Hypothesis Testing

- Left, Right, and Two Tails
- Type I and Type II Errors
- P-Values
- Rejection Regions
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Left, Right, and Two Tails

- Left Tailed Hypothesis: Involves the hypothesis that the statistic is less than a number: H_0: $\mu=10$, H_1: $\mu < 10$
- Right Tailed Hypothesis: Involves the hypothesis that the statistic is greater than a number: H_0: $\mu=10$, H_1: $\mu > 10$
- Two Tailed Hypothesis: Involves the hypothesis that the statistic is not equal to a number: H_0: $\mu=10$, H_1: $\mu \neq 10$

Determine the Null and Alternative Hypotheses

A. You want to find out if more than 50% of voters support a candidate.

B. You want to find out if the mean number of snow boards rented is greater than 60 per day.

C. You want to find out if the average speed that people drive on highway 50 is different than 40 mph.

Type I and Type II Errors

- Type I Error: Rejecting H_0 when H_0 is true: P(Type I) = α
- Type II Error: Failing to reject H_0 when H_0 is false: P(Type II) = 1-β

Example: Suppose a hypothesis is done to see if a proposed vaccination for HIV is effective in reducing the chance of a person getting infected. Discuss the implications of Type I and Type II errors.

P-Value

P-Value: The probability that if H_0 is true, and a sample is taken with the same sample size, then the result will be at least as extreme as the result obtained for our sample.

P-Value Example

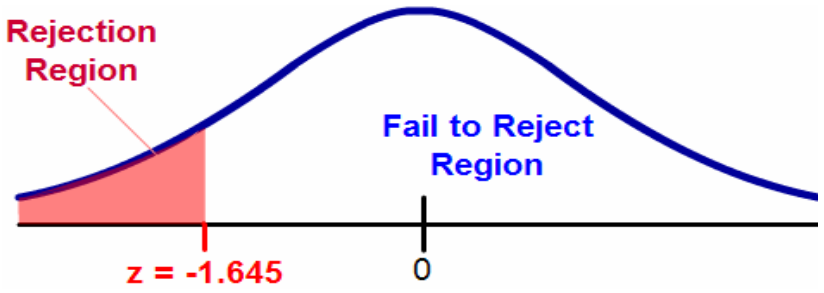
A hypothesis test was conducted with $n = 200$ students to see if more than 70% of all college students gain weight in their first year of college (H_0: $p = 0.7$, H_1: $p > 0.7$). The sample proportion was found to be .76 and the P-Value was 0.03. Then if the proportion is really 0.7 and if many samples of size 200 students are taken, 3% of these samples will produce a sample proportion at least as large as 0.76.

Rejection Region

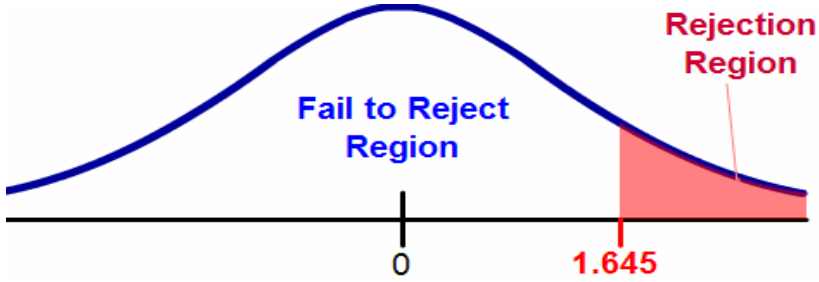
Rejection Region: The region under the z (or t) graph such that a test statistic in that area will result in H_0 being rejected (H_1 accepted). A test statistics outside of that region will result in failing to reject H_0.

Rejection Region Examples

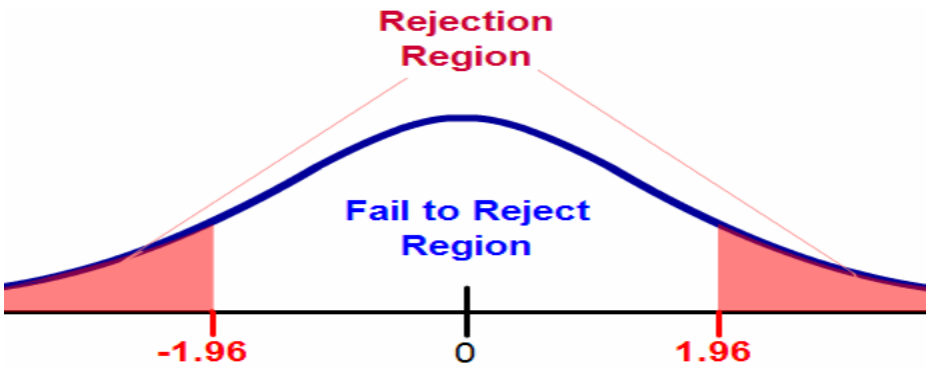
Left Tailed Test:



Right Tailed Test:



Two Tailed Test:



Hypothesis Testing Procedure

- Determine the hypotheses in words
- Write down H_0 and H_1 in symbols
- Determine the level of significance
- Conduct the survey or experiment
- Calculate the test statistic
- Calculate the p-value
- Make a conclusion