OVERVIEW

This worksheet is part of set of short lessons to help students become familiar with relevant vocabulary for introductory statistics.

KEY CONCEPTS

- Statistical p-values are used to evaluate the difference between samples/populations.
- Experimental design is based on a null hypothesis and its counterpart alternate hypothesis.

OBJECTIVES

- Students will be able to define and identify a statistical p-value
- Students will be able to differentiate between statistical hypotheses
- Students will be able to self-assess progress associated with learning aims

Bioinformatics Bite #1: Intro to p-values

Part 1: I hypothesize…

If you were designing an experiment, how many hypotheses would you have? Why?

_____

_____

_____

What makes a good hypothesis (or hypotheses)?

_____

_____

_____

Design a sample hypothesis (or hypotheses).

Part 2: Wait, there's two of them?

There are actually two hypotheses when designing an experiment!

Read the text in the box below, highlight what you consider to be important (or want to ask your teacher about), then answer the items that follow.

"The actual test begins by considering two hypotheses. They are called the null hypothesis and the alternative hypothesis. These hypotheses contain opposing viewpoints.

$H0$: The null hypothesis: It is a statement of no difference between sample means or proportions or no difference between a sample mean or proportion and a population mean or proportion. In other words, the difference equals 0.

Ha: The alternative hypothesis: It is a claim about the population that is contradictory to $H0$ and what we conclude when we reject $H0$.

Since the null and alternative hypotheses are contradictory, you must examine evidence to decide if you have enough evidence to reject the null hypothesis or not. The evidence is in the form of sample data.

After you have determined which hypothesis the sample supports, you make a decision. There are two options for a decision. They are "reject $H0$" if the sample information favors the alternative hypothesis or "do not reject $H0$" or "decline to reject $H0$" if the sample information is insufficient to reject the null hypothesis."

Text from https://opentextbc.ca/introstatopenstax/chapter/null-and-alternative-hypotheses

Define a null hypothesis in your own words

Using your own words, define the "null hypothesis".

_____

_____

_____

How do is it determined whether to reject the null hypothesis or not?

_____

_____

_____

Part 3: How do we know if the evidence is strong enough or not?

Text from https://opentextbc.ca/introstatopenstax/chapter/null-and-alternative-hypotheses

Look at the graph and read the text below, highlight what you consider to be important (or want to ask your teacher about), and then fill out the highlighted table and question below!
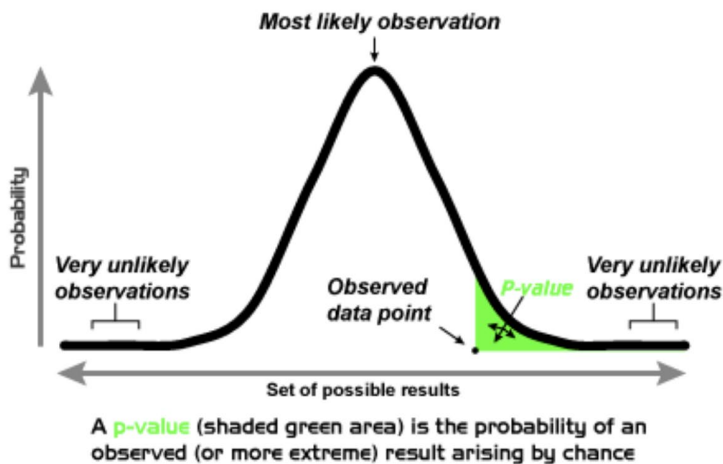
https://upload.wikimedia.org/wikipedia/en/0/00/P-value_Graph.png

The *p*-value reflects the strength of evidence against the null hypothesis. Accordingly, we'll encounter two situations: the strength is *strong enough* or *not strong enough* to reject the null hypothesis.

Generally, we use 0.05 as a threshold. If $p > 0.05$, we say that the evidence against the null hypothesis is not strong enough, and we can't reject the null hypothesis. If $p < 0.05$, we say that the evidence against the null hypothesis is strong enough, so we reject the null hypothesis and accept the alternative hypothesis.

	p>0.05	p<0.05
What does this mean for the null hypothesis?		

Based on the graph and the text, how would you define a p value?

_____

_____

_____

Part 4: Application Time!

Using pennies or other coins design a quick test with a partner, meeting the highlighted requirements below!

Be sure to ask your teacher to look over your plan and explain how to do the calculation step (*)!

Null Hypothesis:

_____

_____

_____

Alternative Hypothesis:

_____

_____

_____

Plan for Experiment:

_____

_____

_____

Data:

_____

_____

_____

*Calculation of P-Value/P-Value:

_____

_____

_____

Reject or accept the null hypothesis and why:

Part 5: Learning Aims and Evaluation

Please rate where you personally are at, with regards to the learning aims, at the end of the lesson and why.

Rating Scale

1- I do not understand it at all yet.

2-I understand parts of it, but I need my teacher and/or classmates' support to answer questions.

3-I understand it and can complete an assignment by myself.

4-I understand it so well I can teach others and apply my knowledge to new situations.

Learning Aim #1: Students will be able to define a null hypothesis and alternative hypothesis and the role that p values play in rejecting or accepting them.

My Evaluation of Learning Aim #1 and Explanation:

Learning Aim #2: Students will understand what a p value is and be able to demonstrate that understanding through the creation of their own definition of a p value.

My Evaluation of Learning Aim #2 and Explanation:

Learning Aim #3: Students will demonstrate their understanding of the topics of this lesson by designing a simple and quick experiment with pennies.

My Evaluation of Learning Aim #3 and Explanation:

References:

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Tanu Seth. January 2020. How to understand p-value in layman terms? https://towardsdatascience.com/how-to-understand-p-value-in-layman-terms-80a5cc206ec2

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Probability Value (p-value). Helpsheet by Giblin Eunson Library. https://library.unimelb.edu.au/__data/assets/pdf_file/0006/1924161/p_value.pdf

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