

Introduction to Hypothesis Testing

Definition

Hypothesis

in statistics, is a claim or statement about a property of a population

Rare Event Rule for Inferential Statistics

If under a given assumption, the probability of an observed event is exceptionally small, we conclude that the given assumption is probably not correct.

Components of a Formal Hypothesis Test

Null Hypothesis: H_0

- Statement about value of population parameter
- Must contain condition of equality
- $=$, \geq , or \leq
- Test the Null Hypothesis directly
- Reject H_0 or fail to reject H_0

Alternative Hypothesis: H_1

- Must be true if H_0 is false
- One of three forms: \neq , $<$, $>$

If you are conducting a study and want to use a hypothesis test to support your claim, the claim must be worded so that it becomes the alternative hypothesis.

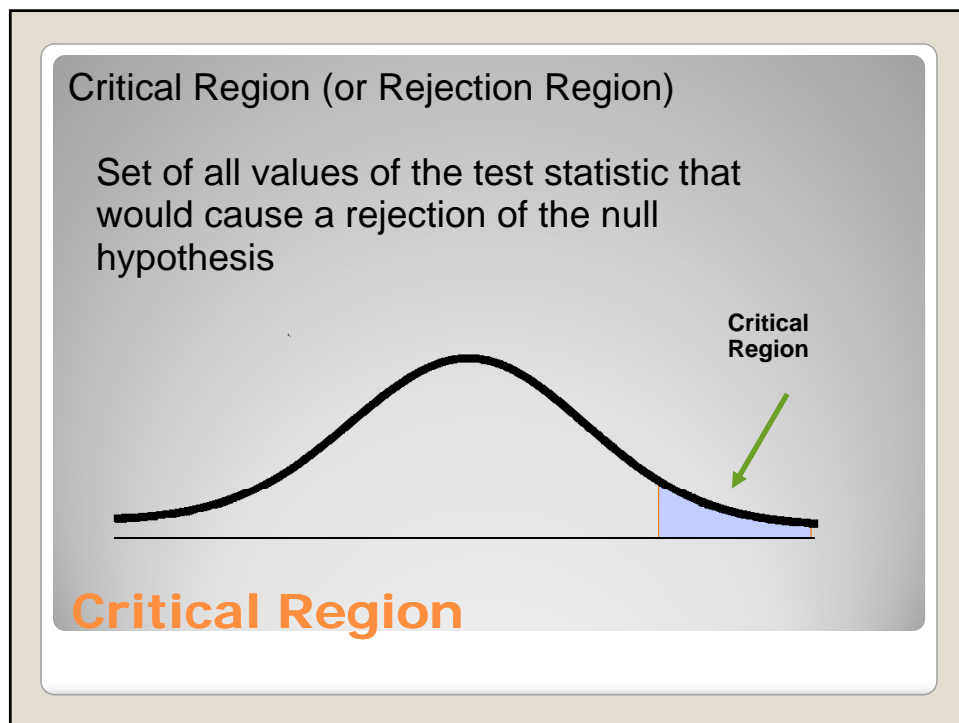
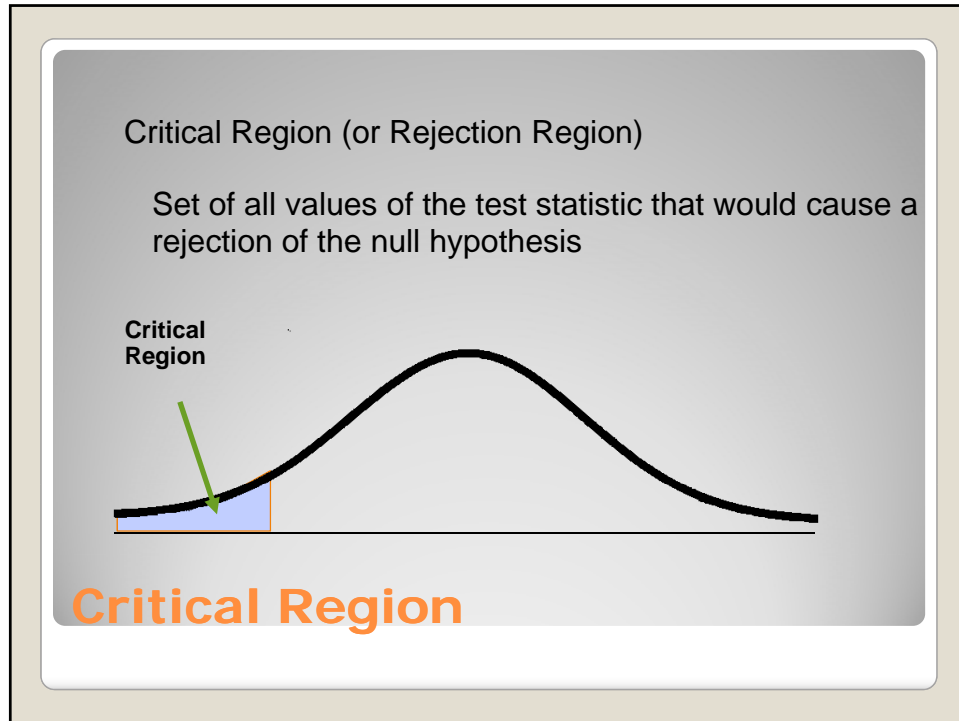
Note about Forming Your Own Claims (Hypotheses)

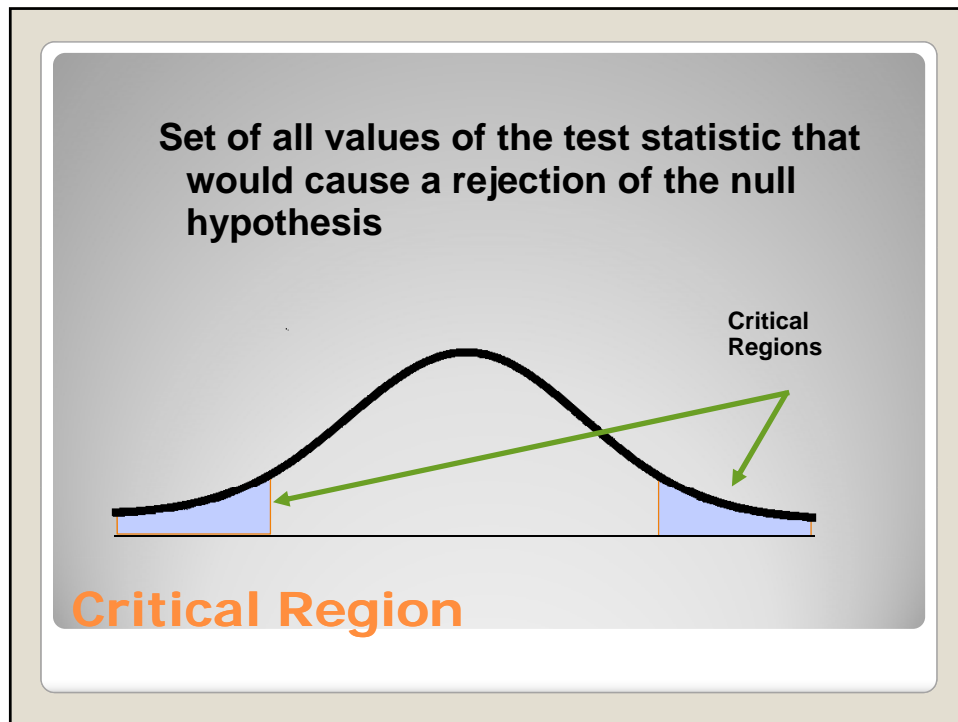
Test Statistic

a value computed from the sample data that is used in making the decision about the rejection of the null hypothesis

For large samples, testing claims about population means the test statistics is:

$$Z = \frac{\bar{X} - \mu_x}{\frac{\sigma}{\sqrt{n}}}$$





- denoted by α
 - the probability that the test statistic will fall in the critical region when the null hypothesis is actually true
 - The probability of rejecting the null hypothesis
 - common choices are 0.05, 0.01, and 0.10
- Significance Level of the Hypothesis Test**

Always test the null hypothesis

1. Reject the H_0
2. Fail to reject the H_0

need to formulate correct wording of final conclusion

Conclusions in Hypothesis Testing

- **The mistake of rejecting the null hypothesis when it is true.**
- **α (alpha) is used to represent the probability of a type I error**

Type I Error

- the mistake of failing to reject the null hypothesis when it is false.
- β (beta) is used to represent the probability of a type II error

Type II Error

Type I and Type II Errors

What's true in Reality

		What's true in Reality	
		The null hypothesis is true	The null hypothesis is false
Decision based on Hypothesis Test	Reject the null hypothesis	Type I error (rejecting a true null hypothesis) α	Correct decision
	Fail to reject the null hypothesis	Correct decision	Type II error (rejecting a false null hypothesis) β

- For any fixed α , an increase in the sample size n will cause a decrease in β .
- For any fixed sample size n , a decrease in α will cause an increase in β . Conversely, an increase in α will cause a decrease in β .
- To decrease both α and β , increase the sample size.

Controlling Type I and Type II Errors