

# **PRESENTATION**

**Non-Parametric Test: One-Sample and Two-Sample Sign Test**

**Course title:** Sampling Distribution and Hypothesis Testing

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**Presented by:**

Joy Saha

ID: 190635

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**Presented to:**

Dr. Md. Sarwar Hosain

Associate Professor

Department of ICE, PUST

# Non-Parametric Tests

- ◆ One-Sample and Two-Sample Sign Test
- ◆ Understanding Sign Tests for Small Sample Analysis

# Introduction

- ◆ **Non-parametric tests** do not assume normal distribution.
- ◆ These tests are also known as **distribution-free tests**.
- ◆ Useful for ordinal, skewed data, or small samples.
- ◆ Focus on the median rather than the mean.

## 📌 Common Non-Parametric Tests:

- ✓ Sign Test
- ✓ Wilcoxon Signed-Rank Test
- ✓ Mann-Whitney U Test

# What is a Sign Test?

- ◆ A **sign test** is used when comparing a median to a known value or when comparing paired samples.
- ◆ It is based on the number of positive (+) and negative (-) signs instead of actual values.

## Types:

- 1 One-Sample Sign Test
- 2 Two-Sample (Paired) Sign Test

# One-Sample Sign Test

- ◆ **Purpose:** Tests if a sample's median equals a hypothesized value.
- ◆ **Hypotheses:**

$$H_0: M = M_0$$

$$H_1: M \neq M_0$$

- ◆ **Steps:**
  - 1 Compare each value to the hypothesized median.
  - 2 Assign " + " if greater, " - " if less.
  - 3 Ignore values equal to the median.
  - 4 Use the binomial test formula:

$$P(X \geq k) = \sum_{x=k}^n \binom{n}{x} (0.5)^x (0.5)^{n-x}$$

- ◆ **Example:** A delivery service claims median delivery time is 30 minutes.  
A sample of 10 deliveries is checked against this claim.

# Two-Sample Sign Test

- ◆ **Purpose:** Compares the medians of two related samples.
- ◆ **Hypotheses:**

$$H_0: M_1 = M_2$$

$$H_a: M_1 \neq M_2$$

- ◆ **Steps:**

- 1 Compare paired data values.
- 2 Assign " + " if Sample 1 > Sample 2, " - " if Sample 1 < Sample 2.
- 3 Ignore ties (equal values).
- 4 Use the binomial test formula:

$$P(X \geq k) = \sum_{x=k}^n \binom{n}{x} (0.5)^n$$

- ◆ **Example:** Testing if two teaching methods lead to different median test scores.

# Advantages & Disadvantages

## ✓ Advantages:

- ✓ Easy to understand and apply
- ✓ No assumption about population distribution
- ✓ Suitable for ranked or graded data

## ✗ Disadvantages:

- ✗ Less powerful than parametric tests
  - ✗ Ignores magnitude of differences
- ✗ Relying on ranks can ignore the magnitude of differences

# Conclusion & Applications

- ◆ Sign tests are useful when data does not follow a normal distribution.
- ◆ Commonly applied in quality control, medical research, and behavioral sciences.
- ◆ Alternative tests: Wilcoxon Signed-Rank Test for stronger conclusions.

# THANK YOU