What is Joint Frequency?

Authored by

stats writer

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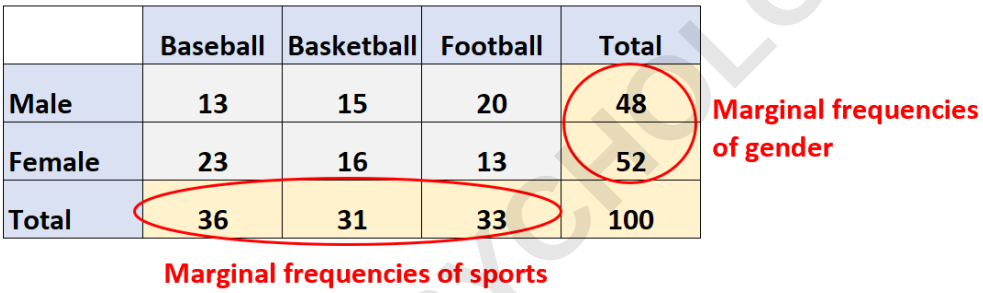
A **two-way frequency table** is a table that displays the frequencies for two categorical variables.

For example, the following two-way table shows the results of a survey that asked 100 people which sport they liked best: baseball, basketball, or football.

The rows display the gender of the respondent and the columns show which sport they chose:

	Baseball	Basketball	Football	Total
Male	13	15	20	48
Female	23	16	13	52
Total	36	31	33	100

The **marginal frequencies** are the frequencies shown in the margins of the table:



These values tell us the total values for each variable. For example:

36 total respondents chose baseball as their favorite sport
31 total respondents chose basketball as their favorite sport
33 total respondents chose football as their favorite sport

We can also see:

48 total respondents were male
52 total respondents were female

The **joint frequencies** are the frequencies shown in the cells of the table:

	Baseball	Basketball	Football	Total
Male	13	15	20	48
Female	23	16	13	52
Total	36	31	33	100

Joint Frequencies

These values are known as "joint" frequencies because they tell us the frequency of two values that occur jointly.

For example, we can see:

There were a total of **13** respondents who were male *and* preferred baseball.
There were a total of **15** respondents who were male *and* preferred basketball.
There were a total of **20** respondents who were male *and* preferred football.
There were a total of **23** respondents who were female *and* preferred baseball.
There were a total of **16** respondents who were female *and* preferred basketball.
There were a total of **13** respondents who were female *and* preferred football.

Notice that the sum of all the joint frequencies adds up to the total number of survey respondents:

Total survey respondents = 13 + 15 + 20 + 23 + 16 + 13 = **100**.

What Are Joint Relative Frequencies?

A **joint relative frequency** tells us the frequency of one variable *relative* to another variable.

For example, consider our two-way table from earlier:

	Baseball	Basketball	Football	Total
Male	13	15	20	48
Female	23	16	13	52
Total	36	31	33	100

Question 1: What is the joint relative frequency that a survey respondent prefers baseball, given that the respondent is a female?

To answer this, we will only consider the row that contains female responses. We'll then take the number of females who prefer baseball and divide by the total number of females.

This turns out to be 23/52 = 0.4423 = **44.23%**

	Baseball	Basketball	Football	Total
Male	13	15	20	48
Female	23	16	13	52
Total	36	31	33	100

In other words, 44.23% of all female survey respondents prefer baseball as their favorite sport.

Question 2: What is the joint relative frequency that a survey respondent is male, given that they prefer football as their favorite sport?

To answer this, we will only consider the column that contains football as the favorite sport. We'll then take the number of males who prefer football and divide by the total number of respondents who preferred football.

This turns out to be 20/33 = 0.606 = **60.6%**

	Baseball	Basketball	Football	Total
Male	13	15	20	48
Female	23	16	13	52
Total	36	31	33	100

In other words, 60.6% of all survey respondents who prefer football are male.