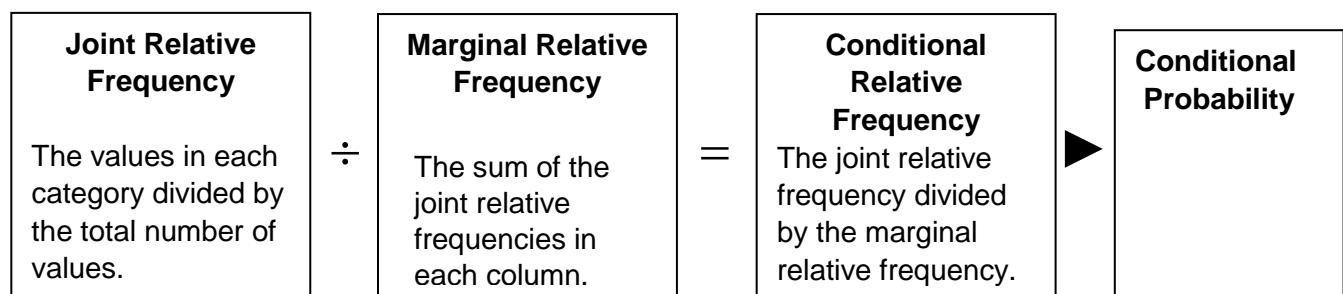


Two-Way Tables

A two-way table is a useful way to organize data that can be categorized by two variables.

Suppose the school board asked 125 households if they would support a tax increase to build a new stadium for the high school. The table shows one way to arrange to data.

| | Have School-Age Children | Does Not Have School-Age Children |
|-----|--------------------------|-----------------------------------|
| Yes | 42 | 25 |
| No | 5 | 53 |



Make a table of the joint and marginal relative frequencies.

Divide each value by the total of 125 to find the joint relative frequency, and add each row and column to find the marginal relative frequency.

| | Have School-Age Children | Does Not Have School-Age Children | Total |
|-------|--------------------------|-----------------------------------|-------|
| Yes | 0.336 | 0.200 | 0.536 |
| No | 0.040 | 0.424 | 0.464 |
| Total | 0.376 | 0.624 | 1 |

1. The table shows the number of students who use a cell phone at school.
Make a table of joint relative frequencies and marginal relative frequencies.

| | Lowerclassmates | Upperclassmates |
|-----|-----------------|-----------------|
| Yes | 48 | 100 |
| No | 58 | 44 |

| | Lowerclassmates | Upperclassmates | Total |
|-------|-----------------|-----------------|-------|
| Yes | | | |
| No | | | |
| Total | | | |

Two-Way Tables

Refer to the school board problem on the previous page.

If you are given that a household would support a tax increase, what is the probability that the household has school-age children?

Use the conditional relative frequency for the row with the condition yes. The total for the row is 0.536. Of these, 0.336 said yes. The conditional relative frequency is $\frac{0.336}{0.536} \approx 0.63$, or 63%.

Given that a household would support a tax increase, there is a probability of about 0.63 that that the household has school-age children.

Use conditional probabilities to determine which group to focus on during its tax-increase campaign.

$$P(\text{household with children that do not support a tax increase}) = \frac{0.040}{0.376} \approx 0.11, \text{ or } 11\%.$$

$$P(\text{household without children that do not support a tax increase}) = \frac{0.424}{0.624} \approx 0.68, \text{ or } 68\%.$$

The school board should focus on the households without children.

2. Refer to the cell phone problem on the previous page. If you are given that a student uses a cell phone at school, what is the probability that the student is an upperclassmate?

3. Randall is assessing which employee should be the “Employee of the Month.” Over one month, he records whether a customer gives his employee a favorable rating or not. The marginal relative frequencies are shown below.

| | Yes | No | Total |
|---------|-------|-------|-------|
| Marylou | 0.155 | 0.267 | 0.422 |
| Manuel | 0.252 | 0.059 | 0.311 |
| Marley | 0.219 | 0.048 | 0.267 |
| Total | 0.626 | 0.374 | 1 |

- a. Find the probability that each employee will receive a favorable rating. Round to the nearest hundredth where appropriate.

-
- b. Determine which employee has the highest favorable rating.
-

1. The table shows the results of a customer satisfaction survey of 100 randomly selected shoppers at the mall who were asked if they would shop at an earlier time if the mall opened earlier. Make a table of joint and marginal relative frequencies.

| | Ages 10–20 | Ages 21–45 | Ages 46–65 | 65 and Older |
|------------|-------------------|-------------------|-------------------|---------------------|
| Yes | 13 | 2 | 8 | 24 |
| No | 25 | 10 | 15 | 3 |

| | Ages 10–20 | Ages 21–45 | Ages 46–65 | 65 and Older | Total |
|--------------|-------------------|-------------------|-------------------|---------------------|--------------|
| Yes | | | | | |
| No | | | | | |
| Total | | | | | |

2. Jerrod collected data on 100 randomly selected students, and summarized the results in a table.

| Owes an MP3 Player | | | |
|---------------------------|------------|-----------|----|
| Owes a Smart phone | Yes | No | |
| | Yes | 28 | 12 |
| | No | 34 | 26 |

- a. Make a table of the joint relative frequencies and marginal relative frequencies. Round to the nearest hundredth where appropriate.

| Owes an MP3 player | | | |
|---------------------------|--------------|-----------|--------------|
| Owes a Smart Phone | Yes | No | Total |
| | Yes | | |
| | No | | |
| | Total | | |

- b. If you are given that a student owns an MP3 player, what is the probability that the student also owns a smart phone? Round your answer to the nearest hundredth.

c.

1. Sarah asked 40 randomly selected underclassmen at her high school whether they were planning to go to college and whether they were planning to move out of their parents' or guardians' homes right after high school. The results are summarized in the table.

Planning to Go to College

| Planning to Move Out | Planning to Go to College | |
|----------------------|---------------------------|----|
| | Yes | No |
| Yes | 16 | 8 |
| No | 12 | 4 |

- a. Make a table of the joint relative frequencies and marginal relative frequencies. Round to the nearest hundredth where appropriate.

Planning to Go to College

| Planning to Move Out | Planning to Go to College | | |
|----------------------|---------------------------|----|-------|
| | Yes | No | Total |
| Yes | | | |
| No | | | |
| Total | | | |

- b. Which is more likely, that an underclassman planning to go to college is also planning to move out, or that an underclassman planning to move out is also planning to go to college? Justify your response with conditional probabilities.
-

2. In a marketing research study, 50 customers at a grocery store were given a sample of a new brand of yogurt and the leading brand of yogurt. They were then asked whether they usually bought yogurt and which sample they preferred. The joint and marginal relative frequencies are given below. Use them to create a frequency table showing the number of people who responded each way.

Usually Buys Yogurt

| Preferred Brand | Usually Buys Yogurt | | |
|-----------------|---------------------|------|-------|
| | Yes | No | Total |
| New | 0.4 | 0.22 | 0.62 |
| Leading | 0.24 | 0.14 | 0.38 |
| Total | 0.64 | 0.36 | 1 |

Usually Buys Yogurt

| Preferred Brand | Usually Buys Yogurt | |
|-----------------|---------------------|----|
| | Yes | No |
| New | | |
| Leading | | |