

What is a Marginal Distribution?

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April 23, 2024

RECOMMENDED CITATION

stats writer (2024). *What is a Marginal Distribution?*. PSYCHOLOGICAL SCALES. Retrieved from <https://scales.arabpsychology.com/?p=138518>

A Marginal Distribution is a statistical concept that describes the probability distribution of a subset of variables within a larger set of variables. It is calculated by summing or integrating the joint distribution of all the variables except for the subset of interest. In other words, it shows the probability of each possible outcome for a particular variable, while holding all other variables constant. This allows for a more focused analysis of the relationship between the variables and can provide valuable insights into the overall distribution of the data. Marginal Distributions are commonly used in various statistical methods, such as regression analysis and hypothesis testing, to understand the impact of individual variables on the overall distribution.

What is a Marginal Distribution?

A two-way frequency table is a table that displays the frequencies (or "counts") 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

In this example, there are two variables: Sports and Gender.

A marginal distribution is simply the distribution of each of these individual variables. In a two-way table, the marginal distributions are shown in the margins of the table:

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

Marginal distribution
of gender

Marginal distribution of sports

For example, we would say that the marginal distribution of sports is:

Baseball: 36 Basketball: 31 Football: 33

We could also write the marginal distribution of sports in percentage terms (i.e. out of the total of 100 respondents):

Baseball: $36 / 100 = 36\%$ Basketball: $31 / 100 = 31\%$ Football: $33 / 100 = 33\%$

And we would say that the marginal distribution of gender is:

Male: 48 (or 48%) Female: 52 (or 52%)

Note: Marginal distributions always add up to 100%.

Why Use Marginal Distributions?

Marginal distributions are useful because although we often collect data for two variables (like Sports and Gender), sometimes we have specific questions about just one variable.

For example, we might want to know the distribution of survey respondents based purely on gender.

Use the following examples as practice for gaining a better understanding of marginal distributions.

Example 1: Marginal Distributions for Percentages

The following two-way table shows the results of a survey that asked 238 people which movie genre they liked best:

	Fantasy	Drama	Action	Total
Male	22	30	70	122
Female	25	58	33	116
Total	47	88	103	238

Question: What is the marginal distribution for movie genre (in percentages)?

Answer: The marginal distribution for movie genre is:

Fantasy: $47/238 = 19.7\%$ Drama: $88/238 = 37\%$ Action: $103/238 = 43.3\%$

Question: What is the marginal distribution for gender (in percentages)?

Answer: The marginal distribution for gender is:

Male: $122/238 = 51.3\%$ Female: $116/238 = 48.7\%$

Example 2: Marginal Distributions for Counts

The following two-way table shows the exam scores of 64 students in a class based on how many hours they spent studying:

	71-80	81-90	91-100	Total
1 Hour	7	5	2	14
2 Hours	8	3	3	14
3 Hours	3	5	8	16
4 Hours	4	9	7	20
Total	22	22	20	64

Question: What is the marginal distribution for exam scores (in counts)?

Answer: The marginal distribution for exam scores is:

71-80: 2281-90: 2291-100: 20

Question: What is the marginal distribution for hours studied (in counts)?

Answer: The marginal distribution for hours studied is:

1 Hour: 142 Hours: 143 Hours: 164 Hours: 20

Notice that the total of the marginal distribution adds up to the table total of 64 students.