One-tailed Hypothesis Testing for Proportions

STA 2023 & 2122

In testing a Hypothesis concern with a Population Proportion, there are FIVE steps:

1. Identifying the claim, Hypothesis.
2. Information and Test Statistics.
3. Finding the p-value
4. Interpreting Test Results
5. Writing the Conclusion

1. -Identifying the Claim and creating the Null and Alternative Hypothesis. The Claim can be assigned to either of the Hypothesis.

Example: Medics and Teachers want to know if a new vitamin supplement will help decrease the sick absentees of students during the winter. They took a sample of 742 students. They gave the vitamin supplement to the students for the months of August through December, and calculated the Proportion of students who were absent due to sickness was close to 8%. In general, a given students is absent about 10% of the time. Is the difference statistically large enough (α =0.05) to say that the vitamin supplement reduces absentee sickness?

H_0 is the Null Hypothesis H_1 is the Alternative Hypothesis.

H_0: π = .10, this is the usual proportion of absentees.

H_1: π < .10, teachers and medics want to know if the vitamin supplement will decrease this proportion.

2. - Identifying your information and find Test Statistics.

For this example we have:

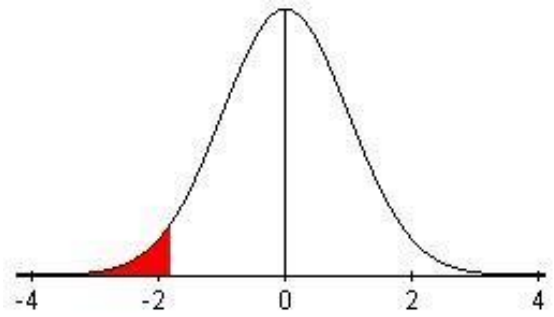
Population Proportion: π = .1 Sample Proportion: $\hat{p}$ = .08 Sample Size: n = 742

Significance Level: α = 0.05.

The Test Statistic will be:

$$Z = \frac{\hat{p}-\pi}{\sqrt{\frac{\pi(1-\pi)}{n}}} = \frac{0.08-0.1}{\sqrt{\frac{0.1(1-0.1)}{742}}} \quad Z \;\; Z = -1.815978463$$

3. -P-value, to find the p-value it is better to draw the Standard Normal Distribution.



The Hypothesis Test is a one-tailed test because the alternative hypothesis points in the direction of the left tail (less than symbol **"<"**); the Test Statistic came up to be Z=-1.815978463. For a left-tail test, the p-value will be the area under the curve to the left of the test statistic – the shaded area on the drawing. To find it, use the **normcdf** function on the calculator:

2^{nd} VARS > 2: normcdf > ENTER: normcdf (Left bound, Right Bound, Mean, Standard Deviation):

normcdf (-E99,-1.815978463,0,1)= 0.0346867815 ≈ 0.035

4. – Interpreting the Test results. Compare the P-value with the Significance Level, α=0.05.

The p-value of 0.035 is less than the Significance Level, α=0.05, so the decision is to reject the Null Hypothesis. Because the H_0 was rejected, there is evidence to support H_1.

5. - Conclusion: Write the conclusion in English in the context of the problem.

The Claim held by the Medics and Teachers is valid; administrating the vitamin supplement will statistically decrease the absentees due to sickness.

With the Calculator:

Example: STAT > TESTS > 5: 1-PropZTest > ENTER

p_0: 0.1

X: (.08)(742)= 59.36 Round to 59 (the nearest number) or you'll get an error message.

n: 742 **p=.0314404472**

prop < p_0 $\hat{p}$=.0795148248

Calculate:

This is the Calculator output:

prop < .1 whole

Z= -1.860031849

n=742

When using the calculator, both the test statistic and the p-value are different from "by hand" due to the rounding done when entering X. However, the conclusion, based on the p-value is the same.