Chi-Square Test for a 2×2 Table

Chi-square statistic, p-value and phi coefficient for a 2×2 contingency table, with or without the Yates continuity correction and the smallest expected count.

Method: Pearson chi-square test of independence

Input parameters

Unit system: SI

Parameter	Value	Unit
Row 1, column 1 count	30.000	
Row 1, column 2 count	20.000	
Row 2, column 1 count	15.000	
Row 2, column 2 count	35.000	
Continuity correction	None (Pearson)	

Calculated results

Parameter	Value	Unit
Chi-square statistic (1 degree of freedom)	9.0909	
p-value	0.002569	
Phi coefficient	0.30151	
Smallest expected count	22.500	

Notes for this case

• For a 2×2 table $\chi^2 = n(ad - bc)^2/[(a + b)(c + d)(a + c)(b + d)]$ with one degree of freedom; Yates's correction replaces $|ad - bc|$ by $|ad - bc| - n/2$. With one degree of freedom $p = \mathrm{erfc}(\sqrt{(\chi^2/2)})$. The approximation needs every expected count (row total × column total / n) to be at least about 5; below that use Fisher's exact test. Phi is the signed correlation between the two binary variables.

Formula and method

$$\chi^2 = \frac{n(|ad - bc| - \delta)^2}{(a+b)(c+d)(a+c)(b+d)}, \quad p = \operatorname{erfc}\sqrt{\chi^2/2}$$

Variables

a	Row 1, column 1 count	-
b	Row 1, column 2 count	-
c	Row 2, column 1 count	-
d	Row 2, column 2 count	-
Yates	Continuity correction	-
χ^2	Chi-square statistic (1 degree of freedom)	-
p	p-value	-
ϕ	Phi coefficient	-
E_{min}	Smallest expected count	-

Method and standards

Chi-square test.

Assumptions and limits

- Independent observations; counts, not proportions; one degree of freedom.

References

Pearson chi-square test of independence

Report details

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Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/general/geometry/chi-square-2x2-test

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Reopens the calculator with the inputs of this report.