

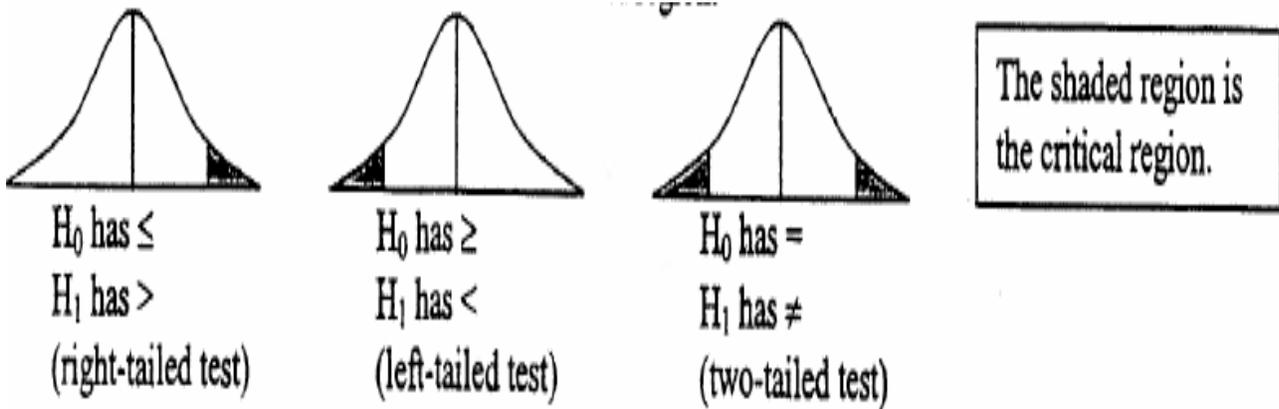
Testing Hypotheses

Testing hypotheses, or testing claims, is a large part of the Elementary Statistics course here at MSJC. The basic idea is to use statistics (items such as the mean, standard deviation, proportion, etc.) from a sample in order to infer something about the population. This will allow us to decide whether or not a given claim is supported by the sample data. This idea of using data from a sample to infer something about the entire population is called "Inferential Statistics."

Here are the 8 easy steps to testing hypotheses:

1. Identify the given information. ($n=?$, $\bar{x}=?$, $s=?$, $\hat{p}=?$, $\alpha=?$)
 - this information is typically given in the problem or can be calculate;
 - also, larger sample sizes yield more reliable results
 - sample sizes also determine whether you use z-table ($n > 30$) or t-table ($n \leq 30$)
2. Write the original claim in symbols, for instance $\sigma \leq 3.5$ or $\mu_1 > \mu_2$
3. Identify the null hypothesis (H_0) and the alternative hypothesis (H_1).
The claim may be either one of these.
 - recall that H_0 contain the following equal symbols: $=, \leq, \geq$
 - thus, H_1 will contain inequality symbols such as $<, >, \neq$
4. Go to a formula sheet and identify which formula to use for the test statistic. Ask yourself questions like how many populations are there? Are they dependent or independent? How large is the sample? Do I have any information about sigma? Is a preliminary F-test required? After determining the correct formula, plug in the required values and find the test statistic.
 - our choice of a formula depends on what type of test we are doing (i.e. mean, standard deviation, proportion, etc.) and possibly on sample information (i.e. how large is our sample size)

5. Now that you know what random variable you're dealing with (i.e. z, t, χ^2 , F), draw a picture of the distribution.
 - both z and t distributions will be symmetric and bell shaped
 - for chi square (χ^2), the distribution will be skewed
6. Obtain the critical value (s) from a table (remember to divide α in half for a two-tailed test) and place it/them in the appropriate location (s) on your picture of the distribution.
 - the critical value defines the critical region which is a set of values for the test statistic that will lead us to reject the null hypothesis.
 - there are three categories for a hypothesis test:



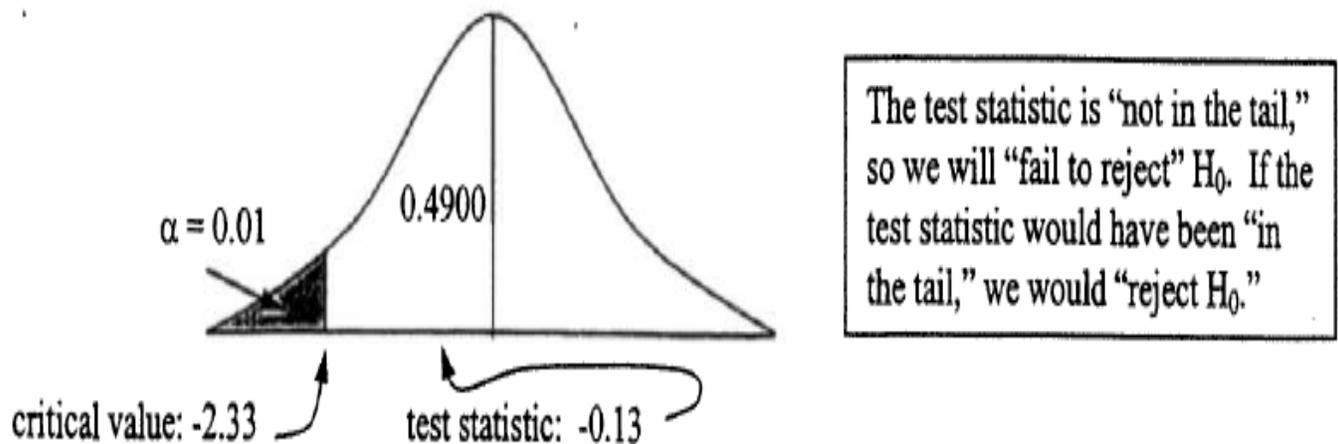
-we use the level of significance (or α) to help determine what is our critical values; α tells us the area under the probability curve defined by the critical region; with this information, you will be able to look up critical values in a table.

7. Compare the test statistic (step 4) with the critical value (s). Make a decision about the null hypothesis. Do you reject H_0 or fail to reject H_0 ?

-if the test statistic falls in the critical region (or in the tail), then you reject H_0

-if the test statistic falls outside of the critical region, then you fail to reject H_0

Example:



8. Write a conclusion, in words not symbols, about the original claim. It is not enough to just say something about the null hypothesis; you must refer back to the original claim in your conclusion.

-our conclusion about the claim is dependent on two things: our decision about H_0 (or did our test statistic fall into the tail or critical region or not) and whether the claim was H_0 or H_1 (does it contain equality or inequality symbols)