

Project 8 - Hypothesis Tests for a Population Proportion

Step 1: State the Null Hypothesis (H_0) and Alternative Hypothesis (H_1)

The null hypothesis is a statement assumed to be true. For a hypothesis test about the population proportion p , the null hypothesis is

$$H_0: p = \#$$

If the evidence against the null hypothesis is strong enough, we will reject the null hypothesis and support the alternative hypothesis. For a hypothesis test about a population proportion, the alternative hypothesis can take one of three forms:

Right-Tailed: $H_1: p > \#$

Left-Tailed: $H_1: p < \#$

Two-Tailed: $H_1: p \neq \#$

The alternative hypothesis depends upon what we are trying to prove: the proportion is greater than a given number (right-tailed), less than a given number (left-tailed), or different than a given number (two-tailed).

Example 1 A dean claims that more than 50% of the students at her school are female. A random sample of 60 students showed that 33 were female. Test the dean's claim.

$H_0:$ _____ $H_0:$ _____ Tail? _____

Example 2 A pharmaceutical company claims that less than 8% of the patients experience headaches as a side effect of their new allergy medication. A random sample of 95 patients showed that 4 experienced headaches as a side effect. Test the company's claim.

$H_0:$ _____ $H_0:$ _____ Tail? _____

Example 3 Apple claims that 35% of college students own an iPhone. A random sample of 320 college students showed that 148 owned an iPhone. Test Apple's claim.

$H_0:$ _____ $H_0:$ _____ Tail? _____

Step 2: State the Level of Significance α (alpha)

The level of significance is the boundary line that indicates the evidence is considered to be strong enough to reject the null hypothesis.

Strong evidence \rightarrow Reject the null hypothesis \rightarrow Support the alternative hypothesis

Lack of Strong Evidence \rightarrow Fail to Reject the null hypothesis \rightarrow Fail to Support the alternative hypothesis

For this section, we shall always choose 0.05 for the level of significance.

Step 2: $\alpha = 0.05$

Step 3: State the Test You Are Performing

We will cover many different hypothesis tests throughout the semester. We label the test so the reader knows exactly what test we are performing.

Step 3: One Proportion Test (Binomial Distribution)

Step 4: Compute the P -value

The test statistic is computed using the binomial distribution calculator in StatCrunch.

The value of n is the sample size, the value of p is the value from the null hypothesis.

Use $x \geq$ "sample successes" for a right-tailed test, and use $x \leq$ "sample successes" for a left tailed test. For a two-tailed test, double the appropriate one-tail P -value (right-tailed if the sample proportion is greater than the claimed population proportion, left-tailed if the sample proportion is less than the claimed population proportion).

Step 5: Make a Decision about the Null Hypothesis and a Conclusion about the Alternative Hypothesis

If the P -value is less than the level of significance, then

- We Reject the null hypothesis (we say it is false).
- We Support the alternative hypothesis (we say it is true).

Otherwise, if the P -value is not less than the level of significance, then

- We Fail to Reject the null hypothesis (we cannot say it is false).
- We Fail to Support the alternative hypothesis (we cannot say it is true).