Chi-square Goodness of Fit Test in R

Tools

- What is chi-square goodness of fit test?
- Example data and questions
- Statistical hypotheses
- R function: chisq.test()
  - Answer to Q1: Are the colors equally common?
  - Answer to Q2 comparing observed to expected proportions
  - Access to the values returned by chisq.test() function
- See also
- Infos

What is chi-square goodness of fit test?

The **chi-square goodness of fit** test is used to compare the observed distribution to an expected distribution, in a situation where we have two or more categories in a discrete data. In other words, it compares multiple observed proportions to expected probabilities.

Example data and questions

For example, we collected wild tulips and found that 81 were red, 50 were yellow and 27 were white.

1. **Question 1**:

> ? Are these colors equally common?

If these colors were equally distributed, the expected proportion would be 1/3 for each of the color.

2. **Question 2**:

Suppose that, in the region where you collected the data, the ratio of red, yellow and white tulip is 3:2:1 (3+2+1 = 6). This means that the expected proportion is:

- 3/6 (= 1/2) for red
- 2/6 (= 1/3) for yellow
- 1/6 for white

> ? We want to know, if there is any significant difference between the observed proportions and the expected proportions.

Statistical hypotheses

- *Null hypothesis* (H_0): There is no significant difference between the observed and the expected value.
- *Alternative hypothesis* (H_a): There is a significant difference between the observed and the expected value.

R function: chisq.test()

The R function **chisq.test**() can be used as follow:

```
chisq.test(x, p)
```

- **x**: a numeric vector
- **p**: a vector of probabilities of the same length of x.

Answer to Q1: Are the colors equally common?

```
tulip <- c(81, 50, 27)
res <- chisq.test(tulip, p = c(1/3, 1/3, 1/3))
res
```

```
    Chi-squared test for given probabilities
data:  tulip
X-squared = 27.886, df = 2, p-value = 8.803e-07
```

The function returns: the value of chi-square test statistic ("X-squared") and a a p-value.

Note that, the chi-square test should be used only when all calculated expected values are greater than 5.

```
# Access to the expected values
res$expected
```

```
[1] 52.66667 52.66667 52.66667
```

Answer to Q2 comparing observed to expected proportions

```
tulip <- c(81, 50, 27)
res <- chisq.test(tulip, p = c(1/2, 1/3, 1/6))
res
```

```
    Chi-squared test for given probabilities
data:  tulip
X-squared = 0.20253, df = 2, p-value = 0.9037
```

The **p-value** of the test is 0.9037, which is greater than the significance level alpha = 0.05. We can conclude that the observed proportions are not significantly different from the expected proportions.

Access to the values returned by chisq.test() function

The result of **chisq.test()** function is a list containing the following components:

- **statistic**: the value the chi-squared test statistic.
- **parameter**: the degrees of freedom
- **p.value**: the **p-value** of the test
- **observed**: the observed count
- **expected**: the expected count

The format of the **R** code to use for getting these values is as follow:

```
# printing the p-value
res$p.value
```

```
[1] 0.9036928
```

```
# printing the mean
res$estimate
```

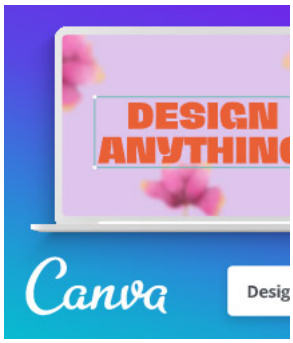
```
NULL
```

See also

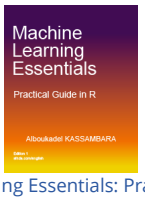
- One Proportion Z-Test in R: Compare an Observed Proportion to an Expected One
- Two Proportions Z-Test in R: Compare Two Observed Proportions
- Chi-Square Test of Independence in R: Evaluate The Association Between Two Categorical Variables

Infos

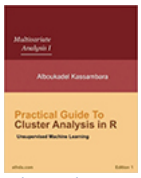
This analysis has been performed using **R software** (ver. 3.2.4).



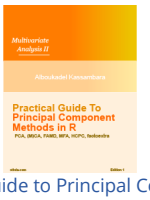
Recommended for You!



Machine Learning Essentials: Practical Guide in R

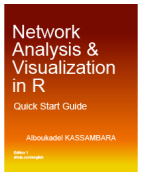


Practical Guide to Cluster Analysis in R



Practical Guide to Principal Component Methods in R

R Graphics Essentials for Great Data Visualization



Network Analysis and Visualization in R

More books on R and data science

Recommended for you

This section contains best data science and self-development resources to help you on your path.

Coursera - Online Courses and Specialization

Data science

- Course: Machine Learning: Master the Fundamentals by Standford
- Specialization: Data Science by Johns Hopkins University
- Specialization: Python for Everybody by University of Michigan
- Courses: Build Skills for a Top Job in any Industry by Coursera
- Specialization: Master Machine Learning Fundamentals by University of Washington
- Specialization: Statistics with R by Duke University
- Specialization: Software Development in R by Johns Hopkins University
- Specialization: Genomic Data Science by Johns Hopkins University

Popular Courses Launched in 2020

- Google IT Automation with Python by Google
- AI for Medicine by deeplearning.ai
- Epidemiology in Public Health Practice by Johns Hopkins University
- AWS Fundamentals by Amazon Web Services

Trending Courses

- The Science of Well-Being by Yale University
- Google IT Support Professional by Google
- Python for Everybody by University of Michigan
- IBM Data Science Professional Certificate by IBM

Books - Data Science

Our Books

- Practical Guide to Cluster Analysis in R by A. Kassambara (Datanovia)
- Practical Guide To Principal Component Methods in R by A. Kassambara (Datanovia)
- Machine Learning Essentials: Practical Guide in R by A. Kassambara (Datanovia)
- R Graphics Essentials for Great Data Visualization by A. Kassambara (Datanovia)
- GGPlot2 Essentials for Great Data Visualization in R by A. Kassambara (Datanovia)
- Network Analysis and Visualization in R by A. Kassambara (Datanovia)
- Practical Statistics in R for Comparing Groups: Numerical Variables by A. Kassambara (Datanovia)
- Inter-Rater Reliability Essentials: Practical Guide in R by A. Kassambara (Datanovia)

Others

- R for Data Science: Import, Tidy, Transform, Visualize, and Model Data by Hadley Wickham & Garrett Grolemund
- Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems by Aurelien Géron
- Practical Statistics for Data Scientists: 50 Essential Concepts by Peter Bruce & Andrew Bruce
- Hands-On Programming with R: Write Your Own Functions And Simulations by Garrett Grolemund & Hadley Wickham
- An Introduction to Statistical Learning: with Applications in R by Gareth James et al.
- Deep Learning with R by François Chollet & J.J. Allaire
- Deep Learning with Python by François Chollet

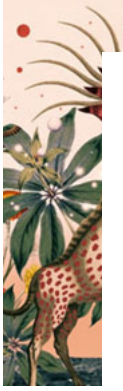
Course & Specialization

Recommended for You (on Coursera):

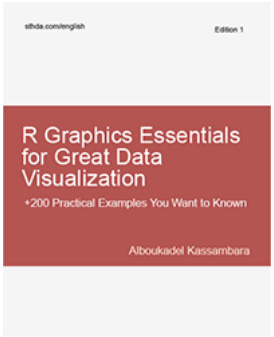
- Course: Machine Learning: Master the Fundamentals
- Specialization: Data Science
- Specialization: Python for Everybody
- Course: Build Skills for a Top Job in any Industry
- Specialization: Master Machine Learning Fundamentals
- Specialization: Statistics with R
- Specialization: Software Development in R
- Specialization: Genomic Data Science

See More Resources

- factoextra
- survminer
- ggpubr
- ggcorrplot
- fastqcr

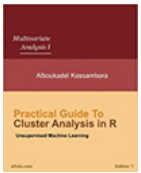


Our Books



R Graphics Essentials for Great Data Visualization: 200 Practical Examples You Want to Know for Data Science

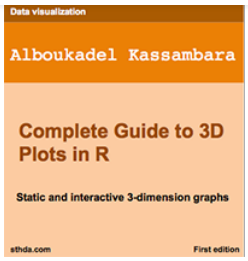
★ NEW!!



Practical Guide to Cluster Analysis in R

Practical Guide to Principal Component Methods in R

3DPlotsinR



- **Datanovia: Online Data Science Courses**
- **R-Bloggers**