

# What are three example problems of one-tailed hypothesis tests?

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A one-tailed hypothesis test is a statistical method used to determine the probability of a specific outcome occurring, based on a set of data. This type of test is commonly used in research and experimentation to make informed decisions and conclusions. Three examples of problems that can be addressed using a one-tailed hypothesis test include determining if a new medication is more effective than an existing one, if a change in marketing strategy leads to an increase in sales, and if a new teaching method improves student test scores. In each of these scenarios, the hypothesis being tested is directional, meaning that the researcher is looking for a specific outcome or trend in the data. By conducting a one-tailed hypothesis test, researchers can confidently make decisions based on the statistical significance of their findings.

## One-Tailed Hypothesis Tests: 3 Example Problems

**In statistics, we use to determine whether some claim about a is true or not.**

**Whenever we perform a hypothesis test, we always write a null hypothesis and an alternative hypothesis, which take the following forms:**

**H<sub>0</sub> (Null Hypothesis): Population parameter =  $\leq$ ,  $\geq$  some value**

**H<sub>A</sub> (Alternative Hypothesis): Population parameter  $<$ ,  $>$ , ? some value**

**There are two types of hypothesis tests:**

**Two-tailed test: Alternative hypothesis contains the ? sign  
One-tailed test: Alternative hypothesis contains**

**either < or > sign**

**In a one-tailed test, the alternative hypothesis contains the less than (" $<$ ") or greater than (" $>$ ") sign. This indicates that we're testing whether or not there is a positive or negative effect.**

**Check out the following example problems to gain a better understanding of one-tailed tests.**

**Example 1: Factory Widgets**

**Suppose it's assumed that the average weight of a certain widget produced at a factory is 20 grams. However, one engineer believes that a new method produces widgets that weigh less than 20 grams.**

**To test this, he can perform a one-tailed hypothesis test with the following null and alternative hypotheses:**

**$H_0$  (Null Hypothesis):  $\mu \geq 20$  grams  
 $H_A$  (Alternative Hypothesis):  $\mu < 20$  grams**

**Note: We can tell this is a one-tailed test because the alternative hypothesis contains the less than ( $<$ ) sign. Specifically, we would call this a left-tailed test because**

**we're testing if some population parameter is less than a specific value.**

**To test this, he uses the new method to produce 20 widgets and obtains the following information:**

**$n = 20$  widgets  $\bar{x} = 19.8$  grams  $s = 3.1$  grams**

**Plugging these values into the  $t$  test, we obtain the following results:**

**t-test statistic: -0.288525 one-tailed p-value: 0.388**

**He does not have sufficient evidence to say that the true mean weight of widgets produced by the new method is less than 20 grams.**

#### **Example 2: Plant Growth**

**Suppose a standard fertilizer has been shown to cause a species of plants to grow by an average of 10 inches. However, one botanist believes a new fertilizer can cause this species of plants to grow by an average of greater than 10 inches.**

**To test this, she can perform a one-tailed hypothesis test with the following null and alternative hypotheses:**

**H0 (Null Hypothesis):  $\mu \leq 10$  inches**  
**HA (Alternative Hypothesis):  $\mu > 10$  inches**

**Note: We can tell this is a one-tailed test because the alternative hypothesis contains the greater than (>) sign. Specifically, we would call this a right-tailed test because we're testing if some population parameter is greater than a specific value.**

**To test this claim, she applies the new fertilizer to a simple random sample of 15 plants and obtains the following information:**

**$n = 15$  plants  
 $\bar{x} = 11.4$  inches  
 $s = 2.5$  inches**

**Plugging these values into the  $t$  test, we obtain the following results:**

**t-test statistic: 2.1689 one-tailed p-value: 0.0239**

**Since the p-value is less than .05, the botanist rejects the null hypothesis.**

**She has sufficient evidence to conclude that the new fertilizer causes an average increase of greater than 10 inches.**

### Example 3: Studying Method

A professor currently teaches students to use a studying method that results in an average exam score of 82. However, he believes a new studying method can produce exam scores with an average value greater than 82.

To test this, he can perform a one-tailed hypothesis test with the following null and alternative hypotheses:

$H_0$  (Null Hypothesis):  $\mu \leq 82$   
 $H_A$  (Alternative Hypothesis):  $\mu > 82$

**Note:** We can tell this is a one-tailed test because the alternative hypothesis contains the greater than (>) sign. Specifically, we would call this a right-tailed test because we're testing if some population parameter is greater than a specific value.

To test this claim, the professor has 25 students use the new studying method and then take the exam. He collects the following data on the exam scores for this sample of students:

$$n = 25 \quad \bar{x} = 85 \quad s = 4.1$$

**Plugging these values into the , we obtain the following results:**

**t-test statistic: 3.6586 one-tailed p-value: 0.0006**

**Since the p-value is less than .05, the professor rejects the null hypothesis.**

**He has sufficient evidence to conclude that the new studying method produces exam scores with an average score greater than 82.**

#### **Additional Resources**

**The following tutorials provide additional information about hypothesis testing:**