

Statistical Reasoning

Hypothesis Tests

Name: _____

Date: _____

Class: _____

Hypothesis Tests: Writing Hypotheses

A hypothesis test is a statistical test to determine whether there is enough evidence to say something is true.

A hypothesis test examines two opposing hypotheses about a population: the null (H_0) hypothesis and the alternative hypothesis.
(H_a)

Null Hypothesis

null hypothesis— statement being tested - "no effect" or "No Difference". The specific null hypothesis varies from situation to situation, but generally it can be thought of as the status quo, or no relationship, or no difference. In most situations, the researcher hopes to disprove or reject the null hypothesis. (equal to)

The null hypothesis is so named because it is the "starting point" for the investigation. The phrase "there is no difference" is often used in its interpretation.

Examples:

- There is no extrasensory perception.
- There is no difference between the mean pulse rates of men and women (their pulse rates are equal).
- There is no relationship between exercise intensity and the resulting aerobic benefit (they are independent).
- The suspect is not guilty (presumed innocence).

Alternative Hypothesis

opposit
The alternate hypothesis, is the competing claim. The alternate hypothesis is a statement about the same population characteristic that is used in the null hypothesis. Generally, the alternate hypothesis is a statement that specifies that the population has a value different, in some way, from the value given in the null hypothesis. It is the statement you want to show is true.

A common misconception is that statistical hypothesis tests are designed to select the more likely of two hypotheses. Instead, a test will remain with null hypothesis until there is enough evidence (data) to support the alternative hypothesis.

Rejection of null hypothesis will imply acceptance of the alternate. We assume H_0 is true and attempt to show that this leads to an absurdity, hence H_0 is false and H_a is true.

The Statistical Hypothesis Testing process can be compared very closely with a judicial trial.

- Assume a defendant is not guilty (H_0)
- Present evidence to show guilt
- Try to prove guilt beyond a reasonable doubt (H_a)

Two Hypotheses are then created.

H_0 : Not guilty

H_a : Guilty

(note: we can "prove" guilt but we cannot prove innocence—failure to prove guilt is "NOT" the same as proving innocence)

The null hypothesis **must** contain the equal sign (no difference).

This is absolutely necessary because the test requires the null hypothesis to be assumed to be true and the value attached to the equal sign is then the value assumed to be true and used in subsequent calculations.

The alternate hypothesis should be what you are really attempting to show to be true (there's a difference).

This is not always possible.

The form of the null hypothesis is

H_0 : population characteristic $\underline{=}$ hypothesized value $\mu =$ $p =$
(where the hypothesized value is a specific number determined by the problem context)

The alternative (or alternate) hypothesis will have one of the following three forms:

H_a : population characteristic $\underline{>}$ hypothesized value } one tailed
 H_a : population characteristic $\underline{<}$ hypothesized value }
 H_a : population characteristic $\underline{\neq}$ hypothesized value two tailed

When you set up a hypothesis test, the result is either:

- Strong support for H_a (reject H_0)
- not enough evidence to reject H_0 (you are stuck with it, because there is a lack of strong evidence against the null hypothesis.)
You CANNOT prove H_0 is true - only fail to show it's false

Test of statistical significance can often be done using confidence intervals.

- If the hypothesized value we are testing is outside the range of the confidence interval,
reject H_0
- If the hypothesized value we are testing is inside the range of the confidence interval,
fail to reject H_0

A test of significance assesses the evidence provided by data against a null hypothesis, H_0 , in favor of an alternative hypothesis, H_a .