

Chi-Square Test of Independence in Excel 2016

For these instructions, you should already have an Excel worksheet with the two-way Phone/Impact Pivot Table that was created in the “Contingency Tables and Pie Charts” tutorial. Use the tutorial or instructions as a reference to get the table set up.

1. You will want to copy the values from the Phone/Impact Pivot Table to a new sheet, so select the data table and

copy it to a new sheet (do not copy the first row of the original pivot table that says “Count of...”). This table can be labeled ‘Observed Counts.’

	A	B	C	D	E
1	Observed Counts	better	no impact	worse	Grand Total
2	Android smartphone	13	9	11	33
3	iPhone	30	9	4	43
4	Grand Total	43	18	15	76

2. We will now copy and paste this table as a guide for our next two portions. Copy the table again omitting the Total row and column and paste this table twice below the original table.
3. Rename the first of the copied tables ‘Expected Counts’ and the second copy ‘Chi-square statistic.’ Then, delete all of the numbers in these tables. Leave only the table headers.

	A	B	C	D
7	Expected Counts	better	no impact	worse
8	Android smartphone			
9	iPhone			
10				
11				
12	Chi-square	better	no impact	worse
13	Android smartphone			
14	iPhone			

Note: For the remainder of the steps, I am going to reference the columns and rows as displayed in the figures on this page.

Depending on where you copy your table, you might not use the same cells as in this example, but the formatting should be the same just with different cell values.

4. First we will update the table of expected counts for each cell are calculated as the (column total*row total)/grand total. For example, for the cell for Android/better, the expected count would be $= (E2*B4)/E4$
5. Enter the appropriate formula for each cell in the first cell of the expected count table.
6. To copy the formula across the other cells of the table we need to create absolute cell references. Click on the equation you just typed and click between the E and the 2 in the equation then to set the absolute reference on a PC click F4 (or FN+F4) on a Mac click COMMAND+t. This will make dollar signs appear before the E and the 2. Repeat this for E4. Your final equation should be: $=\$E\$2*B4/\$E\4 . Now you can copy this equation across the cells in your table to the right.
7. Repeat steps 5 and 6 for the second row of data for the iPhones.
8. In your second blank table you will calculate the following formula for each cell:

$$\frac{(\text{observed value} - \text{expected value})^2}{\text{expected value}}$$

Enter the appropriate formula for each cell in the table you made in step 8. For example, in the Android/better, you would enter $=((B2-B8)^2)/B8$. After you create the formula in the first cell you can copy it to the rest of the cells in the table.

9. In a blank cell, calculate the sum of all the values you generated in step 9. For this example, type **=SUM(B13:D14)** This sum is the chi-square statistic.
10. Calculate the degrees of freedom as **=(# of rows-1)(# of columns -1)** so here $=(2-1)*(3-1)$, where 2 is the number of rows and 3 is the number of columns
11. Use Excel to calculate the critical value for your test with **=CHISQ.INV.RT(0.05,[DF])**, where DF is your degrees of freedom.
12. Use Excel to calculate the p-value associated with the statistic you computed in step 9 by typing **=CHISQ.DIST.RT([X² stat],[DF])**. The first value here is what you calculated in step 9.

To check your answer: You can generate the p-value for the chi-square test by allowing Excel to compute it, type **=CHISQ.TEST([observed count cells], [expected count cells])**. This should match the p-value you computed in step 12.

Here is what your file should look like:

	A	B	C	D	E
1	Observed Counts	better	no impact	worse	Grand Total
2	Android smartphone	13	9	11	33
3	iPhone	30	9	4	43
4	Grand Total	43	18	15	76
5					
6					
7	Expected Counts	better	no impact	worse	
8	Android smartphone	18.67105263	7.815789	6.5132	
9	iPhone	24.32894737	10.18421	8.4868	
10					
11					
12	Chi-square	better	no impact	worse	
13	Android smartphone	1.722497311	0.179426	3.0909	
14	iPhone	1.321916541	0.137699	2.3721	
15					
16					
17	Chi-square stat	8.824587683			
18	df	2			
19	Critical Value	5.991464547			
20	p-value	0.012127328			

Copy of pivot table, renamed Observed Counts

Expected counts

Sum of last table = chi-square statistic

p-value from Step 12