FSC
BRINGING ENVIRONMENTAL UNDERSTANDING TO ALL

Chi-Squared (χ^2) Test Worksheet

Juniper Hall Field Centre

Used if you wish to test for a statistically significant <u>association</u> between the <u>frequencies</u> of <u>categorical</u> data taken from different areas.

1. Write a null hypothesis (H_o) :

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2. Write an Alternative Hypothesis (H_1):

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3. Draw and fill in a contingency table with observed values replacing any zeroes with a value of 1.

										Row Total
	O	E	$\frac{(O-E)^2}{E}$	**O**	E	$\frac{(O-E)^2}{E}$	**O**	E	$\frac{(O-E)^2}{E}$	
Column Total										Grand total

4. Calculate the row, column and grand totals, ensuring that ∑ rows = ∑ columns.

5. Calculate the **expected** values:

$$\textbf{Expected} = \frac{\text{row total} \times \text{column total}}{\text{Grand total}}$$

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6. Calculate the **difference** between the observed and expected values:

Difference = $\frac{(O-E)^2}{E}$

7. Calculate the χ^2 value to 2 decimal places:

$$\chi^2 = \sum\left(\frac{(O-E)^2}{E}\right)$$

χ^2 **= .....**

8. Compare the Chi² value with the critical value; which depends on:

i) the degrees of freedom (number of columns-1) x (number of rows-1) **DoF = ...**

ii) the significance level / confidence (P=0.05 / 95%) **Critical Value = ...**

9. Compare the critical value to the Chi² value you calculated. The Chi² value is greater than or equal to / less than the critical value. Therefore reject / accept the Null hypothesis. What does this mean?

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Degrees of Freedom	Critical Value for χ^2
1	3.841
2	5.991
3	7.815
4	9.488
5	11.070
6	12.592
7	14.067
8	15.507
9	16.919

When to use this Test

When you wish to test for an association between two or more sets of categorical data, the measurements must be independent of each other. You can also test whether the distribution of two or more sets of data is uneven. The expected values must be greater than five, to ensure this you need a large amount of data.