PROPORTION TEST

INFERENTIAL STATISTICS

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TOPIC OUTLINE

1 Proportion Test

2 Proportion Test

ANOM

1 PROPORTION TEST

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A **1 Proportion Test** tests whether the proportion of successes in a **single sample** differs from a hypothesized **population** proportion.

Null Hypothesis

$$H_o: P_1 = P_o$$

Alternative Hypothesis

$$H_a: P_1 \neq P_o \text{ (p-value} \leq \alpha\text{)}$$

Binomial Test

```
binomtest(
    k = number of success,
    n = number of trials,
    p = population proportion,
)
```

1 PROPORTION TEST

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Null Hypothesis

$$H_o: P_1 = P_o$$

Alternative Hypothesis

$$H_a: P_1 \neq P_o \text{ (p-value} \leq \alpha)$$

Z-Test

```
z_stat, p_value = proportions_ztest(
    count = number of success,
    nobs = number of trials,
    value = population proportion,
)
```

EXERCISE

In a survey of **1250** people, **600** preferred product A. Test if this is significantly **different** from the expected **50%** preference.

Solution

Let $\alpha = 0.05$

Null Hypothesis

$$\boldsymbol{H_o: P_1 = 0.5}$$

Alternative Hypothesis

$\boldsymbol{H_a: P_1 \neq 0.5}$ (p-value $\leq$ 0.05)

2 PROPORTION TEST

2 PROPORTION TEST

A **2 Proportion Test** compares proportions between **two independent** groups.

Null Hypothesis

$$H_o: P_1 = P_2$$

Alternative Hypothesis

$$H_a: P_1 \neq P_2 \text{ (p-value} \leq \alpha)$$

Z-Test

```
z_stat, p_value = proportions_ztest(
    count = [success_1, success_2)],
    nobs = [trial_1, trial_2],
)
```

EXERCISE

A company produces two types of circuit boards, Board A and Board B. In a quality test:

- **35** out of **150** Board A samples were defective
- **25** out of **120** Board B samples were defective

Is there a significant **difference** in the defect rates between Board A and Board B at a **5%** significance level?

Solution

Let $\alpha = 0.05$

Null Hypothesis

$\boldsymbol{H_o}$: **Board A = Board B**

Alternative Hypothesis

$\boldsymbol{H_a}$: **Board A ≠ Board B** (p-value ≤ 0.05)

ANOM

ANOM

Analysis of Means (ANOM) is **multiple** comparison method to determine which group proportions (or means) differ from the overall average.

Null Hypothesis

$$H_o: P_1 = P_2 = P_3$$

Alternative Hypothesis

$$H_a\text{: at least 1} \neq \text{(p-value} \leq \alpha\text{)}$$

Chi-square Test for Proportions

```
chi_stat, p_value, table =
proportions_chisquare(
    counts = [success array],
    nobs = [trials array],
)
```

EXERCISE

A company produces two types of circuit boards, Board A and Board B. In a quality test:

- **35** out of **150** Board A samples were defective
- **25** out of **120** Board B samples were defective
- **30** out **85** Board C samples were defective

Is there a significant **difference** in the defect rates between the boards at a **5%** significance level?

Solution

Let $\alpha = 0.05$

Null Hypothesis

$\boldsymbol{H_o}$: **Board A = Board B = Board C**

Alternative Hypothesis

$\boldsymbol{H_a}$: **at least 1 board is different** (p-value ≤ 0.05)

LABORATORY