

Two Way Frequency Tables

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Two way frequency tables summarize data into two categories. They can be used to approximate conditional probabilities.

Example 1: A random survey was taken to gather information about grade level and car ownership status of students at a school. This table shows the results of the survey.

	Owns a Car	Does Not Own a Car	Total
Junior	6	10	16
Senior	12	8	20
Total	18	18	36

- $P(\text{junior} \mid \text{owns a car})$
- $P(\text{does not own a car} \mid \text{senior})$
- $P(\text{junior})$

Example 2: A random survey was conducted to gather information about age and employment status. This table shows the data that were collected.

Employment Status	Age (in years)		Total
	Less than 18	18 or greater	
Has Job	20	587	607
Does Not Have Job	245	92	337
Total	265	679	944

- $P(\text{less than 18} \mid \text{has a job})$
- $P(\text{has a job})$
- $P(\text{does not have a job} \mid \text{18 or greater})$

Example 3: A random survey was conducted about gender and hair color. This table records the data.

	Brown	Blonde	Red	Total
Male	548	876	82	1,506
Female	612	716	66	1,394
Total	1,160	1,592	148	2,900

- $P(\text{blonde or red})$
- $P(\text{brown} \mid \text{female})$
- $P(\text{male} \mid \text{blonde})$
- $P(\text{female})$

PRACTICE

Complete the "Totals" column and row for each. Find each listed probability.

1. **Business** Roberto is the owner of a car dealership. He is assessing the success rates of his top three salespeople in order to offer one of them a promotion. Over two months, for each attempted sale, he records whether the salesperson made a successful sale or not. The results are shown in the chart below.

	Successful	Unsuccessful
Becky	6	6
Raul	4	5
Darrell	6	9

$$P(\text{successful} | \text{Raul})$$

$$P(\text{Becky} | \text{unsuccessful})$$

2. **Fundraising** The table shows the number of T-shirts and sweatshirts sold at a fundraiser during parent visitation night at Preston High School.

	Students	Adults
T-Shirts	16	23
Sweatshirts	7	14

$$P(\text{students} | \text{t-shirts})$$

$$P(\text{sweatshirts})$$

$$P(\text{t-shirts} | \text{adults})$$

3. **Customer Service** The table shows the results of a customer satisfaction survey for a cellular service provider, by location of the customer. In the survey, customers were asked whether they would recommend a plan with the provider to a friend.

	Arlington	Towson	Parkville
Yes	40	35	41
No	18	10	6

$$P(\text{Yes} | \text{Towson})$$

$$P(\text{Arlington} | \text{No})$$

$$P(\text{Parkville})$$

4. The table shows the results of a poll of randomly selected high school students who were asked if they prefer to hear all-school announcements in the morning or afternoon.

	Underclassmen	Upperclassmen
Morning	8	14
Afternoon	18	10

$$P(\text{Morning})$$

$$P(\text{underclassmen} | \text{Morning})$$

$$P(\text{Afternoon} | \text{upperclassmen})$$

5. **School** Pamela has collected data on the number of students in the sophomore class who play a sport or play a musical instrument.

		Plays a sport	
		Yes	No
Plays an instrument	Yes	47	38
	No	51	67



$$P(\text{plays an instrument} | \text{plays a sport})$$

$$P(\text{does not play a sport} | \text{plays an instrument})$$

$$P(\text{doesn't play an instrument})$$

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Two way frequency tables summarize data into two categories. They can be used to approximate conditional probabilities.

Example 1: A random survey was taken to gather information about grade level and car ownership status of students at a school. This table shows the results of the survey.

	Owens a Car	Does Not Own a Car	Total
Junior	6	10	16
Senior	12	8	20
Total	18	18	36

a) $P(\text{junior} \mid \text{owns a car}) = \frac{6}{18}$

b) $P(\text{does not own a car} \mid \text{senior}) = \frac{8}{20}$

c) $P(\text{junior}) = \frac{16}{36}$

Example 2: A random survey was conducted to gather information about age and employment status. This table shows the data that were collected.

Employment Status	Age (in years)		Total
	Less than 18	18 or greater	
Has Job	20	587	607
Does Not Have Job	245	92	337
Total	265	679	944

a) $P(\text{less than 18} \mid \text{has a job}) = \frac{20}{607}$

b) $P(\text{has a job}) = \frac{607}{944}$

c) $P(\text{does not have a job} \mid 18 \text{ or greater}) = \frac{92}{679}$

Example 3: A random survey was conducted about gender and hair color. This table records the data.

	Brown	Blonde	Red	Total
Male	548	876	82	1,506
Female	612	716	66	1,394
Total	1,160	1,592	148	2,900

a) $P(\text{blonde or red}) = \frac{1740}{2900}$

b) $P(\text{brown} \mid \text{female}) = \frac{612}{1394}$

c) $P(\text{male} \mid \text{blonde}) = \frac{876}{1592}$

d) $P(\text{female}) = \frac{1394}{2900}$

PRACTICE

Complete the "Totals" column and row for each. Find each listed probability.

1. **Business** Roberto is the owner of a car dealership. He is assessing the success rates of his top three salespeople in order to offer one of them a promotion. Over two months, for each attempted sale, he records whether the salesperson made a successful sale or not. The results are shown in the chart below.

	Successful	Unsuccessful	
Becky	6	6	12
Raul	4	5	9
Darrell	6	9	15
	16	20	36

$$P(\text{successful} | \text{Raul}) = \frac{4}{9}$$

$$P(\text{Becky} | \text{unsuccessful}) = \frac{6}{20}$$

2. **Fundraising** The table shows the number of T-shirts and sweatshirts sold at a fundraiser during parent visitation night at Preston High School.

	Students	Adults	
T-shirts	16	23	39
Sweatshirts	7	14	21
	23	37	60

$$P(\text{students} | \text{t-shirts}) = \frac{16}{39}$$

$$P(\text{sweatshirts}) = \frac{21}{60}$$

$$P(\text{t-shirts} | \text{adults}) = \frac{23}{37}$$

3. **Customer Service** The table shows the results of a customer satisfaction survey for a cellular service provider, by location of the customer. In the survey, customers were asked whether they would recommend a plan with the provider to a friend.

	Arlington	Towson	Parkville	
Yes	40	35	41	116
No	18	10	6	34
	58	45	47	150

$$P(\text{Yes} | \text{Towson}) = \frac{35}{45}$$

$$P(\text{Arlington} | \text{No}) = \frac{18}{34}$$

$$P(\text{Parkville}) = \frac{47}{150}$$

4. The table shows the results of a poll of randomly selected high school students who were asked if they prefer to hear all-school announcements in the morning or afternoon.

	Underclassmen	Upperclassmen	
Morning	8	14	22
Afternoon	18	10	28
	26	24	50

$$P(\text{Morning}) = \frac{22}{50}$$

$$P(\text{underclassmen} | \text{Morning}) = \frac{8}{22}$$

$$P(\text{Afternoon} | \text{upperclassmen}) = \frac{10}{24}$$

5. **School** Pamela has collected data on the number of students in the sophomore class who play a sport or play a musical instrument.

		Plays a sport		
		Yes	No	
Plays an instrument	Yes	47	38	85
	No	51	67	118
		98	105	203



$$P(\text{plays an instrument} | \text{plays a sport}) = \frac{47}{98}$$

$$P(\text{does not play a sport} | \text{plays an instrument}) = \frac{38}{85}$$

$$P(\text{doesn't play an instrument}) = \frac{118}{203}$$