HYPOTHESIS TESTING

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INTRODUCTION

Hypothesis testing is a decision-making process for evaluating claims about a population.

-We must define the population under study.

-State the particular hypotheses that will be investigated,

-Give the significance level.

-Select a sample from the population, collect the data,

perform the calculations required for the statistical reach a conclusion.

STEPS IN HYPOTHESIS TESTING

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A Statistical hypothesis is a conjecture about a population parameter. This conjecture may or may not be true.

The null hypothesis, symbolized by H_0, is a statistical hypothesis that states that there is no difference between a parameter and a specific value or that there is no difference between two parameters.

ALTERNATIVE HYPOTHESIS

The alternative hypothesis, symbolized by H_1, is a statistical hypothesis that states a specific difference between a parameter and a specific value or states that there is a difference between two parameters.

EXAMPLE 1

A medical researcher is interested in finding out whether a new medication will have any undesirable side effects.

The researcher is particularly concerned with the pulse rate of the patients who take the medication.

What are the hypotheses to test whether the pulse rate will be different from the mean pulse rate of 82 beats per minute?

- **H0: $\mu = 82$ H1: $\mu \neq 82$**
- **This is a two-tailed test.**

Example 2

A chemist invents an additive to increase the life of an automobile battery. If the mean lifetime of the battery is 36 months, then his hypotheses are

- $H_0: \mu \leq 36 \quad H_1: \mu > 36$

This is a right-tailed test.

EXAMPLE 3

A contractor wishes to lower heating bills by using a special type of insulation in houses. If the average of the monthly heating bills is $78, her hypotheses about heating costs will be

$H_0: \mu \geq \$78$ $H_0: \mu < \$78$

This is a left-tailed test.

STATISTICAL TEST

A statistical test uses the data obtained from a sample to make a decision about whether or no the null hypothesis should be rejected.

The numerical value obtained from a statistical test is called the test value.

In the hypothesis-testing situation, there are four possible outcomes.

In reality, the null hypothesis may or may not be true, and a decision is made to reject or not to reject it on the basis of the data obtained from a sample.

FOUR POSSIBLE OUTCOMES.

	H_0 True	H_0 False
Reject H_0	ERROR TYPE I	CORRECT DECISION
Do not reject H_0	CORRECT DECISION	ERROR TYPE II

TYPES OF ERROR

THERE ARE TWO TYPES OF ERROR:

1-A type I error occurs if one rejects the null hypothesis H0, when it is true.

2-A type II error occurs if one does not reject the null hypothesis when it is false.

THE LEVEL OF SIGNIFICANCE

The level of significance is the

maximum probability of committing a type I error. This probability is symbolized by α (Greek letter alpha). That is, $P(\text{type I error}) = \alpha$.

$P(\text{type II error}) = \beta$ (Greek letter

beta).

TYPICAL SIGNIFICANCE LEVELS

Typical significance levels are:

0.10, 0.05, and 0.01.

For example, when $\alpha = 0.10$, there is a 10% chance of rejecting a true null hypothesis.

The critical value(s) separates the

critical region from the noncritical region.

The symbol for critical value is C.V.

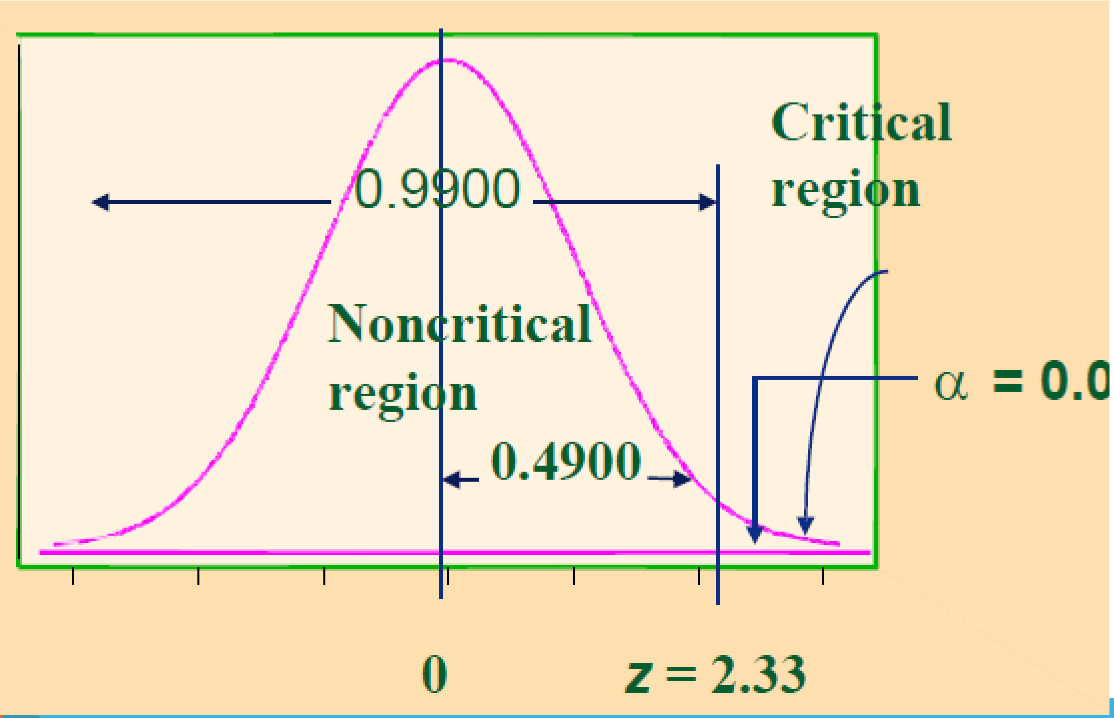
THE NONCRITICAL OR NO REJECTION REGION

The **noncritical** or **no rejection region** is the range of values of the test value that indicates that the difference was probably due to chance and that the null hypothesis should not be rejected.

A **one-tailed test (right or left)** indicates that the null hypothesis should be rejected when the test value is in the critical region on one side of the mean.

FINDING THE CRITICAL VALUE

Finding the Critical Value for α = 0.01 (Right-Tailed Test)



FINDING THE CRITICAL VALUE

Finding the Critical Value for α = 0.01 (Left-Tailed Test)

For a left-tailed **test when α = 0.01, the critical value will be –2.33 and the critical region will be to the left of –2.33.**

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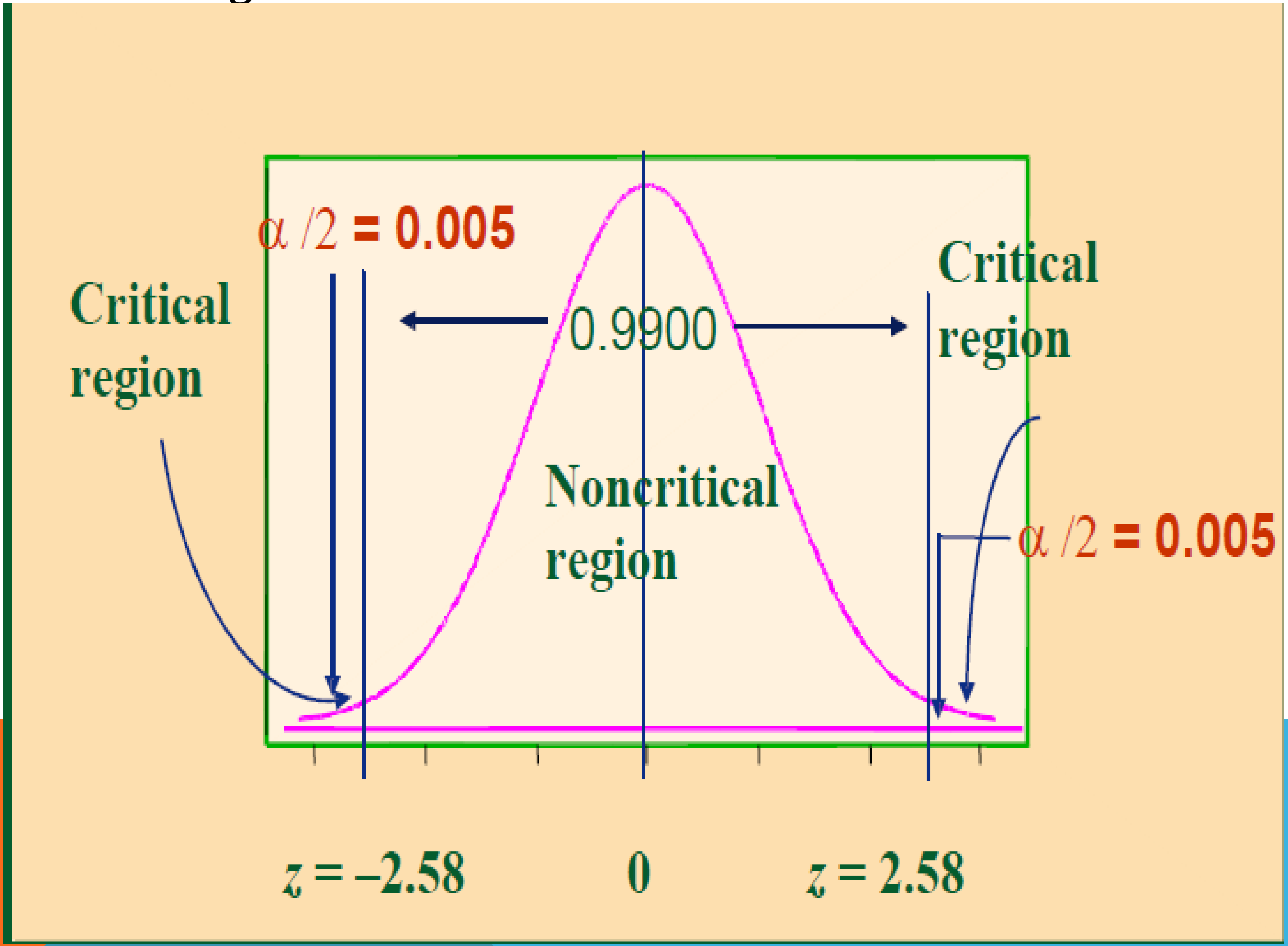
Finding the Critical Value for α = 0.01 (Two-Tailed Test) •In a two-tailed test, the null hypothesis should be rejected when the test value is in either of the two critical regions.



LARGE SAMPLE MEAN TEST (Z TEST)

The *z* test is a statistical test for the mean of a population. It can be used when $n \geq 30$, or when the population is normally distributed and σ is known.

The formula for the *z* test is given on the next slide.

THE FORMULA FOR THE Z TEST

$$z = \frac{\bar{X} - \mu}{\sigma / \sqrt{n}}$$

where

$\bar{X}$ = *sample mean*

μ = *hypothesized population mean*

σ = *population deviation*

n = *sample size*