

Coin Flip Chi-Square

Background & Dataset

A teacher, trying to teach her students about probability, asked her students to conduct 100 coin flips. For each flip they recorded the result and produced this dataset.

At the conclusion of the data collection one student concluded that, "This coin is rigged! That seems like more heads than we would get by chance."



What do the data show? Was this coin rigged?

What would a scientist conclude?

The Chi-Square Goodness of Fit is a statistical test that can be used to test whether the frequency of specific outcomes or observations is significantly different from the expected frequency of outcomes if determined solely by random chance. It can be used when we have a categorical dependent variable of interest with two or more values.

Variables

Coin Flip# - this numerical value references the count of coin flip. The first coin flip is listed as #1, and one hundredth coin flip is #100.

Result - this categorical variable has two possible values (Head or Tail)

Activity

1) Click the **Interactive Analysis** button located near the top right of the screen with the gear icon on it. This will bring up a specific checklist that will help you determine if your dataset and variable(s) of interest are a good fit for the Chi-Square Goodness of Fit animated hypothesis test. Note that an animated t-test is also available for use with other datasets. In this example you can simply click OK in the lower right to move on with the test.

2) Give your analysis a title. This will become the name of the file where your work is saved. Type this into the top field in the pop-up window.

3) State your research question. Note that the computer will suggest a research question based on the variable that you identify as your dependent variable. In this case the variable called Result is the dependent variable and the suggested question is:

Are the counts as expected across all categories of **Result**?

That is the very specific question which the Chi-Square test will help you to answer with your data. Put that into your own words or add to it in the field within the pop-up window.

4) Once you enter the Interactive Analysis, note that the dialogue on the upper right will help you think through each step of the calculation and give instructions. The left half of the screen will use animations to show how your data are tied to the calculations.

The lower right portion of the screen is the Notebook that will create a record of your work and calculations. When finished you can turn it into a PDF or download it as a Word doc that can also be opened as a Google Doc. If your teacher created this assignment in Google Classroom, the Publish button will automatically turn it in as a completed assignment.

5) What is your conclusion? Do these data lead us to reject the null hypothesis that we expect a 50/50 distribution of heads and tails? How do you interpret the P-value obtained with this dataset? Would a scientist conclude that the coin was rigged?