

CHI SQUARE TESTS

Parametric Tests vs. Non-Parametric Tests:

Parametric Tests	Non-Parametric Tests

Five Commonly Used Non-Parametric Tests:

1. *The Chi-Square Test for Goodness of Fit**
2. *The Chi-Square Test for Independence**
3. Mann-Whitney U Test
4. Wilcoxon T Test
5. Kruskal Wallis Test

The Chi-Square (χ^2) Test for Goodness of Fit

Purpose:

Examples:

Steps:

- 1.
- 2.
- 3.

Presentation:

Hypotheses:Null Hypothesis

2 Types of Null Hypotheses:

- 1) *No Preference* among the different categories
- 2) *No Difference* from a known population

Alternative Hypothesis:**The Data for the Goodness of Fit Test**Observed Frequencies (f_o)Expected Frequencies:

$$f_e = p * n$$

(p = proportion stated in the H_0)
(n = total sample size)

The Chi Square Statistic:

$$\chi^2 = \sum \frac{(f_o - f_e)^2}{f_e}$$

- 1) Find the difference between f_o (the data) and f_e (the null hypothesis) for each category.
- 2) Square the difference – ensures all values are positive.
- 3) Divide each squared differences by its f_e .
- 4) Sum the values from all the categories.

Chi-Square Distribution:Degrees of Freedom:

$$df = C - 1$$

(C = the number of categories)

Locating the Critical Region:

Consult “Critical Values of χ^2 ” table

Art Appreciation Example

A psychologist examining art appreciation selected an abstract painting that had no obvious top or bottom. Hangers were placed on the painting so that it could be hung with any one of the four sides at the top. The painting was shown to a sample of $n = 50$ participants, and each was asked to hang the painting in whatever orientation looked best. The following data indicate how many times each of the four sides was placed at top:

Top up (correct)	Bottom up	Left side up	Right side up
18	17	7	8

Research Question: Are there any preferences among the four possible orientations. Are any of the orientations selected more (or less) often than would be expected simply by chance?

Step 1: State the hypotheses.

Step 2: Select the alpha level and locate the critical region.

Step 3: Calculate the chi-square statistic.

Step 4: Make a decision and state the conclusion.

CHI-SQUARE TEST FOR INDEPENDENCE

Purpose:

Color Preference and Personality Example

A researcher is investigating the relationship between personality type and color preference. A sample of $n = 200$ college students is obtained, and each student is classified for both personality type (introvert, extravert) and color preference (red, yellow, green, blue). The following frequencies were obtained:

	Red	Yellow	Green	Blue	Personality Totals
Introvert	10	3	15	22	50
Extravert	90	17	25	18	150
Color Totals	100	20	40	40	$n = 200$

Research Question: Is there a consistent, predictable relationship between personality and color preferences? Are there significant differences between introverts and extraverts for color preference?

Step 1: State the hypotheses.

Step 2: Select the alpha level and locate the critical region.

Step 3: Calculate expected frequencies.

Step 4: Calculate the chi-square statistic.

Step 5: Make a decision and state the conclusion.

CHI-SQUARE TEST FOR INDEPENDENCE

Academic Performance and Self-Esteem Example

A researcher is investigating the relationship between academic performance and self-esteem. A sample of $n = 150$ ten-year-old children is obtained, and each child is classified by level of academic performance and level of self-esteem. The following frequencies were obtained:

	High Self-Esteem	Medium Self-Esteem	Low Self-Esteem	Academic Performance Totals
High Academic Performance	17	32	11	60
Low Academic Performance	13	43	34	90
Self-Esteem Totals	30	75	45	$n = 150$

Research Question: Is there a consistent, predictable relationship between academic performance and self-esteem? Are there significant differences between high and low academic performers for self-esteem?

Step 1: State the hypotheses.

Step 2: Select the alpha level and locate the critical region.

Step 3: Calculate expected frequencies.

Step 4: Calculate the chi-square statistic.

Step 5: Make a decision and state the conclusion.