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The Null and the Alternative Hypotheses

In hypothesis testing there are two mutually exclusive hypotheses; the Null Hypothesis (H_0) and the Alternative Hypothesis (H_1). One of these is the claim to be tested and based on the sampling results (which infers a similar measurement in the population), the claim will either be supported or not. The claim might be that the population proportion (or mean) has increased, decreased, stayed the same, or that it has changed. According to the words used in the problem, the claim will be either H_0 or H_1.

Note that the Null Hypothesis, H_0, ALWAYS contains the condition of equality.

Alternative Hypothesis H_1:			**Null Hypothesis H_0:**
Symbol	Clue words	Type of test	**Symbol**
<	Less than, decreased, faster	Left tailed Test	**=**
>	More than, increased, slower	Right tailed Test	**=**
≠	Not equal to, has changed	Two Tailed Test	**=**

Example 1:

For a shipment of cable, suppose that the specifications call for a mean breaking strength of 2010 pounds. A sample of 32 segments of cable is found to have a mean breaking strength of 1895 pounds with an associated standard deviation of 59 pounds. The shipment will be returned to the manufacturer if there is a significant difference from the specifications. Use a 5% level of significance to decide if the shipment should be returned.

In this example, we must test whether or not the breaking strength specifications are met. This means that the Alternative Hypothesis will have the "not equal sign." The claim will be based on the "specifications call for a **mean** breaking strength **of 2010**"

H_0: μ, mu, =2010 pounds. (This is the claim) H_1: μ, mu, ≠2010 pounds.

Example 2:

A company producing light bulbs wants to know if it can claim that the produced light bulbs last more than 900 burning hours. To answer this question, the company takes a random sample of 300 from those it has produced and finds that the average lifetime for this sample is 884 burning hours. The company knows that the standard deviation of the lifetime of light bulbs is 91 hours. Can the company claim that the average lifetime of its light bulbs is more than 900 hours, at the 5% significance level?

The company wishes to claim that their light bulbs **last more** 900 hours. In this case, the "**greater than**" symbol will be used in writing the claim to be tested, making it the alternative hypothesis.

H_0: μ, mu, = 900 hours.

H_1: μ, mu, > 900 hours. (This is the claim)

Example 3:

The NFL reports that the people who watch Monday night football games on television are evenly divided between men and women. Out of random sample of 500 people who regularly watch the Monday night games, 238 are men. Using a .10 level of significance, can we conclude that the report is false?

The NFL reports that the proportion is actually 50%. This can be false if the proportion is either more than or less than 50%. The Null and Alternative Hypotheses looks like:

H_0: $p = 0.5$ (This is the claim). H_1: $p \neq 0.5$

Example 4:

An electrical company claims that less than 2% of the parts which they supplied on a government contract are defective. A sample of 642 parts was tested, and 17 did not meet the specifications. Can we accept the company's claim at a .05 level of significance?

They want to test what proportion of the parts do not meet the specifications. Since they claim that the proportion is **less than** 2%, the symbol for the Alternative Hypothesis will be <. As is the usual practice, an equal symbol is used for the Null Hypothesis.

H_0: $p = 0.02$ H_1: $p < 0.02$ (This is the claim).