A **relative frequency** is the ratio of the frequency of a particular event in a statistical experiment to the total frequency.

There are three types of relative frequency:

* **Joint Relative Frequency**: The ratio that compares an intersection of qualitative data to the total frequency.
* **Marginal Relative Frequency**: The ratio that compares a qualitative total to the total frequency.
* **Conditional Relative Frequency**: A frequency that compares a specific joint relative frequency to a marginal relative frequency.

**What is Joint Relative Frequency?**

**Joint Relative Frequency** is the frequency of the intersection between two types of categorical data. In the table, the inner cells represent the joint relative frequency. To calculate the joint relative frequency, take the ratio between the joint frequency to the total frequency of the data. In statistics, this is used to compare and pair two distinct types of categorical data. Take for example in the table below:

|  | **English** | **Math** | **Science** | **Total** |
| --- | --- | --- | --- | --- |
| Men | 57 | 35 | 3 | 95 |
| Women | 17 | 20 | 18 | 55 |
| Total | 74 | 55 | 21 | 150 |

In the table above, the inner cells represent the joint frequencies between a pair of categorical data points. In this situation, an example would be the frequency of men who struggled in Math class in high school, which according to the table would be 35 out of 150. To calculate the ratio, use the formula shown below:

JointRelativeFrequency=JointFrequencyTotalFrequencyJointRelativeFrequency=JointFrequencyTotalFrequency

To help with calculations, rounding is an effective way to disclose the relative frequencies.

**Joint Relative Frequency Example**

Find the joint relative frequencies of (a): women who struggled in English in high school and (b) men who struggled in science in high school.

**Solution:**

(a)JointRelativeFrequency=WomenandEnglishTotalFrequency=17150≈0.1133(b)JointRelativeFrequency=MenandScienceTotalFrequency=3150=0.02(a)JointRelativeFrequency=WomenandEnglishTotalFrequency=17150≈0.1133(b)JointRelativeFrequency=MenandScienceTotalFrequency=3150=0.02

According to the data, the relative frequency of women who struggled in English was 0.1133, or 11.33%. The relative frequency of men who struggled in Science was 0.02, or 2%.

## What is Marginal Relative Frequency?

**Marginal Relative Frequency** is the ratio between the frequency of a row total or column total to the total frequency of the data. It is commonly used to analyze general trends in one specific category of data. In the table above, the marginal frequencies can be found using the bottom or far-right "total" columns. To find the relative frequency of a category, divide the total for a specific category by the total number of participants in the study.

### Marginal Relative Frequency Example

#### Use the data from the table to calculate the relative frequency of (a) participants that were men and (b) participants that chose Math as the subject they struggled with the most.

**Answers:**

$$(a)\;Marginal\;Relative\;Frequency=\frac{Men}{Total\;Frequency} = \frac{95}{150}\approx 0.6333 \\ (b)\;Marginal\;Relative\;Frequency=\frac{Math}{Total\;Frequency} = \frac{55}{150}\approx 0.3667 $$

So, about 63.33% of the participants were men, and from the total population, about 36.67% struggled with math the most in their high school.

## What is Conditional Relative Frequency?

**Conditional Relative Frequency** is a ratio that compares a joint relative frequency with one of its marginal relative frequencies. In simpler words, it explains how many members of a marginal frequency have a particular trait. In the table used as an example, an example of a conditional frequency is the relative frequency of people who struggle in English, given that the person is a woman. In other words, it asks what ratio of women struggle in English. Use this formula to find the conditional relative frequency:

$$\frac{Frequency\;A,\;given\;B}{Frequency\;B} $$

Analysts use conditional relative frequency to determine if there is a trend involving two distinct variables of categorical data. Using the example of the table above, surveyors could use conditional relative frequency if there is an association between a person's gender and whether or not they prefer one subject over the other.

### Conditional Relative Frequency Example

Using the data in the table above, find the relative frequency of (a) men, given that they struggle in science, and (b) people who struggle in math, given that the person is a woman.

**Solution:**

To find the first conditional relative frequency, it asks what part of people who struggle in science are men. By applying the formula:

$$\frac{Frequency\;men \cap science}{Frequency\;Science} = \frac{3}{21}\approx 0.1429 $$

Using this reasoning makes solving the second conditional relative frequency that much easier:

$$\frac{Frequency\;math \cap women}{Frequency\;Women} = \frac{20}{55}\approx 0.3636 $$

If unsure of which category to be placed in the denominator of the ratio or the division, the denominator (the divisor) will always be the category after the word *given*,

## Illustrate the concept of statistical indipendence and the resulting mathematical relationship between the above frequencies

**Independence** is a fundamental notion in [probability theory](https://en.wikipedia.org/wiki/Probability_theory), as in [statistics](https://en.wikipedia.org/wiki/Statistics) and the theory of [stochastic processes](https://en.wikipedia.org/wiki/Stochastic_processes). Two [events](https://en.wikipedia.org/wiki/Event_(probability_theory)) are **independent**, **statistically independent**, or **stochastically independent** if, informally speaking, the occurrence of one does not affect the frequency of the other.

{indipendenza}⇔{f(xi|yj)=f(xi)} ⇔ { f(yj|xi)=f(yj) ∀ i,j

https://en.wikipedia.org/wiki/Independence\_(probability\_theory)