PROPORTION TEST

HYPOTHESIS TESTING

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TOPIC OUTLINE

1-Proportion Test

2-Proportion Test

Analysis of Mean (ANOM)

1-PROPORTION TEST

1-PROPORTION TEST

1-Proportion test is a statistical method used to determine whether a **sample proportion** differs significantly from a hypothesized population proportion.

Hypothesis

$H_o: P_1 = P_o$

$H_a: P_1 \neq P_o$ (p-value $< \alpha$)

Assumption

- Discrete data

syntax

```
from scipy import stats
result = stats.binomtest(
    k = number of success,
    n = sample size,
    p = population proportion)
p_value = result.pvalue
```

options

```
alternative = 'two-sided' # default
alternative = 'greater'  # p1 > p0
alternative = 'less' # p1 < p0
```

1-PROPORTION TEST

1-Proportion test is a statistical method used to determine whether a **sample proportion** differs significantly from a hypothesized population proportion.

Hypothesis

$H_o: P_1 = P_o$

$H_a: P_1 \neq P_o$ (p-value $< \alpha$)

Assumption

- Discrete data

syntax

```
from statsmodels.stats.proportion
import proportions_ztest
z_stat, p_value = proportions_ztest(
    count = number of success,
    nobs = sample size,
    value = population proportion)
```

options

```
alternative = 'two-sided' # default
alternative = 'greater'  # p1 > p0
alternative = 'less' # p1 < p0
```

EXERCISE

In a survey of **1250** people, **600** preferred product A.

Test if this is significantly **different** from the expected **50%** preference.

solution

Let $\alpha = 0.05$

Hypothesis

$\boldsymbol{H_o: P_1 = 0.5}$

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

2-PROPORTION TEST

2-PROPORTION TEST

2-Proportion test is a statistical method used to determine whether the proportions of **two independent groups** are significantly different from each other.

Hypothesis

$H_o: P_1 = P_2$

$H_a: P_1 \neq P_2$ (p-value $< \alpha$)

Assumption

- Discrete data

syntax

```
from statsmodels.stats.proportion
import proportions_ztest
z_stat, p_value = proportions_ztest(
    count = [success_1, success_2],
    nobs = [size_1, size_2])
```

options

```
alternative = 'two-sided' # default
alternative = 'greater'  # p1 > p1
alternative = 'less' # p1 < p2
```

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 $\alpha = 0.05$

Hypothesis

$\boldsymbol{H_o}: \boldsymbol{P_A} = \boldsymbol{P_B}$

$\boldsymbol{H_a}: \boldsymbol{P_A} \neq \boldsymbol{P_B}$ (p-value < 0.05)

ANOM

ANOM

Analysis of Mean (ANOM) is a statistical method used to test whether the means of **multiple groups** differ significantly from the overall mean.

Hypothesis

$H_o: P_1 = P_2 = P_3 = \cdots P_n$

H_a: at least 1 ≠ (p-value < α)

Assumption

- Discrete data

syntax

```
from statsmodels.stats.proportion
import proportions_chisquare
chi_stat, p_value, table =
proportions_chisquare(
    counts = [success_1,success_2,
        success_3,...success_n],
    nobs = [size_1, size_2,
        size_3,...size_n])
```

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 $\alpha = 0.05$

Hypothesis

$\boldsymbol{H_o}$: $\boldsymbol{P_A = P_B = P_C}$

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

LABORATORY