

Contingency Chi-Square

The frequency chi-square statistic is used to accept or reject hypotheses concerning the degree to which observed frequencies depart from theoretical frequencies in a row by column contingency table with fixed marginal frequencies. It therefore tests the independence of the categorical variables defining the rows and columns. As an example, assume 50 males and 50 females are randomly assigned to each of three types of instructional methods to learn beginning French, (a) using a language laboratory, (b) using a computer with voice synthesizer and (c) using an advanced student tutor. Following a treatment period, a test is administered to each student with scoring results being pass or fail. The frequency of passing is then recorded for each cell in the 2 by 3 array (gender by treatment). If gender is independent of the treatment variable, the expected frequency of males that pass in each treatment would be the same as the expected frequency for females. The chi-squared statistic is obtained as

$$\chi^2 = \frac{\sum_{i=1}^{\text{row}} \sum_{j=1}^{\text{col}} (f_{ij} - F_{ij})^2}{F_{ij}}$$

where f_{ij} is the observed frequency, F_{ij} the expected frequency, and χ^2 is the chi-squared statistic with degrees of freedom (rows - 1) times (columns - 1).

The dialog for specifying a chi square analysis is shown below:

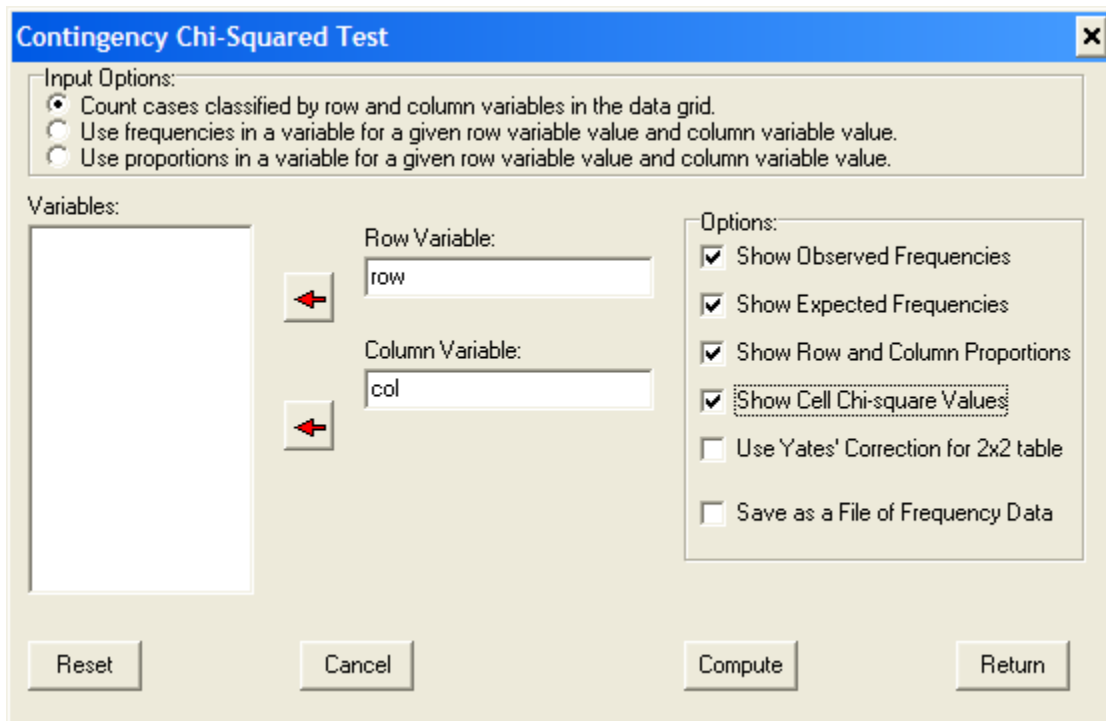


Figure 1. Chi-Squared Dialog

The File ChiSqr.TEX has been loaded for this example. When the Compute button is clicked, the following results are obtained:

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Chi-square Analysis Results for row and col
No. of Cases = 71
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OBSERVED FREQUENCIES

	Frequencies				
	COL. 1	COL. 2	COL. 3	COL. 4	Total
Row 1	5	5	5	5	20
Row 2	10	4	7	3	24
Row 3	5	10	10	2	27
Total	20	19	22	10	71

EXPECTED FREQUENCIES

	Expected Values			
	COL. 1	COL. 2	COL. 3	COL. 4
Row 1	5.634	5.352	6.197	2.817
Row 2	6.761	6.423	7.437	3.380
Row 3	7.606	7.225	8.366	3.803

ROW PROPORTIONS

	Proportions				
	COL. 1	COL. 2	COL. 3	COL. 4	Total
Row 1	0.250	0.250	0.250	0.250	1.000
Row 2	0.417	0.167	0.292	0.125	1.000
Row 3	0.185	0.370	0.370	0.074	1.000
Total	0.282	0.268	0.310	0.141	1.000

COLUMN PROPORTIONS

	Proportions				
	COL. 1	COL. 2	COL. 3	COL. 4	Total
Row 1	0.250	0.263	0.227	0.500	0.282
Row 2	0.500	0.211	0.318	0.300	0.338
Row 3	0.250	0.526	0.455	0.200	0.380
Total	1.000	1.000	1.000	1.000	1.000

PROPORTIONS OF TOTAL N

	Proportions				
	COL. 1	COL. 2	COL. 3	COL. 4	Total
Row 1	0.070	0.070	0.070	0.070	0.282
Row 2	0.141	0.056	0.099	0.042	0.338
Row 3	0.070	0.141	0.141	0.028	0.380
Total	0.282	0.268	0.310	0.141	1.000

CHI-SQUARED VALUE FOR CELLS

	Chi-square Values			
	COL. 1	COL. 2	COL. 3	COL. 4
Row 1	0.071	0.023	0.231	1.692
Row 2	1.552	0.914	0.026	0.043
Row 3	0.893	1.066	0.319	0.855

Chi-square = 7.684 with D.F. = 6. Prob. > value = 0.262

Likelihood Ratio = 7.498 with prob. > value = 0.2772

phi correlation = 0.3290

Pearson Correlation r = -0.0537

Mantel-Haenszel Test of Linear Association = 0.202 with probability
> value = 0.6532

The coefficient of contingency = 0.312

Cramer's V = 0.233