Hypothesis Formulation

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Today's Lecture

- Intro. to Hypothesis Testing
- Null and Alternative Hypotheses
- Game

What is a hypothesis?

"a tentative assumption made in order to draw out and test its logical or empirical consequences"

— Merriam-Webster Dictionary

"a mere assumption or guess."

— Dictionary.com

What is a test?

"statistical tests are tools used to determine how likely it is that the overall effect would be observed if no real relation, as hypothesized, exists. If that likelihood is sufficiently small (e.g. less than 1%), then the existence of a relation may be assumed. Otherwise, any observed effect may as well be due to pure chance."

— Wikipedia

Notes

What is hypothesis testing?

"Hypothesis testing is the use of statistics to determine the probability that a given hypothesis is true."

— Wolfram MathWorld

Notes

Hypothesis Testing, 5 concepts:

1. Formulate the null hypothesis (H_0) and the alternative or research hypothesis (H_1).
2. Assume that the null hypothesis is true.
3. Select an appropriate statistical test to determine whether there is enough evidence to infer that the alternative hypothesis is true.
4. Make a conclusion: there is enough evidence to support the alternative hypothesis or there is not enough evidence to support the alternative hypothesis.
5. Consider the error types possible, Type I: rejecting a true null hypothesis and Type II: accepting a false null hypothesis.

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Null and Alternative Hypotheses

Null Hypothesis: Written: H_0. This hypothesis always has an equality in it somewhere. It is the hypothesis that maintains the status quo, the expected value.

- Example: A shop owner is in the habit of always ordering 20 cases of shampoo per month. S/he is wondering how the monthly sales compares to this order size. What null hypothesis can be used in this setting?
  - Helpful hint: "null" rhymes with "dull".

Alternative Hypothesis Written: H_1. This hypothesis reflects the more interesting state of affairs; what we're really interested in.

- Example: A shop owner is in the habit of always ordering 20 cases of shampoo per month. S/he is wondering how the monthly sales compares to this order size. What alternative hypothesis can be used in this setting?

Notes

Null and Alternative Hypotheses: Mathematically Speaking

$$H_0 : \mu = 20$$
$$H_1 : \mu \neq 20$$

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Null and Alternative Hypotheses: As Opposites

Test Name	H_0	H_1
Two-tailed	$\mu = 20$	$\mu \neq 20$
Right-tailed	$\mu \leq 20$	$\mu > 20$
Left-tailed	$\mu \geq 20$	$\mu < 20$

Note: Your book uses a short hand and always states the null hypothesis as an equality.

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Hypotheses aren't always stated in equations. . .

1. Each one of you will be randomly given a piece of paper with a hypothesis.
2. Take 2 minutes to write down:
   - Whether you think the hypothesis is a null hypothesis or an alternative hypothesis.
   - What the corresponding alternative or null hypothesis should be.
3. Now that you know what the alternative/null hypothesis should be, stand up, walk around, and go meet the person that has the pair for your given hypothesis.

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