

ADVANCED ALGEBRA NOTE TEMPLATE SECTION 10.3

TWO-WAY TABLES = CONTINGENCY TABLES AND PROBABILITY

Success Criteria:

- I can identify joint frequencies and marginal frequencies from a two-way table.
- I can create a frequency table
- I can find probabilities using a frequency table
- I can find relative joint frequencies and relative marginal frequencies
- I can find probabilities using a relative frequency table

A two-way table is a frequency table that displays data collected from one source that belong to two different categories. One category is represented by rows and the other by columns. Each entry in the table is called a joint frequency. The sums of the rows and columns are called the marginal frequencies. (Another name for two-way tables is Contingency-Table)

EXAMPLE:

You randomly survey juniors and seniors about whether they are attending a school concert. There are 106 juniors and 114 seniors that respond. Of those, 42 juniors and 77 seniors plan on attending. Organize these results in a two-way table. Then find and interpret the marginal frequencies.

		Attendance	
		Attending	Not Attending
Class	Junior		
	Senior		

Notice the Marginal Frequencies are the totals of each column and each row. Notice the numbers in the middle of the table, which are the joint frequencies, represent the total in the combined category. For example, the 42 are in the category of attending and in the category of being a junior, thus 42 is a "joint-frequency".

The interpretation: 220 students were surveyed, 106 were juniors and 114 were seniors. 119 students are attending the concert and 101 students are not attending the concert.

You Try This One:

You randomly survey students about whether they are in favor of planting a community garden at school. Of 96 boys surveyed, 61 are in favor. Of 88 girls surveyed, 17 are against. Organize the results in a two-way table. Then find and interpret the marginal frequencies.

		Response		Total
		In Favor	Against	
Gender	Boy			
	Girl			
	Total			

RELATIVE FREQUENCIES

Joint-Relative Frequency is the ratio for a frequency that is NOT in the total row or total column to the total number of values in the table.

Marginal-Relative-Frequency is the sum of the joint-relative-frequencies in a row or in a column.

FOR EXAMPLE:

Make a two-way table that

Shows the relative joint and

Relative marginal frequencies.

		Attendance		Total
		Attending	Not Attending	
Class	Junior	42	64	106
	Senior	77	37	114
	Total	119	101	220

		Attendance		Total
		Attending	Not Attending	
Class	Junior			
	Senior			
	Total			

YOU TRY THIS EXAMPLE:

There are 16 juniors and 24 seniors on a debate team. Of these, 7 juniors and 19 seniors qualify for the state debate competition.

- (a) Organize this information in a two-way table with marginal frequencies.

		Results		Total
		Qualified	Did Not Qualify	
Class	Junior			
	Senior			
	Total			

- (b) Make a two-way table that shows the joint and marginal relative frequencies.

		Results		Total
		Qualified	Did Not Qualify	
Class	Junior			
	Senior			
	Total			

NOTE: Relative frequencies can be interpreted as probabilities. The probability that a randomly selected student is a junior and not qualified is 0.225 or 22.5%.

Use the table above to find the given probabilities that a randomly selected student is:

- (a) A senior
 (b) Is Qualified
 (c) Is a senior and qualified.

CONDITIONAL RELATIVE FREQUENCIES

A conditional relative frequency is the ratio of a joint relative frequency to the marginal relative frequency. You can find a conditional relative frequency using a row total or a column total of a two-way table.

EXAMPLE:

Use the table of relative frequencies to create the conditional-relative-frequency table requested:

(A) Make the conditional Relative frequency table based Row totals.

	Qual.	DNQ	Total
Junior	0.175	0.225	0.4
Senior	0.475	0.125	0.6
Total	0.65	0.35	1

		Results	
		Qualified	Did Not Qualify
Class	Junior		
	Senior		

(B) Interpret each cell of the table made in part A.

(c). Make the conditional Relative Frequency table based upon column totals. Then interpret each cell of the table.

		Results	
		Qualified	Did Not Qualify
Class	Junior		
	Senior		

YOU TRY THIS EXAMPLE:

Below is the relative-frequency table for the survey of students who favor planting a community garden at school.

		Response		
		In Favor	Against	Total
Gender	Boy	0.332	0.190	0.522
	Girl	0.386	0.092	0.478
Total		0.718	0.282	1

(a) Make the conditional relative frequency table based upon gender (rows). Then interpret the conditional relative frequencies in context to the problem.

		Response	
		In Favor	Against
Gender	Boy		
	Girl		

(b) Make the conditional relative frequency table based upon response (columns). Then interpret the conditional relative frequencies in context to the problem.

		Response	
		In Favor	Against
Gender	Boy		
	Girl		

FINDING CONDITIONAL PROBABILITIES USING A RELATIVE FREQUENCY TABLE.

Note: This method does not require the conditional-relative-frequency-tables made in the previous example. This method uses only the relative-frequency tables.

A satellite TV provider surveys customers in three cities. The survey asks whether they would recommend the TV provider to a friend. The results, given as joint relative frequencies, are shown in the two-way table.

		Location		
		Glendale	Santa Monica	Long Beach
Response	Yes	0.29	0.27	0.32
	No	0.05	0.03	0.04

- What is the probability that a randomly selected customer who is located in Glendale will recommend the provider?
- What is the probability that a randomly selected customer who will not recommend the provider is located in Long Beach?
- Determine whether recommending the provider to a friend and living in Long Beach are independent events.

YOU TRY THIS EXAMPLE: A store surveys customers of different ages. The survey asks whether they would like to see the store expand its toy department. The results are given as joint-relative frequencies.

		Age (in years)		
		< 10	10–20	> 20
Yes	0.27	0.06	0.23	
No	0.09	0.17	0.18	

- What is the probability that a randomly selected customer whose age is between 10 and 20 would not like to see the toy department expanded?
- What is the probability that a randomly selected customer who would like to see the toy department expanded is younger than 10?
- Determine whether replying “yes” and being younger than 10 are independent events?

COMPARING CONDITIONAL PROBABILITIES

A jogger wants to burn a certain number of calories during his workout. He maps out three possible jogging routes. Before each workout, he randomly selects a route, and then determines the number of calories he burns and whether he reaches his goal. The table shows his findings. Which route should he use?

	Reaches Goal	Does Not Reach Goal
Route A		
Route B		
Route C		

STEP ONE is to make a table of joint and marginal relative frequencies.

		Result		Total
		Reaches Goal	Does Not Reach Goal	
Route	A	0.22	0.12	0.34
	B	0.22	0.08	0.30
	C	0.24	0.12	0.36
Total		0.68	0.32	1

Step Two: Find conditional probabilities in the appropriate form to the context of the problem.

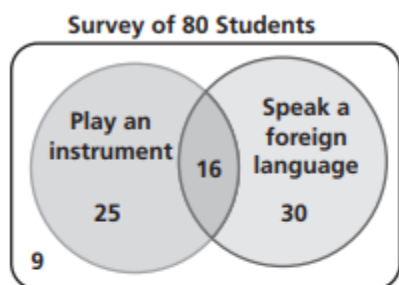
Probability that “reaches goal given that the jogger took route_____”

YOU TRY THIS EXAMPLE: An airline company strives not to lose luggage for passengers. A manager at the company randomly selects three flights to check on lost luggage. As the end of each day, the manager determines whether or not there was luggage lost on the flight that day. The table shows the findings. Which flight does the best a not losing luggage?

	Lost Luggage	No Lost Luggage
Flight 1		
Flight 2		
Flight 3		

LAST EXAMPLE:

The Venn diagram shows the results of a survey in which 80 students were asked whether they play a musical instrument and whether they speak a foreign language. Use the Venn diagram to complete the two-way table. Then use the two-way table to answer each question.



	Play an Instrument	Do Not Play an Instrument	Total
Speak a Foreign Language			
Do Not Speak a Foreign Language			
Total			

- How many students play an instrument?
- How many students speak a foreign language?
- How many students play an instrument and speak a foreign language?
- How many students do not play an instrument and do not speak a foreign language?
- How many students play an instrument and do not speak a foreign language?