

# How can the Chi-Square Test of Independence be performed in R, and what are some examples of its application?

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The Chi-Square Test of Independence is a statistical method used to determine whether there is a significant relationship between two categorical variables. This test is commonly used in various fields such as social sciences, marketing, and healthcare to analyze data and make informed decisions.

To perform the Chi-Square Test of Independence in R, the first step is to import the data into R and organize it into a contingency table. This table displays the frequency of observations for each combination of the two variables. Then, the chi-square test can be performed by using the function "chisq.test()" and specifying the contingency table as the input.

This test calculates the expected frequency for each cell in the contingency table based on the assumption that there is no relationship between the two variables. It then compares the expected frequencies with the observed frequencies and calculates a p-value. The p-value indicates the probability of obtaining the observed results if there is no significant relationship between the variables. If the p-value is less than the chosen significance level (typically 0.05), we can reject the null hypothesis and conclude that there is a significant relationship between the two variables.

Some examples of the application of the Chi-Square Test of Independence include analyzing the relationship between gender and voting preference in an election, studying the association between smoking habits and health conditions, and examining the connection between customer satisfaction and product loyalty in a marketing study. Overall, the Chi-Square Test of Independence is a useful tool for analyzing categorical data and understanding the relationship between variables in a dataset.

## Chi-Square Test of Independence in R (With Examples)

**A Chi-Square Test of Independence is used to determine whether or not there is a significant association between two .**

**This tutorial explains how to perform a Chi-Square Test of Independence in R.**

**Example: Chi-Square Test of Independence in R**

Suppose we want to know whether or not gender is associated with political party preference. We take a simple random sample of 500 voters and survey them on their political party preference. The following table shows the results of the survey:

	Republican	Democrat	Independent	Total
Male	120	90	40	250
Female	110	95	45	250
Total	230	185	85	500

Use the following steps to perform a Chi-Square Test of Independence in R to determine if gender is associated with political party preference.

**Step 1: Create the data.**

First, we will create a table to hold our data:

**#create table**

```
data <- matrix(c(120, 90, 40, 110, 95, 45), ncol=3, byrow=TRUE)
```

```
colnames(data) <- c("Rep", "Dem", "Ind")
```

```
rownames(data) <- c("Male", "Female")
```

```
data <- as.table(data)
```

**#view table**

**data**

**Rep Dem Ind**

**Male 120 90 40**

**Female 110 95 45**

**Step 2: Perform the Chi-Square Test of Independence.**

**Next, we can perform the Chi-Square Test of Independence using the `chisq.test()` function:**

```
#Perform Chi-Square Test of Independence  
chisq.test(data)
```

**Pearson's Chi-squared test**

**data: data**

**X-squared = 0.86404, df = 2, p-value = 0.6492**

**The way to interpret the output is as follows:**

**Chi-Square Test Statistic: 0.86404 Degrees of freedom: 2  
(calculated as  $\#rows-1 * \#columns-1$ ) p-value: 0.6492**

**Recall that the Chi-Square Test of Independence uses the following null and alternative hypotheses:**

**H0: (null hypothesis) The two variables are independent.**  
**H1: (alternative hypothesis) The two variables are *not* independent.**

Since the p-value (0.6492) of the test is not less than 0.05, we fail to reject the null hypothesis. This means we do not have sufficient evidence to say that there is an association between gender and political party preference.

**An Introduction to the Chi-Square Test of Independence**

**Chi-Square Test of Independence Calculator**

**How to Calculate the P-Value of a Chi-Square Statistic in R**

**How to Find the Chi-Square Critical Value in R**