SNS COLLEGE OF TECHNOLOGY

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Approved by AICTE, New Delhi & Affiliated to Anna University, Chennai

Department of Computer Science and Engineering

Course Code & Title : 23ADO201 - Data Science Fundamentals

III YEAR / VI SEMESTER - ECE

Unit 3 - INFERENTIAL STATISTICS

Topic : Interpretations, One-tailed and Two-tailed tests.

K.KARTHIKEYAN AP /CSE

Empathy

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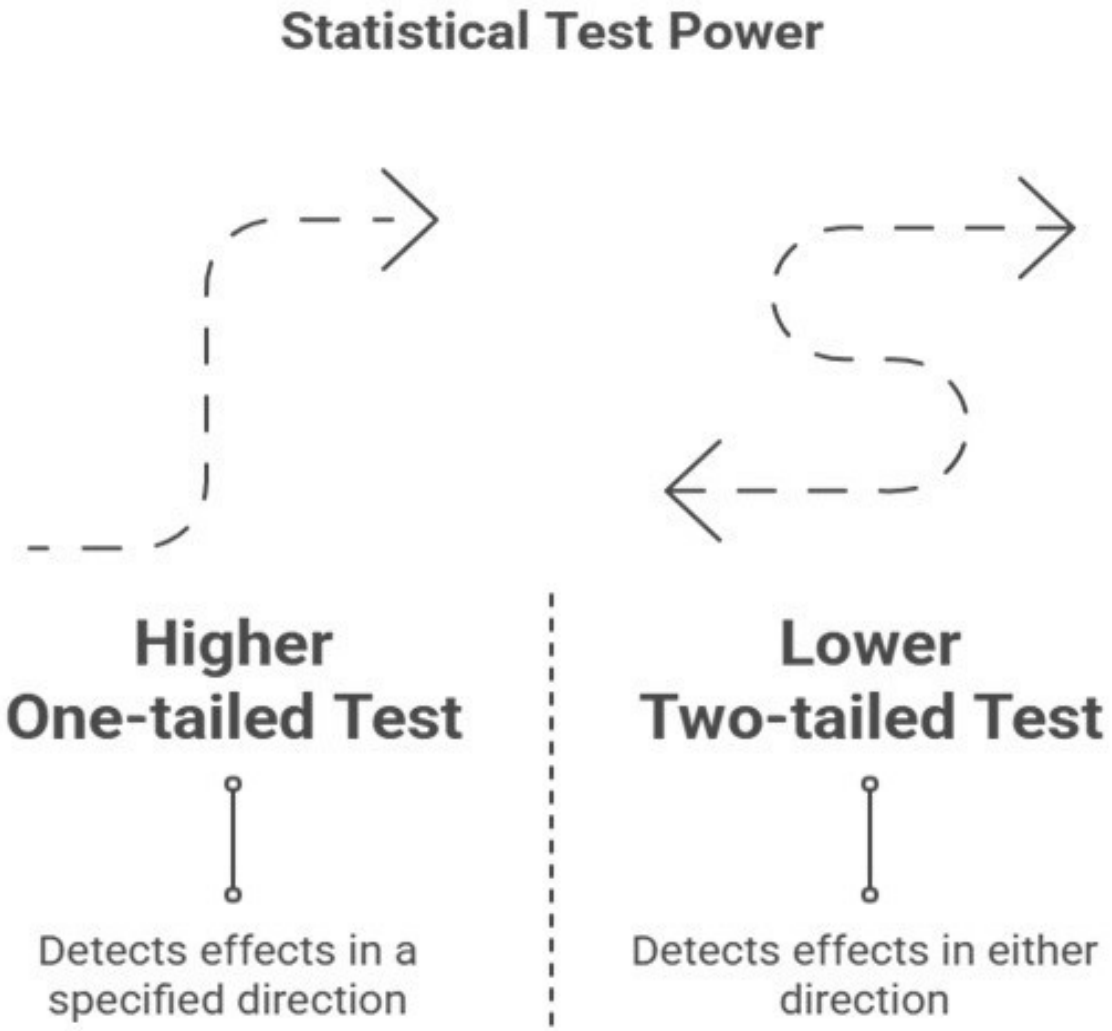

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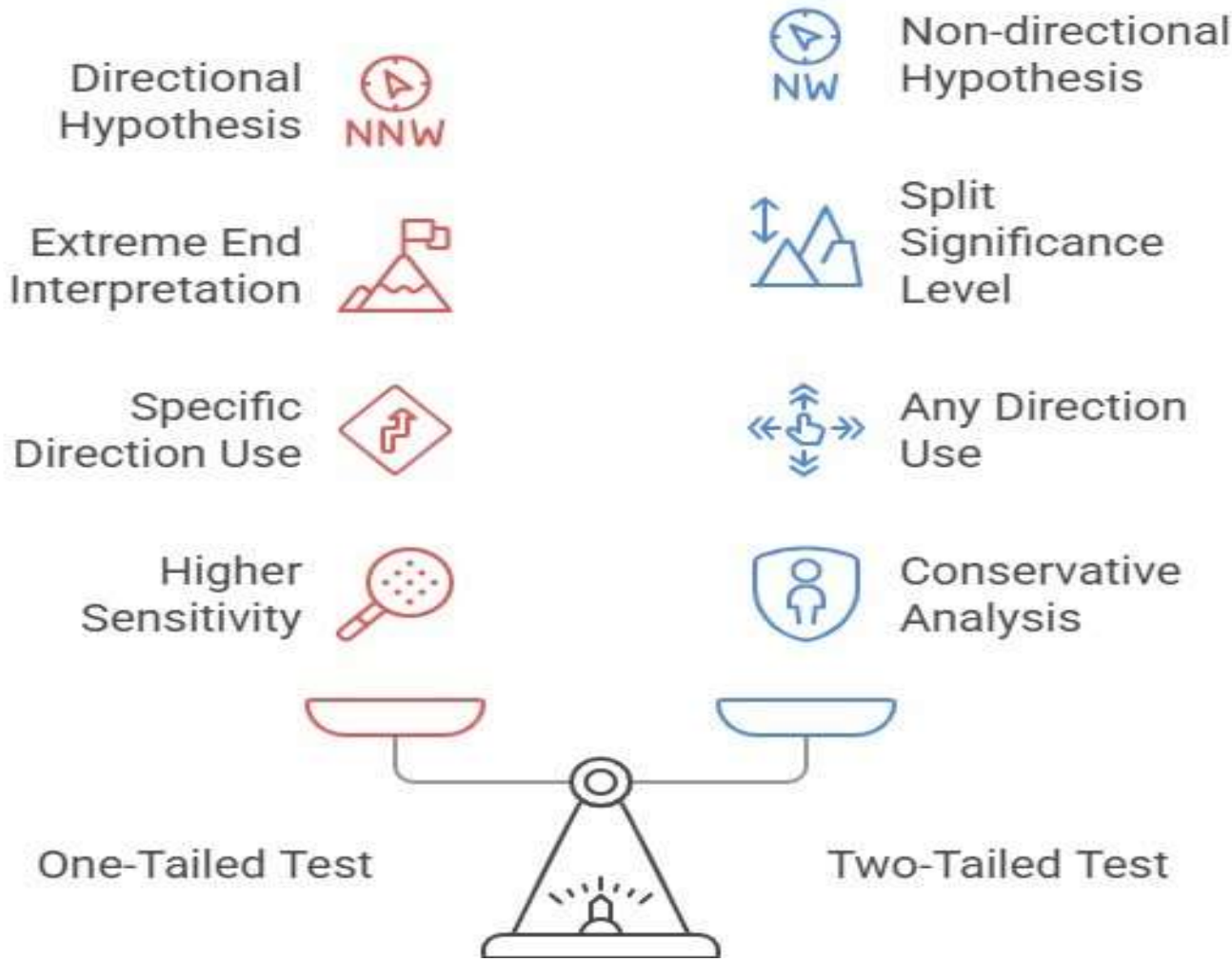
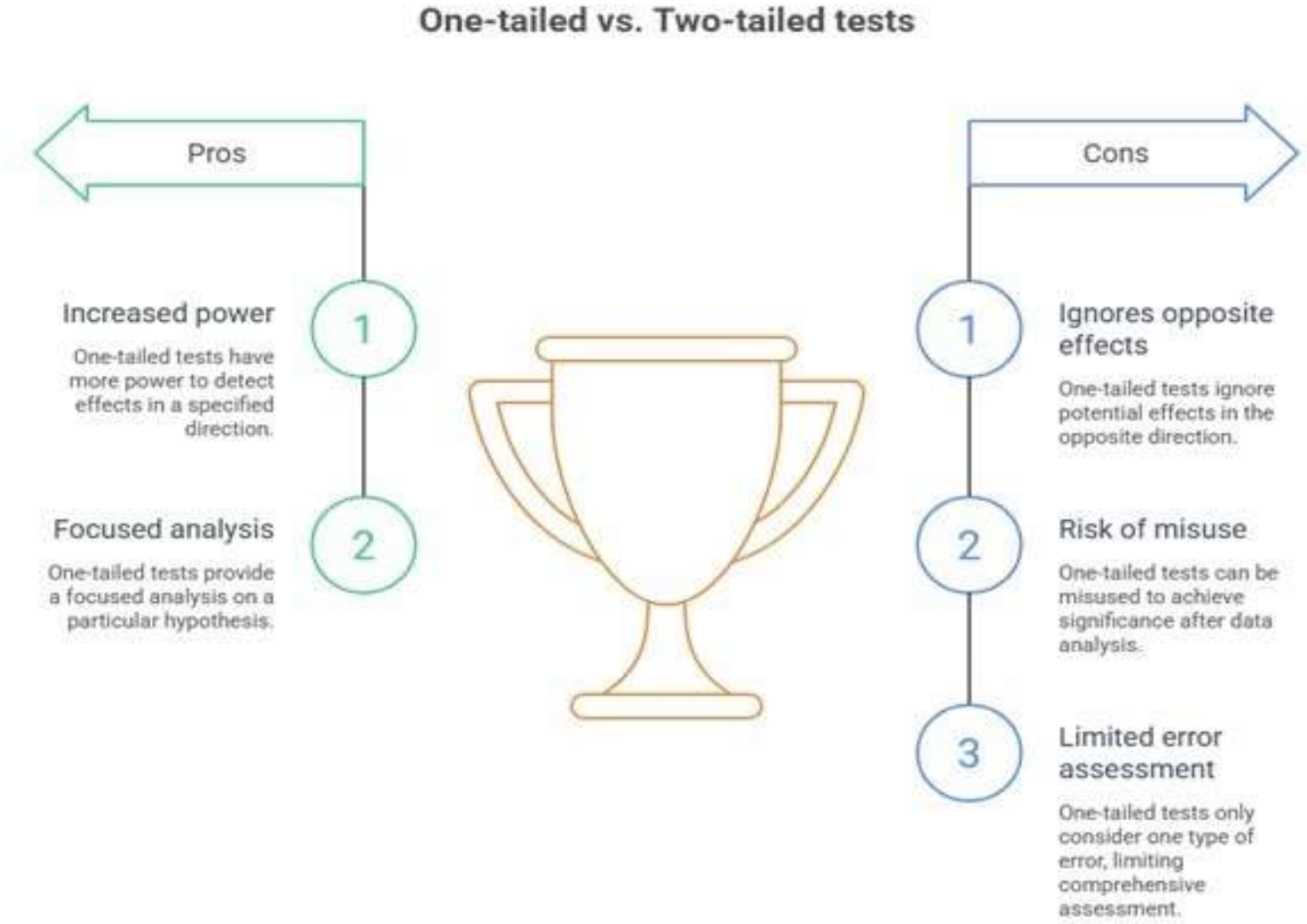
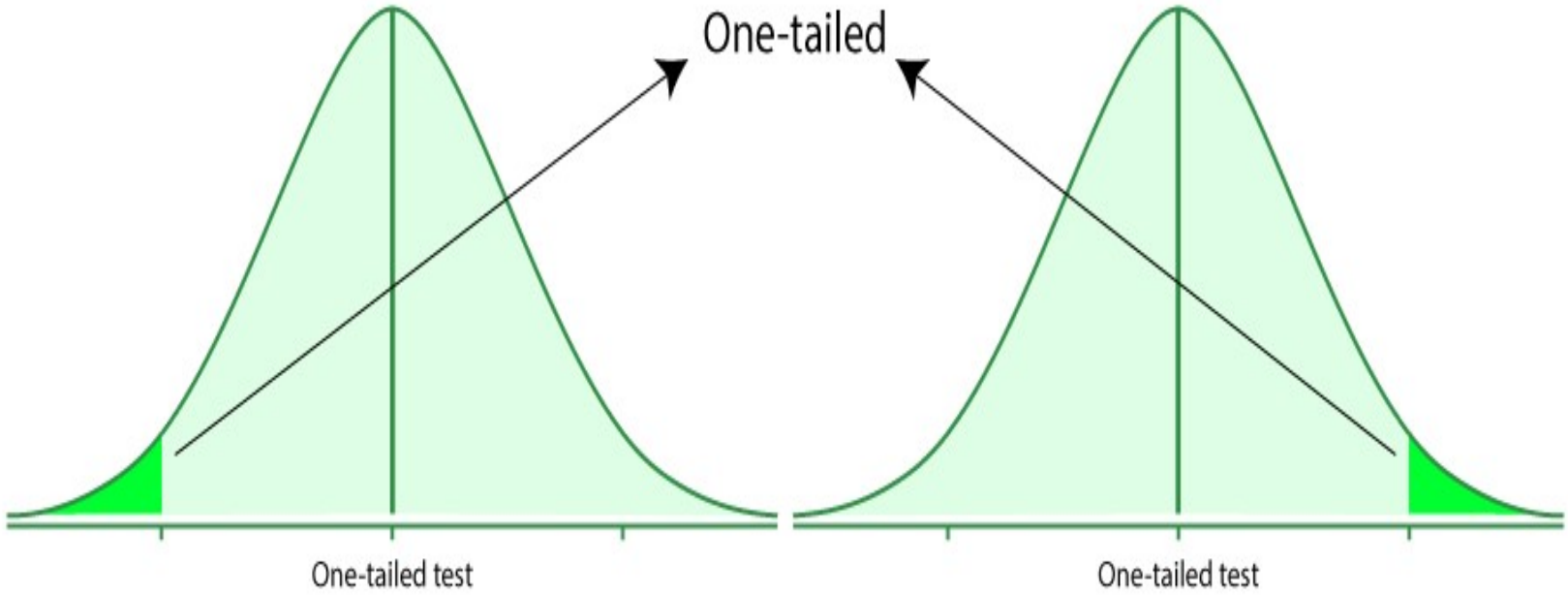
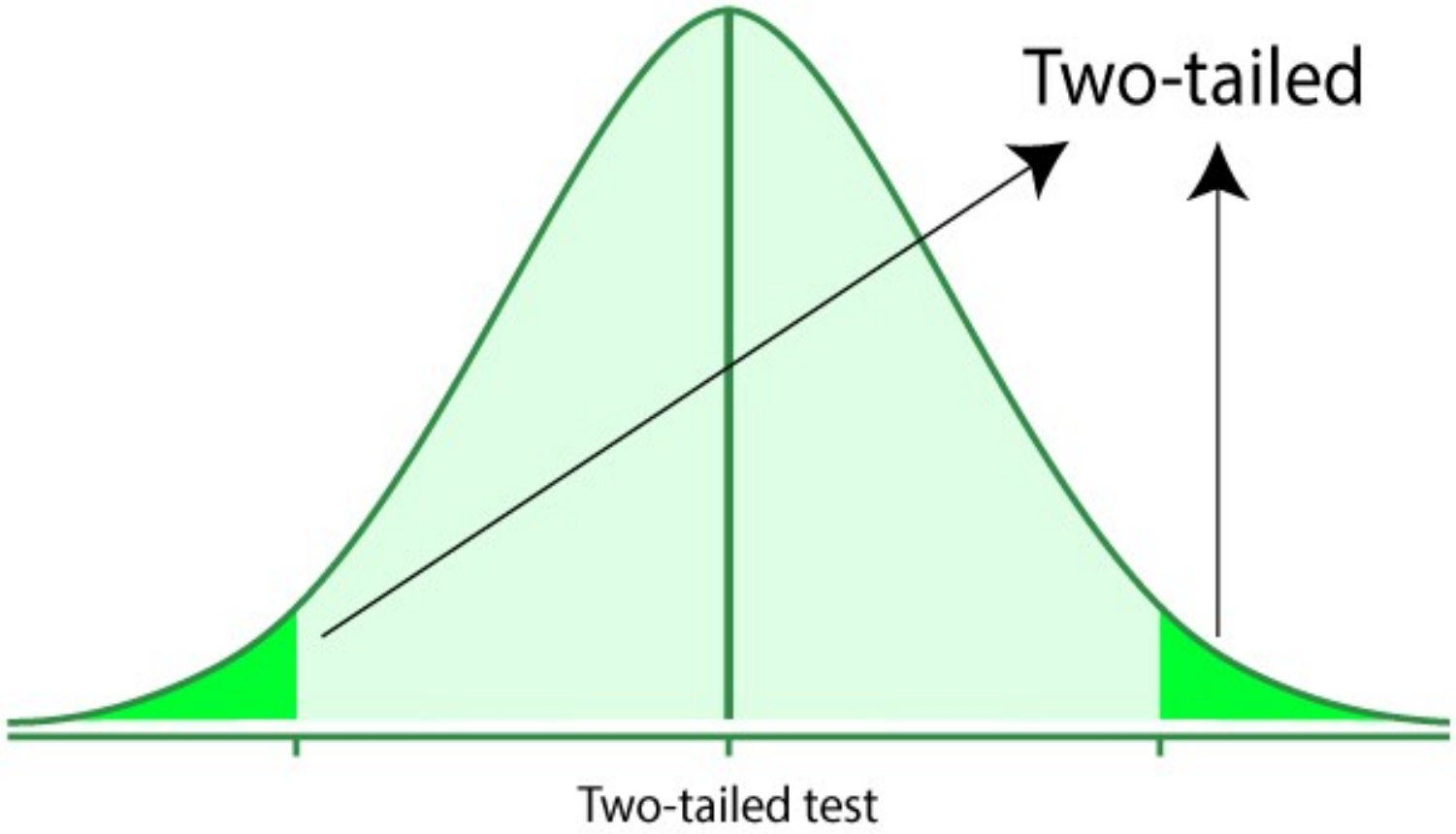
Choose the right test for your research.




One-tailed vs. Two-tailed tests
Pros
1
Increased power
One-tailed tests have more power to detect effects in a specified direction.
2
Focused analysis
One-tailed tests provide a focused analysis on a particular hypothesis.
Cons
1
Ignores opposite effects
One-tailed tests ignore potential effects in the opposite direction.
2
Risk of misuse
One-tailed tests can be misused to achieve significance after data analysis.
3
Limited error assessment
One-tailed tests only consider one type of error, limiting comprehensive assessment.


One-tailed
One-tailed test
One-tailed test


Two-tailed
Two-tailed test

Problem 1 – Two-Tailed Test

A company claims that the **average weight of a product is 500 g**.

A sample of **36 products** has a **sample mean of 490 g**. The **population standard deviation is 30 g**.

Test the claim at **5% significance level**.

Step 1: Hypotheses

- $H_0: \mu = 500$
- $H_1: \mu \neq 500$

This is a **two-tailed test** because we check whether the mean is **different** from 500.

Step 2: Test Statistic

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

$\bar{x}$

μ

σ

$$z = \frac{x - \mu}{\sigma} \approx 1.2$$

$$\Phi(z) \approx 88.5\%$$

$$Z = \frac{490 - 500}{30/\sqrt{36}}$$

$$Z = \frac{-10}{30/6}$$

$$Z = \frac{-10}{5}$$

$$Z = -2$$

Step 3: Critical Value

At α = 0.05,

Critical value = ±1.96

Step 4: Decision

Since −2 < −1.96, we reject H_0.

Interpretation

There is sufficient evidence that the average product weight is different from 500 g.

Activity

Activity: Interpretations, One-Tailed and Two-Tailed Tests

Objective:

Help students understand the difference between one-tailed and two-tailed hypothesis tests and how to interpret results in hypothesis testing.

Activity Scenario

A company claims that the average weight of a product is 100 g.

A sample is taken to test whether the claim is correct at a 5% significance level.

Students must determine whether the test is one-tailed or two-tailed and interpret the result.

Step	Student Task	Expected Answer
1	State the **Null Hypothesis (H_0)**	$\mu = 100$
2	Write the **Alternative Hypothesis (H_1)** for two-tailed test	$\mu \neq 100$
3	Write the **Alternative Hypothesis (H_1)** for right-tailed test	$\mu > 100$
4	Write the **Alternative Hypothesis (H_1)** for left-tailed test	$\mu < 100$
5	Identify the **type of test when H_1: $\mu \neq 100$**	Two-tailed test
6	Identify the **type of test when H_1: $\mu > 100$**	Right-tailed test
7	Identify the **type of test when H_1: $\mu < 100$**	Left-tailed test
8	Interpret the result if the test statistic falls in rejection region	Reject H_0
9	Interpret the result if the test statistic falls in acceptance region	Fail to reject H_0

MCQ

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MCQ questions on Interpretations, One-tailed and Two-tailed Tests.

1. In hypothesis testing, interpretation mainly refers to:

A) Drawing graphs of data

B) Making a decision about the null hypothesis

C) Calculating the mean

D) Finding the sample size

Answer: B

2. A two-tailed test is used when the alternative hypothesis is:

A) $\mu > \mu_0$

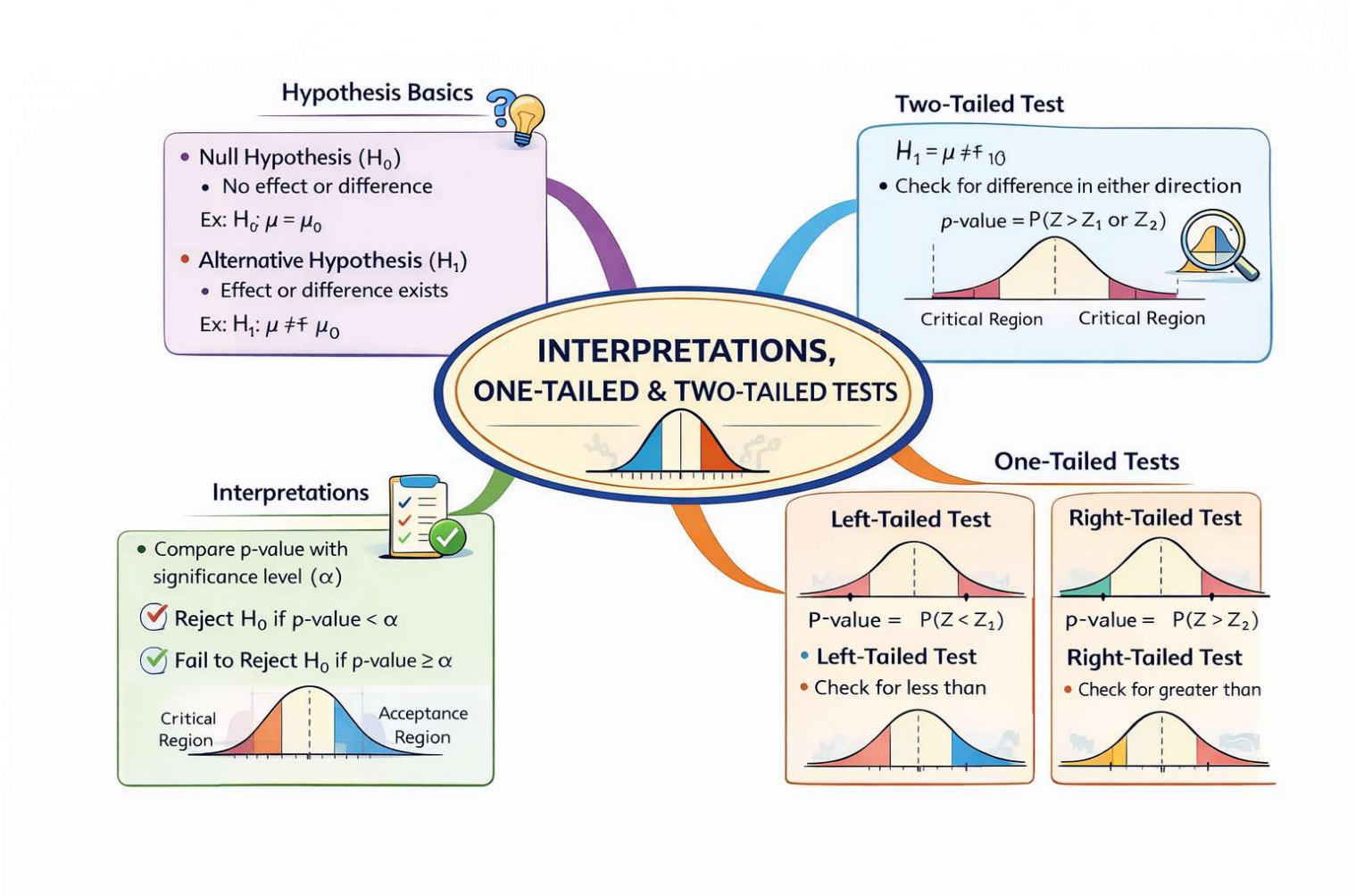
B) $\mu < \mu_0$

C) $\mu \neq \mu_0$

D) $\mu = \mu_0$

Answer: C

MIND MAP


INTERPRETATIONS,
ONE-TAILED & TWO-TAILED TESTS
Hypothesis Basics
Null Hypothesis (H_0)
No effect or difference
Ex: H_0: $\mu = \mu_0$
Alternative Hypothesis (H_1)
Effect or difference exists
Ex: H_1: $\mu \neq \mu_0$
Two-Tailed Test
$H_1 = \mu \neq \mu_0$
Check for difference in either direction
p-value = $P(Z > Z_1$ or $Z_2)$
Critical Region
Critical Region
Interpretations
Compare p-value with significance level (α)
Reject H_0 if p-value < α
Fail to Reject H_0 if p-value ≥ α
Critical Region
Acceptance Region
One-Tailed Tests
Left-Tailed Test
P-value = $P(Z < Z_1)$
Left-Tailed Test
Check for less than
Right-Tailed Test
p-value = $P(Z > Z_2)$
Right-Tailed Test
Check for greater than

REFERENCE BOOKS

1.Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press, 2014.
2.Sanjeev J. Wagh, Manisha S. Bhende, Anuradha D. Thakare, “Fundamentals of Data Science”, CRC Press, 2022.
3.Chirag Shah, “A Hands-On Introduction to Data Science”, Cambridge University Press, 2020.
4.Vineet Raina, Srinath Krishnamurthy, “Building an Effective Data Science Practice: A Framework to Bootstrap and Manage a Successful Data Science Practice”, A press, 2021.

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