**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

blinding

pseudoreplication

biological vs technical replicates

confounding variables

common faults in plots

sample

population

transformation

parametric

non-parametric

**R skills you should have**

Create matrices and vectors

Subset a dataframe or matrix to select only specific rows or columns

Subset a vector to select only specific elements

Read a csv file to import data

Make a basic plot of 1, 2, or 3 variables that have a mix of continuous and discrete values

Perform the statistical tests mentioned below

**Tests you should be able to run**

Binomial

Chi-square

T-test (single sample, two sample, paired)

Anova

Permutation

**Example Problems**

You flip a coin 235 times you get heads 269 times you get tails.

Does this dataset provide support for this being a fair coin? \_\_\_\_\_\_\_\_\_\_\_

What test did you use? \_\_\_\_\_\_\_\_\_\_\_

What p-value was associated with this test? \_\_\_\_\_\_\_\_\_\_\_

You measure height of students at the MSC and the gym. Are the heights you measured significantly different

MSC: 126, 164, 148, 120, 178, 183

Gym: 151, 109, 151, 174, 118, 136

What test did you use for this question? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

What p-value was associated with this test? \_\_\_\_\_\_\_\_\_\_\_\_\_

What do you infer from your test? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

You grow plants with three different potting soils and measure height at 21 days does your data support any difference in the growth with these soils.

Soil1: 23, 12, 45, 23, 21, 45, 21

Soil2: 35, 45, 21, 34, 67, 23, 16

Soil3: 16, 21, 18, 33, 16, 21, 19

Stickleback fish occur in deep water and shallow water populations. These populations rarely interbreed. It has been hypothesized that these fish have genetic adaptations to their habitat. To test this you grow fish from both strains in both deep and shallow water. Does the data below support the hypothesis that these fish are adapted to their natural habitat? The values in the table are fitnesses for fish in your experiment

|  |  |  |
| --- | --- | --- |
|  | Deep water habitat | Shallow water habitat |
| Deep water fish | .97, .78, .99, .87, .91, .89 | .61, .87,.88, .78, .80, .37 |
| Shallow water fish | .56, .95,.73, .81, .89, .64 | .77, .95,.93, .95, .89, .94 |