PRACTICE MIDTERM ONE
Introduction to Evolution and Scientific Inquiry
Instructor: Dr. Spielman

NOTE: On a real exam you can expect 1-2 additional questions.

Question 1

For each of the following alternative hypothesis, do the following:
- State whether the hypothesis is directional or nondirectional.
- <u>In a single complete sentence</u>, write the appropriate corresponding <u>null hypothesis</u>.
- <u>State</u> if the hypothesis is scientific, i.e. testable and falsifiable. You need to only write yes/no for "scientific," not testable/falsifiable each.

a. Hawks prefer to eat rabbits over mice.

Directional
Null: Hawks have no prefer to eat rabbits or mice
Yes, scientific and testable

b. The Great Sphinx of Giza was built by ancient aliens who visited Earth.

Nondirectional
Null: Ancient aliens had no effect on the construction of the Great Sphinx of Giza.
NOT scientific and testable

c. The amount of nitrogen in the soil affects the growth rate of oak trees.

Nondirectional
Null: Amount of nitrogen in the soil has no effect on growth rate of oak trees.
Yes, scientific and testable

d. Diets high in sugary foods increase the risk for adult onset diabetes.

Directional
Null: Diets high in sugary foods decrease the risk for adult onset diabetes
Yes, scientific and testable

Question 2

Consider the following scenario: Researchers tested whether eating different types of protein has an effect on chicken weight. They collected 578 baby chicks and randomly placed them into four groups receiving different feeds: one group received the standard chicken feed, and groups 2-4 each received their feed supplemented with a different protein source ("Protein1", "Protein2", or "Protein3"). Researchers measured the weight of chickens in grams after two weeks of feeding on different diets.

a. What is the <u>alternative</u> hypothesis for this experiment?

Type of protein in feed affects chicken weight.

b. What is the <u>null</u> hypothesis for this experiment?

Type of protein in feed has no effect on chicken weight.

c. What is the <u>independent variable</u> for this experiment? Is this variable <u>categorical</u> or <u>quantitative</u>? If quantitative, is it <u>discrete</u> or <u>continuous</u>?
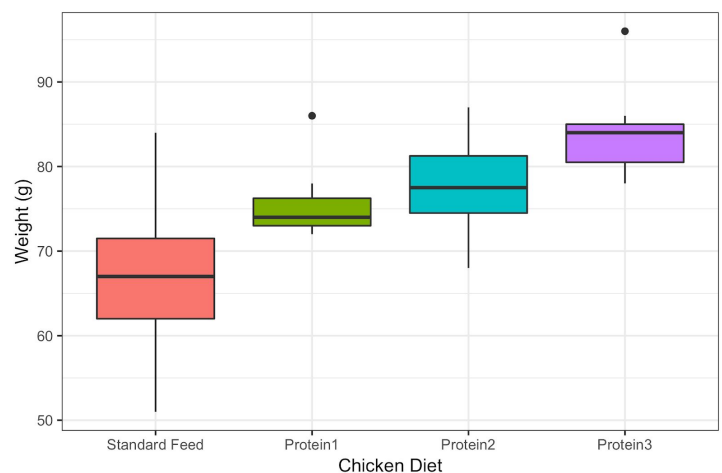
Protein type
Categorical

d. What is the <u>dependent variable</u> for this experiment? Is this variable <u>categorical</u> or <u>quantitative</u>? If quantitative, is it <u>discrete</u> or <u>continuous</u>?

Weight of chickens
Quantitative continuous

e. The researchers obtained the results shown in the figure to the right. Do the results produced by this study support or fail to support the alternative hypothesis?

There is evidence to support - different protein feeds result in chickens of different weights.

f. <u>State</u> which feed group (Standard Feed, Protein1, Protein2, Protein3) has the...

- Largest mean? ___Protein 3_____

- Smallest mean? ___Standard feed_____

- Largest standard deviation? __Standard feed_____

- Smallest standard deviation?__Protein 1_____
(For the purposes of THIS QUESTION, just answer about standard deviation, not COV).

g. Assume that there are the same number of chickens in each experimental group. Based on this information and the results figure, which group is likely to have the larger standard error: "Standard Feed" or "Protein1"?

Standard Feed

Question 3
Provide a *precisely-worded* definition of biological evolution as a single complete sentence.

Heritable change (or, changes in allele frequencies) in populations over generations (or, time).

Question 4
Draw a graph for how a resource-limited population is expected to grow over time, with the axes as given below (directly draw in this space). Additionally <u>state</u> the name for this type of population growth in the space provided.

logistic growth
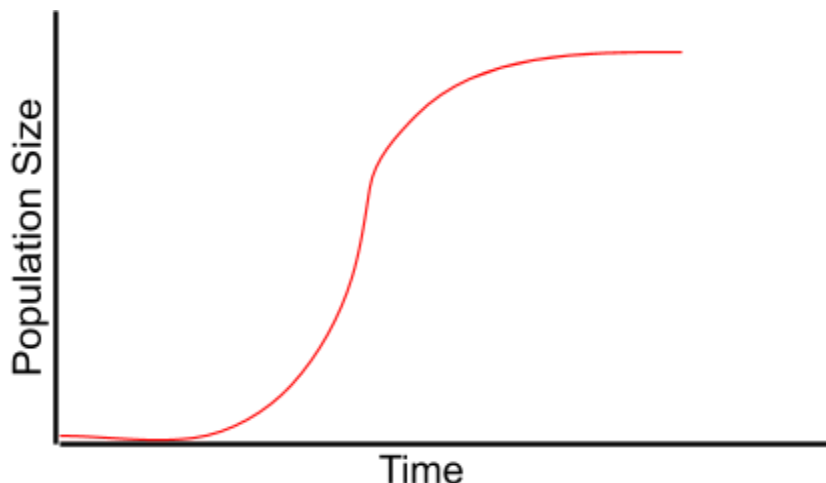
Name: _____

Question 6

Researchers studied a population of crabs in Florida in 2010 in order to determine whether claw length was evolving in the population.

a. In 2010, researchers obtained the results show in the figure to the right for claw length measurements among 100 parent-offspring groups.
Based on these results, do you conclude that claw length is a heritable trait? Your answer must indicate which specific quantity you used to assess heritability. If claw lengths is heritable, indicate if it is high or low.

Crabs studied in 2010

YES heritable: slope of midparent-midoffspring regression is positive and close to 1, so strongly heritable.
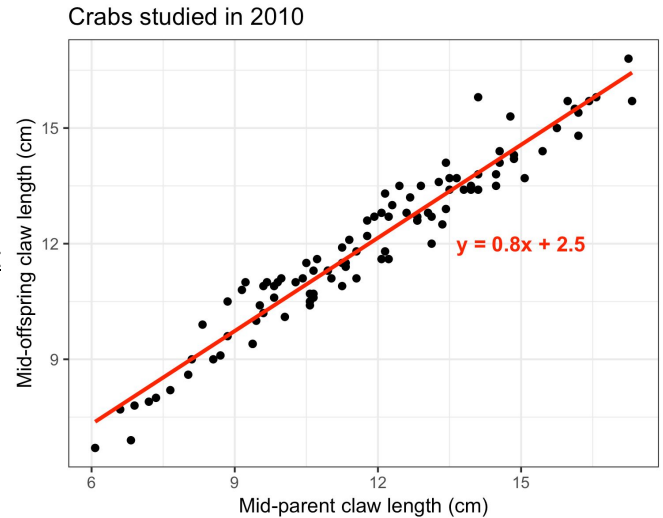
b. Interpret the correlation in the figure for part (a) by filling in the blank: *(2 points each)*

● Is the correlation <u>positive</u> or <u>negative</u>? _____positive_____

● Is the correlation <u>strong</u>, <u>moderate</u>, or <u>weak</u>? _____strong_____

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c. Imagine crab parents with an average claw length of 12.5 cm have 100 offspring. Given your answer to part (a), <u>circle</u> which distribution below (a, b, or c) is most likely to represent offspring claw lengths.

the answer is a
(the mean for b is too low, and c has no variation)

Offspring Claw Length (cm)
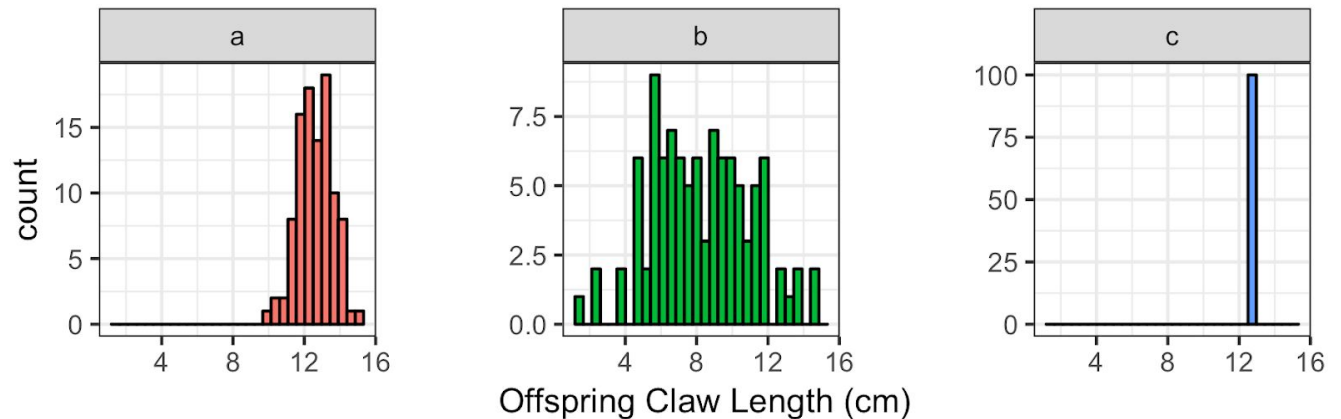
d. In the axes below, draw **points and a trendline** for hypothetical midparent-midoffspring that would give the <u>opposite</u> conclusion about heritability to your answer for part (a). <u>Do not worry about specific numbers or axis tick marks - just draw plot points and a line!</u>