

UNIT 4 • DESCRIBING DATA

Lesson 2: Working with Two Categorical and Quantitative Variables

Instruction

Guided Practice 4.2.1

Example 1

Cameron surveys students in his school who play sports, and asks them which sport they prefer. He records the responses in the table below.

Gender	Preferred sport		
	Baseball	Soccer	Basketball
Male	49	52	16
Female	23	64	33

What is the joint frequency of male students who prefer soccer?

1. Look for the row of male students.

The characteristic “male” is in the first row of responses.



2. Look for the column with the response “soccer.”

The response “soccer” is in the second column of responses.



3. The frequency for the given characteristic and the given response is the joint frequency.

The cell in the first characteristic row and the second response column is 52.

The joint frequency of male students who prefer soccer is 52.



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Example 2

Abigail surveys students in different grades, and asks each student which pet they prefer. The responses are in the table below.

Grade	Preferred pet			
	Bird	Cat	Dog	Fish
9	3	49	53	22
10	7	36	64	10

What is the marginal frequency of each type of pet?

1. Sum the responses of people with each characteristic for the first pet type, “bird.”

3 people in grade 9 preferred birds, and 7 people in grade 10 preferred birds.

$$3 + 7 = 10 \text{ people who preferred birds}$$



2. Sum the responses of people with each characteristic for the second pet type, “cat.”

49 people in grade 9 preferred cats, and 36 people in grade 10 preferred cats.

$$49 + 36 = 85 \text{ people who preferred cats}$$



3. Sum the responses of people with each characteristic for the third pet type, “dog.”

53 people in grade 9 preferred dogs, and 64 people in grade 10 preferred dogs.

$$53 + 64 = 117 \text{ people who preferred dogs}$$



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4. Sum the responses of people with each characteristic for the fourth pet type, “fish.”

22 people in grade 9 preferred fish, and 10 people in grade 10 preferred fish.

$$22 + 10 = 32 \text{ people who preferred fish}$$

5. Organize the marginal frequencies in a two-way frequency table.

Create a row and include the marginal frequencies of each response under the name of each response.

Grade	Preferred pet			
	Bird	Cat	Dog	Fish
9	3	49	53	22
10	7	36	64	10
Total	10	85	117	32

Example 3

Ms. Scanlon surveys her students about the time they spend studying. She creates a table showing the amount of time students studied and the score each student earned on a recent test.

Time spent studying in hours	Test score			
	0–25	26–50	51–75	76–100
0–2	2	8	12	2
2–4	0	10	8	24
4–6	1	0	2	9
6+	0	0	1	4

Ms. Scanlon wants to understand the distribution of scores among all the students, and to get a sense of how students are performing and how much students are studying. Find the conditional relative frequencies as a percentage of the total number of students.

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1. Find the total number of students represented in the table by summing the joint frequencies.

$$2 + 8 + 12 + 2 + 0 + 10 + 8 + 24 + 1 + 0 + 2 + 9 + 0 + 0 + 1 + 4 = 83$$

2. Divide each joint frequency by the total number of students.

$$\begin{array}{cccc} \frac{2}{83} \approx 0.024 & \frac{8}{83} \approx 0.096 & \frac{12}{83} \approx 0.145 & \frac{2}{83} \approx 0.024 \\ \frac{0}{83} \approx 0 & \frac{10}{83} \approx 0.120 & \frac{8}{83} \approx 0.096 & \frac{24}{83} \approx 0.289 \\ \frac{1}{83} \approx 0.012 & \frac{0}{83} \approx 0 & \frac{2}{83} \approx 0.024 & \frac{9}{83} \approx 0.108 \\ \frac{0}{83} \approx 0 & \frac{0}{83} \approx 0 & \frac{1}{83} \approx 0.012 & \frac{4}{83} \approx 0.048 \end{array}$$

3. Represent the conditional joint frequencies in a new table.

Insert each conditional joint frequency in a table set up the same way as the two-way frequency table.

Time spent studying in hours	Test score			
	0–25	26–50	51–75	76–100
0–2	0.024	0.096	0.145	0.024
2–4	0	0.120	0.096	0.289
4–6	0.012	0	0.024	0.108
6+	0	0	0.012	0.048

