

## ADS2 Week 6 Problem Set

November 1, 2023

Instructor: GL

1. What's a good hypothesis? Use an example to illustrate a good hypothesis and a bad hypothesis (you can discuss your examples on Discussion Board!)

A hypothesis is a statement instead of a question, but it must be based on a scientific question that is testable. A good hypothesis should avoid vagueness, be specific, have easy-to-measure variables and be testable.

2. Explain  $H_0$  and  $H_A$ ; give an example of each.

$H_0$  is the null hypothesis that states there is no difference between two or more measured sample groups while  $H_A$  (standing for alternative hypothesis) states there is a difference between at least two of the sample groups.  $H_0$  and  $H_A$  need to be 1) mutually exclusive and 2) complementary. This means that they cannot both be true, and they cannot both be false. Either one is true, or the other. For example, I want to compare whether there is a height difference between 20 boys and 20 girls. Then the  $H_0$  is the heights of 20 boys and 20 girls are the same. The  $H_A$  would be the heights of 20 boys and 20 girls are different.

3. What's a p-value in terms of hypothesis testing? What can be possible misunderstandings of p-value?

In hypothesis testing, p-value is a probability of observing a test result at least as extreme as the one measured in your experiment when the  $H_0$  is correct. Thus, when we got a small p-value (e.g.  $p < 0.05$ ), we say that the probability of observing a test result at least as extreme as the one we have is small, if  $H_0$  is correct. Thus, we conclude that  $H_0$  is not a good explanation of the data, and we can therefore reject the null hypothesis.

4. See the following scenario and try to complete the empty fields

**OBSERVATION:** In a conditioning experiment, an animal is given a food pellet in response to light. However, because the delivery mechanism is noisy, the animal sometimes gets scared and doesn't always eat the food. I want to know if animals eat more food in response to light or in the interval between trials. There are 20 trials.

**NULL HYPOTHESIS:**

There is no difference in the amount of food eaten in response to light and between trials

**ALTERNATIVE HYPOTHESIS:**

The amount of food eaten in response to light is significantly different from the amount eaten during the inter-trial interval.

**DESIGN AN EXPERIMENT TO TEST THE HYPOTHESIS:**

Measure the amount of food eaten in response to light and during the inter-trial interval for a number of animals. Then perform a statistical test to determine if one is consistently bigger than the other (we will soon discuss what that test can be).

## RESULTS & THEIR INTERPRETATION:

### p-VALUE

$p < 0.05$ : there is a significant difference between the food eaten in response to light and during the inter-trial interval

$p > 0.05$ : there is no evidence of significant difference between the food eaten in response to light and during the inter-trial interval (**note that it's different from concluding that "there is no difference", which is a much stronger statement than that there is not enough evidence, which could be due to insufficient statistical power, for example**).

You can discuss this with your peers. Feel free to ask questions or share your thoughts in the Discussion Board.