**What am I learning today?**

How to write a hypothesis statement and calculate p-value

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<th>Main Ideas/Questions</th>
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<td><strong>RECALL:</strong></td>
<td>Population = The group of <strong>individuals</strong> that is being <strong>studied</strong>. Sample = A subgroup (a part) of the <strong>population</strong>.</td>
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<td><strong>KEY SYMBOLS:</strong></td>
<td>$\mu = \text{pop. mean}$ $\sigma = \text{pop. st. deviation}$ $\bar{x} = \text{sample mean}$</td>
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**Hypothesis Statements**

**Null hypothesis** — A statement about the **population** or the 'true mean'. It tries to state what is 'commonly' **accepted**. It attempts to show that a variable is **not different** than its mean. It is assumed to be true until there is **evidence** to show that it should be rejected and to use the alternative hypothesis.

****Denoted $H_0 \neq$****

****The statement MUST include one of the following words: less than or equal to, equal to, greater than or equal to.****

**Alternative hypothesis** — States the **opposite** of the null hypothesis. This is something that is **not** commonly accepted or claimed. The variable is **different** from its mean.

****Denoted $H_A \neq$****

****The statement MUST include one of the following words: less than, greater than****

**How to write a hypothesis statement:**

1. Decide what is **claimed**.
2. Decide what **sample** was taken.
3. Write your null hypothesis about what they 'claimed' and write your alternative hypothesis based on the sample and how it **relates** to the claim.
**Main Ideas/Questions**

Examples

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**Notes**

**Example 1:** The Spud Potato Chip company claims that their bags of chips contain 28.3 grams of chips. You decided to conduct an investigation and find that they mean weight of the chips in your sample is 25 grams.

Write your hypothesis statements **in words:**

\[ H_0 : \text{on average, a bag of potato chips is 28.3 grams.} \]

\[ H_A : \text{on average, a bag of potato chips is less than 28.3 grams.} \]

Write the hypothesis statement **in symbols:**

\[ H_0 : M = 28.3 \]

\[ H_A : M < 28.3 \]

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**P-value Test**

**P-Value** (1-tailed hypothesis tests) – The probability of obtaining a result either equal to or “more extreme” (higher or lower) than what is actually observed.

**How to calculate a p-value:**

1) Compute the __Z-score__

2) Use the __normal__ table to find the probability

3) Compare to a significance level (\( \alpha \))

**Test Results – MUST HAVE A SIGNIFICANCE LEVEL**

Example: \( \alpha = 0.05 \ (5\%) \)

**If the p-value is greater than** 0.05 \( \Rightarrow \) **Fail to reject** the null hypothesis

**If the p-value is less than** 0.05 \( \Rightarrow \) **Reject** the null hypothesis

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**Examples:** State if the null hypothesis should be rejected given the p-value

1. \( \overline{\alpha = 0.05}; \ p = 0.04 \) **Reject Ho**

2. \( \alpha = 0.05; \ p = 0.051 \) **Fail to reject Ho**

3. \( \alpha = 0.01; \ p = 0.02 \) **Fail to reject Ho**

4. \( \alpha = 0.08; \ p = 0.05 \) **Reject Ho**
Example 1:
Eric loves Snapchat. He claims that he sends 50 snaps during 1st block ("gotta keep those streaks"). Mrs. Brattebo saw that he sent 35 snaps this morning.

a. Write a hypothesis statement

\[ H_0: \text{On average, Eric sends 50 snaps during 1st block.} \] 
\[ M = 50 \]

\[ H_a: \text{On average, Eric sends less than 50 snaps during 1st block.} \] 
\[ M < 50 \]

b. Find the p-value.

\[ Z = \frac{35 - 50}{5} = -3 \]
\[ p = 0.0013 \]

c. Do we have enough evidence to reject the null hypothesis? Use a significance level of \( \alpha = 0.05 \) and a standard deviation of 5 snaps.

\[ p = 0.0013 \]

\( \alpha \) wins - reject \( H_0 \) - we have enough evidence to show that Eric sends less than 50 snaps.

Example 2:
Amber loves chicken wings. She claims that she eats 8 wings (with a standard deviation of 2 wings) every time she goes out. Yesterday at lunch, Marie noticed Amber ate 12 wings.

a. Write a hypothesis statement

\[ H_0: \text{On average, Amber eats 8 wings.} \] 
\[ M = 8 \]

\[ H_a: \text{On average, Amber eats more than 8 wings.} \] 
\[ M > 8 \]

b. Find the p-value.

\[ Z = \frac{12 - 8}{2} = 2 \]
\[ p = 1 - 0.9772 = 0.0228 \]
\[ p = 0.0228 \]

c. Do we have enough evidence to reject the null hypothesis? Use a significance level of \( \alpha = 0.01 \).

\[ p = 0.0228 \]

\( \alpha \) wins - Fail to reject \( H_0 \) - we do not have enough evidence to show that Amber eats more than 8 wings.