Chapter 22

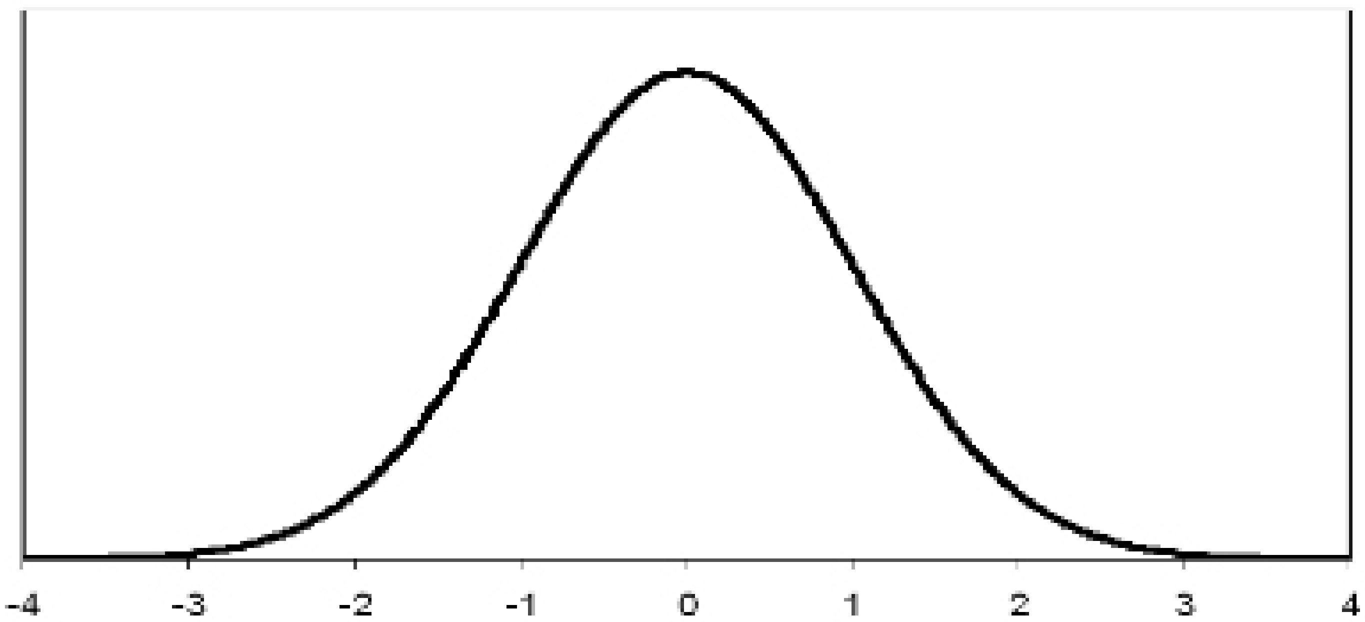
What is a Test of Significance?

A company claims that it has only a 5% complaint rate for its products. A consumer protection group thinks the percent is higher. A survey of a random sample of 400 product owners shows that 33 had complaints.

$\hat{p}$ is:

a. $\frac{0.05}{400} = 0.0001$ b. 0.05 c. $\sqrt{\frac{0.05}{400}} = 0.01$ d. $\frac{33}{400} = 0.83$ e. $\sqrt{\frac{0.05(1-0.05)}{400}} = 0.01$

Assume that the company's claim is true and that p is really 0.05 (5%). What is the probability that a $\hat{p}$ of 8% or more would be observed?



This is an example of a Hypothesis Test.

The claim that p=0.05 is what is called the "Null Hypothesis".

The probability 0.15% is called the "P-value". It is similar to the probability in a criminal trial using DNA evidence… a small number is evidence against the "Null Hypothesis".

A **hypothesis test** checks sample data against a claim or assumption about the population.

The claim or assumption being tested is called the **null hypothesis** such as:

$$H_0: p = 0.05$$

The null hypothesis is the status quo. It is always set up using an equal sign.

For tests about a proportion, the value of the null hypothesis is the mean of the normal distribution we will use to calculate the p-value.

The statement we are looking for evidence of is called the **alternative hypothesis.**

Three possible alternate hypotheses for the above null hypothesis are:

1) H_a: $p < 0.05$

or 2) H_a : $p > 0.05$

or 3) H_a: p is not equal to 0.05

The alternative hypothesis is the experimental hypothesis. It is opposed to the null hypothesis.

For tests about a proportion, the alternate hypothesis tells which probability should be calculated from the normal curve.

Example

A new drug is advertised as being 80% effective. A consumer advocacy group thinks that it isn't that effective and is looking for evidence that it doesn't work well.

What is the null hypothesis?

What is the alternate hypothesis?

Example

Historically, 76% of students in an introductory psychology course have correctly answered the professor's favorite test question on Freud. This semester the professor gave a randomly selected group of students an extra lecture on the subject and wants to see if it will help them do better on the question.

The null hypothesis (H_0) should be:

A) $p < 0.76$
B) $p \neq 0.76$
C) $p > 0.76$
D) $p=0.76$
E) $p<0.24$

The alternate hypothesis (H_A) should be:

A) $p < 0.76$
B) $p \neq 0.76$
C) $p > 0.76$
D) $p=0.76$
E) $p<0.24$

The **P-value** is used to summarize the amount of evidence we have against the null hypothesis. The P-value is the probability that we would see a statistic at least as extreme as the one observed if the null hypothesis was true.

The smaller the p-value, the more evidence against the null hypothesis.

The **Level of significance** (α) determines how much evidence against H_0 we require to reject H_0 and find in favor of the alternative hypothesis, H_a.

If the P-value is less than or equal to α then we have statistically significant evidence against the null hypothesis (for the alternative hypothesis).

With a P-value of 0.0436 and an α of 0.05 we would

A) Reject the null hypothesis and conclude the alternate hypothesis was true.

B) Conclude that we do not have enough evidence to reject the null hypothesis.