or “mi” respectively. The columns of this dataset show in order:

chrom1	chrom2	types	chrom1.c	chrom2.c	contacts	chrom1.s	chrom2.s
First contact chromosome	Second contact chromosome	Ma and mi code identifying the types of chromosomes	Total contacts on first chromosome	Total contacts on second chromosome	Contacts for this pair	Size of chromosome one	Size of chromosome two

Use a method of your choice to decide whether or not micro chromosome have a different number of contacts with other chromosomes than you expect by chance. A good starting place to think about this might be that the number of contacts a chromosome has is a function of its size.